PESTICIDE HANDLING BEHAVIOUR OF VEGETABLE FARMERS - A MULTIDIMENSIONAL ANALYSIS

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2019-11-234

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COLLEGE OF AGRICULTURE

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by

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THESIS

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2022

DECLARATION

I, hereby declare that the thesis entitled **"PESTICIDE HANDLING BEHAVIOUR OF VEGETABLE FARMERS - A MULTIDIMENSIONAL ANALYSIS"** is a bonafide record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

Place: Vellayani **ARATHY B S**

Date: 25/03/2022 **(2019-11-234)**

CERTIFICATE

Certified that this thesis entitled **"PESTICIDE HANDLING BEHAVIOUR OF VEGETABLE FARMERS - A MULTIDIMENSIONAL ANALYSIS"** is a record of research work done independently by Mrs. Arathy B S under my guidance and supervision and that it has not previously formed the basis for any degree, diploma, fellowship or associateship to her.

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ARATHY B S

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LIST OF ABBREVIATIONS AND SYMBOLS USED

%	Per cent
&	And
₹	Indian Rupee
/	Per
≤	Less than or equal to
>	Greater than
kg	Kilogram
ha	Hectares
et al.	And co-workers/co-authors
Fig.	Figure
No.	Number
MT	Million Tonnes
SD	Standard Deviation
AEUs	Agro-Ecological Units
SMS	Subject Matter Specialist
KVK	Krishi Vigyan Kendra
PPE	Personal Protective Equipment
IPM	Integrated Pest Management

Introduction

CHAPTER I

INTRODUCTION

Indian agricultural ecosystem is growing rapidly utilizing the most powerful food production system. To grow in such a way, modern agriculture is not focused to save the environment or health of the living beings, but is exclusively for taking out the maximum from the soil which can be above its capacity. One of the major issue that Indian agriculture faces is catastrophic out turn of pest attack, which would be around 10-30 per cent each year. Instead of understanding the natural processes to control we have started to throw more chemicals into the nature. More than two-thirds of the total population is employed under agriculture sector, hence exposed to pesticides, which pose potential health hazards to humans and other life forms.

Pesticides are matter or concoction of matter and has the ability to destroy unwanted weeds, pests and disease causing micro-organisms (WHO, 2010). Pesticides are used to protect the food production system from pest and diseases and to improve the productivity, but they are being used indiscriminately and are polluting the environment. Cornell Entomologist David Pimentel reported that only 0.1 per cent of pesticides were properly reaching the target pests, rest of the 99.9 per cent creating impression on environmental pollution. Regular usage of these chemical causes health hazard, environmental degradation, resurgence of pest, reduce agricultural production, financial problems to small and marginal farmers.

The total pesticide use at global level in agriculture was steady in 2018 with respect to 2017 with a modest change from 4.15 mt to 4.12 mt. This steadiness was due to the contraction in the consumption of herbicide from 1.25 mt to 1.22 mt. Pesticide used per area of crop land also brought down from 2.65 kg/ha to 2.63 kg/ha from 2017 to 2018. In spite of the steadiness hitherto, total use increased by more than 50 per cent in 2010s with respect to 1990s. The increasing trend of pesticide usage was seen both in terms of absolute amount and usage per area. This increase was also due to the increase in the consumption of herbicide. Thus, herbicide is a most predominant pesticide used in agriculture worldwide (FAO, 2020). Asia is the top pesticide

consumer with more than 50 per cent of share in world total with 2.17 mt pesticide applied to cropland during 2010s at a rate of 3.72 kg/ha. Whereas Oceania and America had the highest growth rate in total pesticide use, Africa and Europe had the stagnant growth rate in comparison.

The pattern of pesticide usage in India is quite different from that of the world. Insecticide is predominantly used in the country compared to other pesticide, but recently the trend has changed. Herbicides were used with a relative share of 38%, followed by fungicides, and insecticides were used with a share of 32 per cent and 29 per cent, respectively (FAO, 2020). In India the highest pesticide usage was observed in Maharashtra with 12738 tons in 2019- 2020 and in Kerala it was 459 tons in 2019-20. Forty per cent of the total agricultural land area of the country is pesticide treated and of which 65-70 per cent is irrigated land (DES, 2015).

From the report published by Govt. of India, the chemical pesticide consumption in Kerala has declined by 34.6 per cent in 2021 when compared to the consumption in 2017. While we observe an overall decline in consumption of pesticide usage in Kerala, it is important to note that highly toxic and persistent pesticides like Lindane and Chlorpyrifos are increasing at an alarming rate whereas usage of low toxic pesticides like Fenitrothion and Carbendazim shows a decline in usage among the farmers. It is undesirable to observe that toxic and more persistent pesticides show high rate of consumption and the safer pesticides are showing more in number of declining rate of consumption.

India occupies second position in vegetable production. The total horticulture production of 329.8 million tonnes in 2020-21 is the highest ever, increase in production over the previous years was due to the increase of production in vegetable, fruits, aromatic and medicinal (DAC&FW 2020-21). Around 58.7 per cent of total horticulture production is contributed by vegetables. The major problem faced by farmers in vegetable production is pest infestation and its destructive effects in the field. Totally a 35 – 40 per cent of vegetable crop loss is due to pest infestation (Sardana, *et al*., 2005). Vegetables are integral part of healthy diet as they are loaded with lots of vitamins and minerals. But now we must rethink a bit before we consume

them because vegetables are highly exposed to pesticides and consuming them will result in chronic diseases.

Heavy loss in production because of the pest infestation forces farmers to use highly toxic chemicals like organophosphates, organochlorides, carbamates etc. in their fields. Farmers are using pesticides as foremost mechanism to control the pest attack and its non- selective and injudicious use results critical issues like environmental pollution, insect resurgence, residues in food, destruction of pollinators, results in low production in agriculture also (Kodandram *et al*., 2013). India has 10 per cent share in global pesticide market in FY17 and is the 4th largest producer of pesticides after US, Japan, and China (Devi *et.al*.,2017). As Rachel Carson quoted in her famous book silent spring about a metamorphic fight between men and the nature where man is throwing chemicals at nature while nature strikes back in unexpected ways. Pesticides causes health issues like acute and chronic diseases which could bring the risk of cancer, neurobehavioral defects, congenital, malformation, leukemia, and neoplasms (Thompson *et al.,*2003).

Unscientific use of pesticides and improper disposal mechanism were the major causes of the pesticide poisoning. Direct hazard mainly happens while mixing and loading of pesticide products, application of spray, cleaning of spraying equipment. Greater intensity of pesticide exposure is during these phases as farmers are exposed to concentrated products and also exposure can happen through drift, while using improper and damaged protective equipment and when coming in contact with residue on crop or soil. A nationwide study on pesticide usage pattern of farmer reported that only 20 per cent of the farmers are getting information regarding the plant protection from agricultural extension officers and the remaining 80 per cent are depending on unreliable sources (Shetty *et al*., 2011). Spurious pesticides are duplicates of the original pesticides and may contain a mixture of various pesticides. These spurious pesticides are manufactured by unauthorized agencies and are delivered at the doorsteps of farmers. Flow of these chemicals are not traceable as the bottles do not be have any sufficient details on it and the farmers are also reluctant to share the source of purchase. These pesticides are a major concern to the country (Devi *et al*. 2017).

Farmers and applicators of pesticides were directly exposed to pesticides due to unsafe and non-preventive practices which results in inhalation of pesticides and dermal exposure which affect their eyes, skin, and respiratory system (Choudhary, 2014). Production workers, sprayers, formulators, mixers, loaders, and agricultural farm workers are at high risk of pesticide poisoning (Aktar *et al*., 2009). According to Devi *et al*. (2017), usage of banned chemicals, unscientific pesticide handling practices, low awareness level, insufficient data management and monitoring system, improper disposal mechanism and level of investment in chemical higher than optimum were the major reasons behind the risk of pesticide usage. Thus, the need for proper training on how to handle the pesticides and creating awareness regarding the ill effects of the pesticides is found necessary for proper adoption of the safety practices by the vegetable farmers. In this context, the present study entitled "Pesticide handling behaviour of vegetable farmers - A multidimensional analysis" was taken up with the following specific objectives:

1. Knowledge of farmers about the safe handling of pesticides.
2. Extent of adoption of safe handling procedures of pesticides by the farmers.
3. Attitude of farmers about the safe handling of pesticides.
4. Personal and social characteristics of vegetable farmers.
5. Constraints in following the safe handling procedures of pesticides.

SCOPE AND IMPORTANCE OF THE STUDY

As the farmers and agricultural labourers are highly exposed to toxic pesticides it is important to adopt safe handling procedures of pesticides to ensure their health. For this, the study tries to measure the knowledge, extent of adoption and attitude of farmers in safe handling procedures to delineate the aspect on which training is needed and other constraints faced by them in adopting the safe procedure is also to be analyzed to take necessary steps to promote the usage of the safety measures and to tackle the constraint issues.

LIMITATIONS OF THE STUDY

The researcher faced all limitations of, being a single investigator. Major issue faced by the researcher was the time availability. The study was conducted on five objectives that is knowledge, extent of adoption and attitude of farmers about the safe handling of pesticides, also personal and social characteristics of vegetable farmers and constraints in following the safe handling procedures of pesticides were analyzed. Since the research was completely based on the viewpoint of respondents to the questionnaire, it may have some personal bias and prejudices. However, maximum effort was made to avoid the bias and carry out research in an effective manner. Apart from these, research was conducted very carefully to make the research focused to the objective and organized as possible.

ORGANISATION OF THE THESIS

The thesis has been prepared in five different chapters. The first chapter is an introductory chapter that has major objectives, scope of the work, importance and limitations of the research work. The second chapter deals with literature review done in line with the objectives. The third chapter explains methodology followed in conducting the research work. The fourth chapter describes results and discussion of this thesis. The fifth chapter contains summary, conclusions of the research and implications for future study. To the end references, appendices and abstract were arranged.

Review of Literature

CHAPTER II

REVIEW OF LITERATURE

Reviews of past literatures provide us a basic theoretical orientation to build our study. It provides the idea to find the problem, finding variables, conduct data collection, find results, and obtain the conclusion. Each and every step of research is important and irreplaceable. In accordance with objective review of literature of associated studies are listed under the subheadings given below:

2.1 Personal and social characteristics of vegetable farmers.

2.2 Knowledge of farmers about the safe handling of pesticides.

2.3 Extent of adoption of safe handling procedures of pesticides by the farmers.

2.4 Attitude of farmers about the safe handling of pesticides.

2.5 Constraints in following the safe handling procedures of pesticides.

2.1 PERSONAL AND SOCIAL CHARACTERISTICS OF VEGETABLE FARMERS.

2.1.1 Age

Shashidhara (2006) in his investigation on governance of sustainable environment by vegetable farmers of Karnataka observed that 42.5 per cent of the vegetable farmer respondents belonged to the middle age group followed by 37.5 per cent old age group and 20 per cent young age group.

Rathode (2009) in his study on adoption of endorsed crop protection practices by chilli farmers in Anand reported that 54.16 per cent of the chilli farmer respondents were under middle age group, while 37.50 per cent and 8.34 per cent of the respondents were under old and young age group respectively.

Devi (2009) in her review on toxicity perception and handling nature of pesticides by the farm labourers revealed that the average age of pesticide applicators was 45 years,

the minimum 23 years and the maximum 70 years.

Desale (2009) in his investigation on adoption of hybrid castor management by the castor growers in Kheda concluded that 62.50 per cent of the respondents were under middle age group followed by 20.84 per cent and 16.66 per cent were under old and young age group respectively.

Choudhary (2010) in his study on pesticide utilizing character of paddy farmers in Khambhat found that majority of the paddy farmer respondents (45.83%) were belong to the middle age group followed by 33.33 per cent were belong to the old age and only 20.84 per cent were in young age group.

According to Darandale (2010) in his investigation on tribal farmer's attitude towards organic cultivation in maize reported that most of the tribal farmer respondents (38.34%) were in middle age category, while 32.50 per cent were in old age category and 29.16 per cent were in young age category.

Sonawane (2010) in her study adoption of drip irrigation by the banana farmers in Anand concluded that more than half of the respondents (62.51%) were in middle age category, followed by 21.66 per cent were in old age group and 15.83 per cent were in young age category.

Sindhu (2016) in their study on effect of agrochemicals on environment and human health found that majority (60%) of the vegetable farmer respondents belong to middle age group, followed by 40 per cent belong to old age and 10 per cent belong to young age group.

Bano (2019) in her study on knowledge and usage of agrochemical in Jammu and Kashmir found that 26 per cent of the respondents were in the age group of 15 to 46 years, 53 per cent in the age group of 47-65 years and 21 per cent in the age group of 66-88 years.

Sharma (2020) in their study on farmer's knowledge in use of pesticides in Punjab observed that 64 per cent of the respondents were of middle age, 20 per cent belongs to young age group ad only 16 per cent belonged to old age group.

2.1.2 Education

Yassin *et al*. (2002) in his investigation on knowledge and use of pesticide and the side effects caused by it among farm workers in the Gaza observed that 49.90 per cent of the respondents had studied up to secondary school level, 22.20 per cent of the respondents had studied up to higher secondary school level, 13.20 per cent of the respondents had studied up to primary school level, 13.20 per cent of the respondents studied up to university degree and 8.50 per cent ofthe respondents were illiterate.

Devi (2009) revealed that majority of the respondents had studied up to 7^{th} std and only some had studied up to university level & all the respondents could be able to read and write the local language.

Desale (2009) found that most of the vegetable farmer respondents (56.67%) had secondary level education, followed by 25 per cent had primary level education and 18.33 per cent had higher secondary level education.

Rathode (2009) indicated that 35 per cent of the respondents had primary level education, were as 15 per cent had college level education and 12.50 per cent of the respondents were equally illiterate and higher secondary level education.

Choudhary (2010) reported that 41.66 per cent of the respondents had secondary level education, while 19.16 per cent had higher secondary level education, 20 per cent had college level education, 10.83 per cent had primary level education and 8.34 per cent were illiterate.

Shitre (2010) in study her on utilizing mechanization in potato farms in Anand concluded that 34.17 per cent of the respondents had secondary level education, followed by 25 per cent had higher secondary level education, 18.33 per cent had primary level education and 16.66 per cent had college level education. Only 5.84 per cent of the respondents were illiterate.

Kumar *et al*. (2010) in their investigation on health care awareness for safe usage of

agrochemicals in Ranchi revealed that majority (41%) had education up to secondary level & 29 per cent had higher secondary level, 6 per cent had graduate level & 24& were illiterate.

Arathy (2011) in her study on rice grower's constraints in Trissur observed that 45.83 per cent respondents had high school level education, 20 per cent had higher secondary education, 15 per cent had college level, 13.33 per cent had middle school level, 4.17 per cent had primary level and 1.67 per cent were functionally literate & none were in illiterate category.

Kumari and Reddy (2013) in their research observed that majority (42%) of the respondents had education up to secondary school level whereas, 32.66 per cent studied up to primary school level & 25.33 per cent studied up to 10^{th} level.

Babu (2015) in her observed that majority (40.83%) of the respondents had high school level education followed by 21.67 per cent were illiterate, 17.50 per cent had primary school level, 16.67 per cent had middle school level, 15 per cent had higher secondary education, 3.3 per cent had graduate level & none were functionally literate and post graduate level.

Amle (2016) in his study on adoption of safety practices by vegetable growers in pesticide use observed that 43 per cent of the respondents had college level education followed by 32 per cent and 15 per cent had high school and middle school level of education respectively. Only 8 per cent of the respondents had primary school level education and 2 per cent were illiterate.

Rahimi (2018) in her investigation on among vegetable growers about impacts of pesticide residues observed that 30.83 per cent of the respondents had secondary education followed by 24.17 per cent of the respondents were graduate & above, and 23.33 per cent had up to primary education & 20% had up to higher secondary level education & very least category of 1.67% were illiterate.

Prathamesh (2019) in his study on health effects and usage of pesticides by farm workers observed that majority (45.83%) of the respondents had the education up to

high school & 27.50 per cent of the respondents had education up to middle school & 19.17 per cent of the respondents had education up to primary school & 7.50 per cent were illiterate.

2.1.3 Farming experience

Malgie (2001) in her investigation on agrochemical utilization and its impacts in Commeewijne reported that majority (35%) of the respondents has more than 20 years of experience and 21.70 per cent had 11-15 years' experience and 10 per cent had 16-20 years.

Rabari (2006) in his research on technology utilization by tomato growers in Anand indicated that 54 per cent of the respondents had medium level of farming experience, followed by 26 per cent and 20 per cent had low and high level of farming experience respectively.

Devi (2009) reported that majority (80.80%) farm workers had more than 10 years of experience, 2.62 per cent had less than 5 years of experience and 16.58 per cent had medium experience that is 5 to 10 years of pesticide use.

Rathode (2009) indicated that majority of the respondents (47.50%) had high level of farming experience, whereas 35 per cent and 17.50 per cent had medium and low level of farming experience respectively.

Choudhary (2010) noticed that 50 per cent of the respondents were having low experience, followed by 41.67 per cent had medium and 8.33 per cent had high level of farming experience respectively.

Arathy (2011) found that most of the respondents (49.17%) had medium level of farming experience, followed by 30 per cent and 20.83 per cent had high and low level of farming experience respectively.

Shirke et al, (2011) in their study on knowledge of storage management practices to the onion growers from Pune observed that majority of the respondents (60.84%) had medium level of farming experience while 24.16 per cent had low and 15 per cent had

high level of farming experience respectively.

Ramalakshmi (2012) in her study reported that 69.17 per cent of sugarcane farmers had medium farming experience followed by low (15.83%) and 15 per cent had high farming experience.

Kumari and Reddy (2013) observed that majority of farm workers (39%) had high experience that is more than 5 years, 32.67 per cent had low experience that is less than 1 year and 28.33 per cent had medium level of experience that is 1 to 5 years of pesticide use.

Ram (2015) in his investigation on agrochemical usage and its environmental effects by paddy growers noticed that majority (46.66%) of the respondents had low level of farming experience and 40 per cent and 13.34 per cent had medium and high level of farming experience respectively.

Arpit (2015) in his study on impact of pesticides by the vegetable growers in Tapi reported that majority (65%) of the respondents had medium level of farming experience followed by 18.33 per cent and 16.67 per cent had low and high farming experience respectively.

Babu (2015) observed that majority (73.33%) of the cotton growers had medium farming experience followed by high (17.50%) and (9.17%) low level of farming experience.

Amle (2016) found that 43 per cent of the respondents had above 8 years of farming experience, while 38 per cent of the respondents had 5 to 8 years of farming experience and 25 per cent had up to 4 years of farming experience.

Raut (2016) in his study on use of agrochemicals by the brinjal growers reported that majority of the respondents (70.67%) had medium level of farming experience, whereas 16 per cent and 13.33 per cent had high and low level of farming experience respectively.

Prathamesh (2019) revealed that majority (43%) of the respondents had above 8

years' experience in growing vegetable crops and 32 per cent had 5 to 8 years of experience in growing vegetable crops.

2.1.4. Labour availability

Selvarajah (2007) showed that 33 per cent of the respondents hire the labourers for vegetable cultivation especially spraying activities. And the remaining respondents had their family members engaging in the farm activities.

Mihireth (2008) noted that 40 per cent of the respondents claimed that there was shortage of labours for spraying activities, while 60 per cent claimed that there is no labour shortage, and enough labour was available for spraying activities.

Shetty *et al.* (2010) observed that majority (40%) farmers hired agricultural labours for pesticide application.

Jyothika (2011) reported that 54.60 percent of peoples in total agricultural sector are agricultural labours out of 263 million peoples.

Malgie (2015) reported that 70 per cent of the respondents were engage in farming only part time, while 30 per cent were full time workers.

Amle (2016) showed that 70 percent of the respondents had both hired labours as well as family members to work in the field to grow vegetables, followed by 17 percent and 13 percent had family members and hired labours to grow vegetables respectively.

Borhade (2017) showed that majority of the respondents (52.50%) had hired labours to work in their farms, while 41.50 per cent and 6 per cent of the respondents uses family members and skilled labourers respectively to work in their farm.

2.1.5 Economic orientation

Gopinath (2005) indicated that nearly half (49.17%) of the respondents had medium level of economic orientation, while 19.33 per cent and 13.345 per cent had low and high level of economic orientation respectively.

Rabari (2006) reported that 72 per cent of the respondents had medium level of economic orientation, followed by 20.67 per cent and 7.33 per cent had high and low level of economic orientation respectively.

Santhi (2006) in her study on Thirunelveli rice farmers observed that 49.17 per cent of the respondents had medium level of economic orientation followed by 26.66 per cent had high level and 24.17 per cent had low level of economic orientation respectively.

Rathode (2009) observed that majority (62.50%) of the respondents had medium level of economic orientation, followed by 23.34 per cent had low and 14.16 per cent had high economic orientation.

Sonawane (2010) indicated that 57.50 per cent of the respondents had medium level of economic orientation, whereas 27.50 per cent and 15 per cent had high and low level of economic orientation respectively.

Darandale (2010) indicated that most of the respondent (60%) had medium level of economic orientation, followed by 24.165 per cent had high and 15.84 per cent had low level of economic orientation.

Arathy (2011) concluded that 56.67 per cent of the farmers had medium level of economic orientation followed by high level (25.83% and low level (17.50%) of economic orientation.

Kumar (2012) observed that majority of the respondents (72.50%) had medium level of economic orientation, whereas 18.33 per cent of the respondents and 9.17 per cent of the respondents had low and high level of economic orientation respectively.

Bandhe (2012) concluded that 60 per cent of the respondents had medium, economic orientation followed by low and high level of economic orientation with 18 per cent and 15 per cent.

Maheriya (2013) observed that 45.83 per cent of the respondents had medium level of economic orientation, while 25 per cent had high, 16.66 per cent had low and 12.50 per cent had very low level of economic orientation.

Raut (2016) reported that most of the vegetable farmers had medium level of economic orientation, followed by 27.33 per cent had low level of economic orientation and 6 per cent had high level of economic orientation.

2.1.6 Environmental orientation

Farouque and Takeya (2007) in their investigation about ecofriendly crop production reported that 41 percent of the respondents had low level of environmental orientation, 37 per cent had very low-level orientation and 15 percent and 7 per cent had medium and high level of environmental orientation respectively.

Madhu (2013) in his study on risk perception of farmers while pesticide use found that 52.50 percent of the respondents had medium level of environmental orientation whereas 26.66 percent and 20.83 per cent had high and low level of environmental orientation respectively.

Preethi *et al*. (2014) in their study on scale for measuring youth involvement in agriculture indicated that 46.67 per cent of the respondents had medium level of environmental orientation, whereas 30 per cent and 23.33 per cent had low and high level of environmental orientation respectively.

According to Pundalikrao (2018) most of the green chilli growers (61.33%) had medium level of environmental orientation followed by 23 per cent and 15.67 per cent had low and high level of environmental orientation respectively.

2.1.7 Risk orientation

Gopinath (2005) indicated that more than half (67.33%) of the respondents had medium level of risk orientation, whereas 20 percent and 12.67 per cent of the respondents had low and high level of risk orientation respectively.

Rabari (2006) revealed that majority (65.67%) of the respondents had medium level of risk orientation, followed by 20 percent and 14.33 per cent had low and high level of risk orientation respectively.

Rathod (2009) concluded that 67.50 per cent of the respondents had medium level of

risk orientation allowed by 20 percent and 12.50 per cent had high and low level of risk orientation respectively.

Desale (2009) concluded that majority of the respondents (54.17%) had high level of risk orientation followed by 25 per cent and 20.83 per cent had medium and low level of risk orientation respectively.

Sonawane (2010) observed that more than 53.33 per cent of the respondents had medium level of risk orientation followed by 35.83 per cent and 20. 84 per cent had high and low level of risk orientation respectively.

Arathy (2011) found that most of the respondents (61.67%) had medium level of risk orientation, followed by high (32.50%) and low (5.83%) risk orientation.

Wankhande *et al.* (2014) revealed that majority of the respondents (77%) had medium level of risk orientation followed by 18 per cent and 15 per cent had low and high level of risk orientation respectively.

Vihariya (2015) reported that (84.17%) of the respondents had medium to high level of risk orientation, it may be due to the limited source of income in vegetable cultivation.

Ram (2015) reported that majority 70.67%) of the respondents had medium risk orientation, while 20 per cent, 8 per cent, and 1.33 per cent of them had high, low, and very low risk orientation.

2.1.8 Innovativeness

Sangeetha (2004) in her study on Madurai cotton farmer's TNA states that majority of the respondents (47.50%) had medium level of innovativeness, followed by low (33.33%) and high (19.17%) level of innovativeness.

Gopinath (2005) found that most of the respondents (51.33%) had medium level of innovativeness, while 31.33 per cent and 17.34 per cent had low and high level of innovativeness.

Naik (2006) in his study on TNA of Ananthpur groundnut farmers revealed that majority (41.34%) of the respondents had medium level of innovativeness, were as 33.33 per cent and 25.33 per cent had low and high level of innovativeness respectively.

Kalyan (2011) in her study on effect of technology utilization by Chittoor farmers found that most of the respondents (59.17%) had medium level of innovativeness, followed by high (20.83%) and low (20%) level of innovativeness.

Arathy (2011) more than half (59.17%) of the respondents had medium level of innovativeness followed by high (28.33%) and low (12.50%) level of innovativeness.

Ram (2015) indicated that more than half (56%) of the respondents had medium level of innovativeness, followed by subjects with low (30%) and high (14%) level of innovativeness.

2.1.9 Perception about health risk

Devi (2009) reported that there were two types of health risk one is short term the other one is long term and some believed that there was no health risk associated with the usage of pesticides. However, their health risk perception was not scientific.

Harilal (2013 observed that 50 percent of the respondents faced bad odour, 55 per cent breathing problem, 38 per cent weakness, 24 per cent vomiting, 13 per cent body pain, 21 per cent headache, 18 per cent itching, 25 per cent drowsiness, and 67 per cent sleeplessness after the application of pesticides.

Kumari and Reddy (2013) reported that farm workers with low educational qualification find had to follow the safety measures while using pesticides as they were unable to understand the label.

Silapanuntakul *et al.* (2016) in his investigation about agrochemical usage by farmers in Myanmar reported that majority of the respondents (56.60%) had fair perception and 16.90 percent and 26.50 percent had good and poor perception about health risks respectively.

2.1.10 Training received

Selvarajah and Thiruchelvam (2007) in their study on characteristics impact of pesticide use in Vavuniya reported that 45 per cent of the respondents undergone training for safe use of pesticide.

Mihireth (2008) informed that 53.6 per cent attended training programmes, while 46.40 per cent of the respondents did not attended training programmes.

Shinde (2011) in her study on IPM awareness by cotton growers reported that majority of the respondents (44.16%) received only one training followed by 31.67 per cent, 14.17 per cent, and 10 per cent had received two, three and, more than three trainings.

Yabe and Khai (2012) in their study on farmers perception, knowledge, and pesticide usage practices of tomato production in in Myanmar observed that only 37 per cent of the respondents got trained on pesticide application and the remaining 63 per cent did not attended any trainings.

Choudhary (2013) in his study on awareness of agricultural farmers about environmental degradation while using pesticides in Anand reported that majority of the farmers (70.83%) was trained and only 29.17 per cent were untrained.

Vihariya (2015) in her study about awareness of vegetable farmer about the impact of pesticide use reported that more than half of the respondents (54.16%) did not received any trainings and 45.84 per cent received training.

Thomsen and Sekimpi (2014) in their study about pesticide use in Uganda reported that only 31 per cent of the respondents had trained on pesticide management, pesticide application and safe handling of pesticides.

Gore and Aryan (2015) in their study on awareness of farmers about agrochemicals in Uttar Pradesh reported that 57 percent of the respondents did not attended trainings on organic farming, IPM and pesticide application, while only 43 per cent attended trainings.

Kenyon *et al.* (2015) noted that 56.8 per cent had received trainings on safe handling of pesticides, while 43.2 per cent did not received any trainings on safe handling of pesticides.

Mustapha and Jallow (2017) observed that majority (64%) of the respondents had not received any training and 36 per cent were trained.

Aldosari *et al*, (2018) found that majority (82.10%) of the respondents had not trained on safe pesticide handling followed by 9.20 per cent received training once or twice, 4.60 per cent received three to four times, and 4.10 per cent more than four times.

Prathamesh (2019) observed that majority (80.83%) of the respondents had not received any training followed by 19.17 per cent received training.

2.1.11 Information source utilization.

Rao and Dubey (2001) in their investigation environmental hazards caused by the pesticides suggested that 62.50 per cent of the respondents had medium level of information source utilization, while 30 per cent and 7.50 per cent of the respondents had low and high level of information source utilization.

Sonawane (2010) showed that majority of the respondents (46%) had medium level of information source utilization, while 32.67 per cent and 21.33 per cent had low and high level of information source utilization.

Benal *et al.* (2010) in his study on dry land management reported that 72.50 per cent of the respondents had high level of source of information, whereas 17.59 per cent had medium and 10 per cent had low level of source of information.

Shetty *et al*. (2010) in her investigation on farmers pesticide utilization in Indian showed that 47 per cent of the farmers obtain information from pesticide dealers, 33 per cent from neighbours and only 1 per cent from field officers.

Tidke *et al.* (2012) that majority of the respondents (63.33%) had medium level of source of information, followed by 23.33 per cent and 23.33 percent of the respondents had low and high level of source of information.

Abang *et al*. (2013) reported that more than 75 per cent of the respondents did not have access to information and only 50 per cent collect information about production marketing etc. about vegetable cultivation.

Raut (2016) observed that majority (62.66%) of the respondents were belongs to medium category of information source utilization followed by 20.67 per cent had low level of information source utilization and 16.67 per cent had high level of information source utilization.

Amle (2016) indicated that most of the respondents (70%) had medium level of utilization of information source, followed by 21 percent had low and only 9 percent had high level of utilization of information source.

Pundalikrao (2018) in his study on perception of green chilli growers regarding environmental risk in use of pesticides in Vidarbha reported that 55 per cent respondent had medium level of information source utilization, while 22.6 per cent and 22.335 per cent had low and high level of information source utilization.

2.2 KNOWLEDGE OF FARMERS ABOUT THE SAFE HANDLING OF PESTICIDES.

Kumar (2004) reported that majority (65.62%) of the respondents had medium level of knowledge followed by 20 per cent and 14.38 per cent had high and low level of knowledge.

Salameh, *et al*. (2004) reported that almost 50 per cent of the respondents did not know about any pesticide name and more than 75 per cent did not know to distinguish a safe pesticide from a dangerous pesticide. Majority of the respondents consider the protective measures as useless.

Guptha *et al*. (2006) in his research on problems in cauliflower cultivation in Uttar Pradesh found that majority of the respondents had medium level of knowledge about safe handling of pesticides and 62.98 per cent were not of side effects of pesticides.

Patel (2006) in his study about impacts of pesticides in Anand indicated that 54.43 per

cent of the respondents had medium level of knowledge about the IPM.

Mathews (2007) found that majority of the respondents did not know about the need of safe handling of pesticides because of the low number of incidents affecting their health.

Waichman *et al*. (2007) revealed that 77.6 per cent did not know to read the label, while 22.4 per cent able to read the label out of which only 13.2 per cent understood the meaning.

Nagenthirarajah and Thiruchelvam (2008 found that more than half of the respondents (60%) had medium level of knowledge about plant protection practices, while only 6 per cent had good knowledge on plant protection practices. Majority of the respondents depends on chemical pesticides at 35 per cent higher concentration than recommended.

Sam *et al.* (2008) in his study on impact of training about pesticide use reported that majority of the respondents had lack of knowledge on safe pesticide usage.

Mahantesh *et al.* (2009) found that 41 per cent of the farmers had knowledge on pesticide hazards in vegetable farming, while only 9.75 per cent had knowledge on recommended level of pesticide usage.

Rathod (2009) found that majority of the respondents (87.15%) had medium to low level of knowledge about safety measures.

Giri *et al*. (2014) in his study on usage of pesticides by potato farmers in Nepal revealed that 80 per cent of the respondents had knowledge about adverse health effects of pesticides and 26 per cent do not had knowledge about adverse effects of pesticides.

Mane (2012) in his study on management of green gram indicated that most of the respondents (70%) had medium level to high level of knowledge.

Chaudhari (2012) in their study on management of chilli noted that most of the respondents had medium level knowledge about interventions of chilli.

Madhu (2013) observed that most of the respondents (52.50%) of the farmers had knowledge about various aspects of pesticides, followed by 28.34 per cent and 19.16 per cent had high and low level of knowledge.

Mishra (2016) in his investigation on use of agrochemicals by the farmers of Uttar Pradesh revealed that the overall knowledge about the safe plant protection measures before training was, the majority of respondents (74.63%) had medium level of knowledge about pesticide, while 13.66 per cent and 11.71 per cent had high and low level of knowledge respectively and after training the majority of respondents (64.88%) had medium level of knowledge, while 18.54 per cent and 16.59 per cent had high and low level of knowledge respectively.

2.3 EXTENT OF ADOPTION OF SAFE HANDLING PROCEDURES OF PESTICIDES BY THE FARMERS.

Malgie (2001) indicated that 88.3 per cent of the respondents used protective equipments, while spraying and only 3.3 per cent never used it.

Amera *et al*. (2017) noted that about half of the respondents (50%) reuses empty containers of pesticides for storing food and 7 per cent uses it for other purposes. Almost 30 per cent of the respondents were keeping the pesticides inside their houses and among them 6 per cent stored it in the kitchen.

Damalas *et al.* (2010) in their study on awareness of health risk and use of PPE while using pesticides in Greece reported that 54.9 per cent of the respondents re-spray the treated area to finish the tank, while 30.2 per cent apply the left overs to other crops and 4.3 per cent releases it in irrigation canals.

Singh *et al*. (2010) reported that majority of the respondents (66%) had medium adoption of safety measures, followed by 19 per cent and 15 per cent had low and high level of adoption behavior.

Yao (2013) in his study pesticide use by farmers of Togo showed that majority of the vegetable farmers (84%) didn't wear any protective clothing like gloves, goggles and only less than 30 per cent of the respondents wear mask.

Kumari and Reddy (2013) indicated that most of the respondents (71.3%) reported that they wear protective clothing while handling pesticides but among them only42.5 per cent were practicing. Almost 86 per cent of respondents claimed that hey wear face mask while spraying but only 46.1 per cent were practicing the same. And 81.3 per cent of the respondents answered that they won't drink, eat or smoke while using pesticide but only 52.9 per cent were actually practicing it.

Abang *et al.* (2013) found that 90 per cent of the respondents used knapsack sprayer, 20 per cent felt sickness after spraying pesticides, 25 per cent store pesticide at their home. The study also identified that 45 per cent of the respondents couldn't identify fungicides and insecticides.

Sheikh and Hoque (2014) reported that most of the respondents (93%) were partially using safety measures while using pesticides. And almost all avoid proper safety practices. Almost 72 per cent of the respondents used to partially wear protective clothing like shirt or pants as pre spraying protection and wash their face and hands as post spraying protection.

Al-zyoud (2014) in his study Jordanian vegetable and fruits growers found that the pesticide usage by the respondents were very unsafe and noted the storage of pesticides at home, mixing pesticides in kitchen, improper disposal of empty containers, not wearing PPE and eating and drinking between spraying without washing their hands.

Giri *et al*. (2014) reported that 62.6 per cent of the respondents used to wear a piece of cloth to cover mouth and nose, 41 per cent used to bath after spraying, 29.5 per cent wear gloves, 27.8 per cent wear aprons, 22 per cent wear hat and 16.3 per cent wear shoes. In the case of pesticide application only 26 per cent of the respondents avoid spraying while wind and only 1.5 per cent uses other protective measures.

Asongwa *et al*. (2014) in their study on vegetable farmers in Cameroon found that most of the respondents did not uses protective clothing, and use to smoke, drink and eat while spraying and also dispose the empty pesticide containers in the field itself or reused for household purposes.

Tandi *et al*. (2014) in his study about pesticide use in tomato production in Cameroon reported that 83.8 per cent of the respondents uses knapsack sprayers, 76.3 per cent partially adopt safety clothing and 55 per cent did not believed in pesticide drift and used to spray while wind.

Gore and Aryan (2015) found that 95 per cent of the respondents aware about harmful effects of pesticide and only 5 per cent were not aware of the harmful effects of pesticides.

Tyagi *et al.* (2015) revealed that 70 per cent of the respondents adopt safety measures while 56 per cent of the farmers did not adopt any safe handling measures and 38 per cent of the respondents were partially adopting safety measures.

Mishra (2016) reported that majority of the respondents (66.3%) had medium level of overall adoption of safe plant protection measures before training followed by 20 per cent and 13.7 per cent had low and high level of adoption respectively. After training majority of the respondents (68.8%) had medium level of adoption of safe plant protection measures followed by 16.1 per cent and 15.1 per cent had high and low level of adoption respectively.

George *et al.* (2012) in their study on IPM adoption in vegetable cultivation in Karnataka reported that 63.7 per cent of the respondents had medium level of adoption of IPM practices.

2.4 ATTITUDE OF FARMERS ABOUT THE SAFE HANDLING OF PESTICIDES.

Atreya (2007) in her study on pesticide use in Nepal found that even though most of the respondents had awareness about safe handling procedures there was a gender difference in attitude towards following the safe handling procedures

Patel (2007) in his study on impact of IPM in Karnataka reported that 55 per cent of the respondents had medium favourable attitude towards IPM followed by 30 per cent and 15 per cent had low and high favourable attitude respectively.

Selvarajah and Thiruchelvam (2007) indicated that 60 per cent of the respondents used 30- 50 percent higher dosage than recommended.

Mathews (2007) reported that majority of the respondents were aware of safe pesticide usage and the extent of usage of these safe practices also fair as they had good attitude to the risk of poisoning from the pesticides.

Sam *et al*. (2008) concluded that the attitude of farmers on safe use of pesticides before and after trainings and noted a significant improvement after training.

Choudhary (2010) reported that 61. 67 per cent of the respondents had medium level of attitude, were as 20.83 per cent and 17.50 per cent of the respondents had high and low level of attitude towards the safe handling of pesticides.

According to Khan *et al.* (2011) noted that farmers had very casual attitude towards safe handling procedures of pesticides and shows very poor usage of protective equipment and similar attitude was shown towards storage and disposal of pesticides.

Shafiee *et al.* (2012) in their study on pesticide poisoning in Iran concluded that most of the farmers uses chemical pesticides in a carefully manner with adoption of all the safety measures, but still the farmers felt sickness after usage of pesticides.

Oesterlund *et al*. (2014) in their study on pesticide use in Uganda reported that majority of the farmers had poor knowledge about safe handling of pesticides and pesticide toxicity and did not use any PPE or personal hygiene practices.

Huda *et al.* (2015) reported that 66.2 per cent of the respondents had less favorable attitude towards pesticide risk followed by 21.3 per cent and 12.5 per cent had medium and high favorable attitude towards pesticide risk.

Amle (2016) indicated that majority (71%) had medium level of attitude towards safe practices of pesticides followed by 17 per cent and 12 per cent had high and low level of attitude towards safe practices while handling pesticides.

Raut (2016) found that majority (51.33%) of the farmers had favourable attitude and 24.67 per cent had unfavourable attitude towards safe handling of pesticides.

Mishra (2016) found that the attitude of vegetable farmers towards plant protection measures before training shows, the majority of the respondents (70.73%) had medium level of attitude, followed by 16.69 per cent and 12.68 per cent had high and low level of attitude towards safe plant protection measures. After training majority of the respondents (67.8%) had medium level of attitude followed by 16.1 per cent equally low and high level of attitude towards safe plant protection measures.

2.5 CONSTRAINTS IN FOLLOWING THE SAFE HANDLING PROCEDURES OF PESTICIDES.

Mekonnenn *et al.* (2002) in his study on pesticide use of Ethiopian farmers reported that lack of knowledge and source of information about hygiene and sanitation practices and safe usage of pesticides were the limiting factors which restrict them to adopt the safety measures.

Desai (2005) reported that most of the respondents (67.33%) faced irregular power supply, 21.33 per cent faces ineffectiveness of insecticide, 18 per cent faces lack of technical advice, from the part of technical constrains. In case of financial constrains majority of the respondents faced lack of loans at proper time, 23.33 per cent faced high cost of fertilizers, 11.3 per cent faced high cost of pesticides.

Walke (2008) in his study about management of brinjal cultivation reported that 93.33 per cent of the respondents faced high cost of fertilizer, 56.66 per cent faced shortage of labourers, 72.50 per cent faced high cost of pesticides, 81.60 per cent faced high labour charge, 74.16 per cent faced price fluctuation in market, and 65.83 per cent faced lack of knowledge as the limiting factor which reduces the adoption of proper safe handling procedures.

Mahantesh and Sigh (2009) in his study about farmer's knowledge of pesticide use in vegetable production in Uttar Pradesh observed that only 34 per cent of the respondents used face mask and gloves all the remaining respondents did not follow any kind of safety measures.

Rahman (2012 found that there were mainly five factors that restricts the farmers to

use IPM they were limited labour availability, lack of knowledge on safe practices, lack of trainings, availability of insecticides and complexity of IPM.

Henry *et al.* (2013) found that lack of training and high cost of the protective measures are the reason which hinders the adoption process of safe handling practices of pesticides.

Quinteiro *et al.* (2013) in their study on impact of training n pesticide application in Spain reported that lack of training is the major factor that reduces the adoption of safety practices while handling pesticides.

Mohanty *et al*. (2013) in her investigation on adoption of vegetable farm management of tribal farmers in Sikkim noted that lack of marketing networks, soil management, awareness, achievement motivation, poor information source were the major limiting factors.

Pandit and Basak (2013) reported that 97.20 per cent of the respondents had medium to high level of constrains in seed management, 41.7 per cent faced low constrains in pest management, in case of field management 91.6 per cent faced medium constrains, 92.4 per cent faced medium to high level of marketing constrains.

Sahu *et al*. (2013) reported that lack of knowledge (88.33%), unavailability of hybrid seeds (83.33%), lack of proper irrigation facility (80%), non- remunerative price (78.33%), lack of training (75%) and lack of subsidy (75%) were the limiting factors of proper adoption.

Parsa *et al.* (2014) reported that 12.8 per cent of the respondents claimed that lack of training, 9.4 per cent lack of government policies were the constrains faced by the farmers for proper adoption of safe handling of pesticides.

Tandi *et al.* (2014) found that lack of information and cost of safety equipment were the reasons of low adoption of pesticides.

Krishnamurthy *et al*. (2016) in their study about adoption of new production technology in tomato cultivation observed that high labour wage, non-availability of

labour, irregular power supply, high cost of plant protection, lack of knowledge was the major constrains.

Iyagba *et al*. (2017) observed that bulkiness of organic materials and irregular visit by extension officers were the major issues faced by the respondents.

Gupta *et al.* (2017) in their research on agrochemical handling of vegetable growers in Varanasi reported that on remunerative prices from the market is the most important issue faced by the farmers.

Chand *et al.* (2017) concluded that lack of market facilities, lack of market intelligence, lack of remunerative prices was the major marketing constrains faced by the farmers.

Methodology

CHAPTER III

METHODOLOGY

Research methodology is the systematic pathway of deducing solution for a particular problem. This chapter entails various methods or techniques used by the researcher to attain the research objectives. The following subheadings were the strategies adopted for the completion of the research work.

3.1 Research design

3.2 Locale of the study

3.3 Sampling procedure

3.4 Data collection methods and tools

3.5 Operationalization and measurement of independent variables

3.6 Operationalization and measurement of dependent variables

3.7 Constraints faced by the respondents

3.8 Statistical tools

3.1 RESEARCH DESIGN

A research design is the ordering of various methods that are needed for data collection and techniques to analyze the data generated by giving maximum focus to the objectives. For this study ex-post-facto research design was followed. This design is used to study the phenomenon that has already happened. According to Kerlinger (1973), the researcher did not have straight command over the variables as because it is a phenomenon occurred in past and thus manipulation will not be possible.

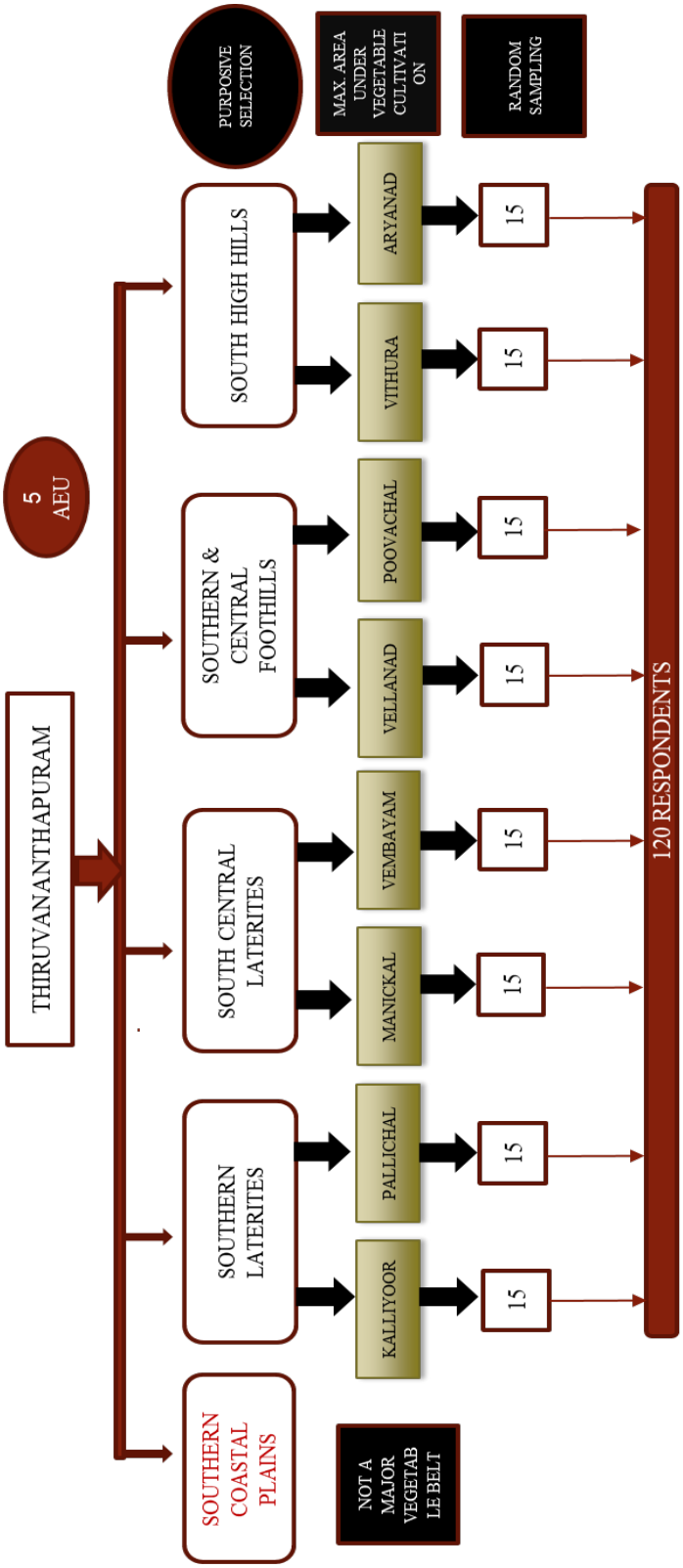
3.2 LOCALE OF THE STUDY

The study was conducted in Thiruvananthapuram district of Kerala state, as it has the highest area under vegetable cultivation in Southern Kerala and maximum number of agricultural labourers (GoK, 2020).

3.3 SAMPLING PROCEDURE

Four out of five AEU's which are the main vegetable growing belts of the district were selected. The selected AEUs were southern laterite, south central laterite, southern and central foothills and south high hills. From the four AEU two panchayats were selected purposively which were having maximum area under vegetable cultivation. The selected eight panchayaths were Pallichal, Kalliyoor, Vembayam, Manickal, Vellanad, Poovachal, Vithura and Aryannad. Fifteen vegetable growers were selected randomly from each of these selected panchayats, thereby making a total sample size of 120 respondents.

Plate 1: Representation of selection of respondents



3.4 DATA COLLECTION METHODS AND TOOLS

As per the review of literature and judges rating with experts 11 independent variables were selected from 34 independent variables that were given. The variables were judged by judges on a five-point relevancy rating scale with response pattern - most relevant, more relevant, relevant, less relevant and least relevant with scores of 5, 4, 3, 2 and 1, respectively. The questionnaire was sent to the judges through mail and 34 responses were received. The scores obtained by each variable was added individually and the variable with high scores were selected as independent variables and is represented in Appendix I.

Table 1: Independent variables and measurement procedure

Sl. No.	**Independent variables**	**Measurement**
1	Age	GOI census 2021
2	Education	Supe (2007)
3	Source of information	Arbitrary scale
4	Economic orientation	Supe (1969)
5	Labour availability	Pundalikrao (2018)
6	Training received	Amle (2016)
7	Farming experience	Silvakumar (1988)
8	Environmental orientation	Sreevalsan (1995)
9	Risk orientation	Supe (1969)
10	Innovativeness	Reddy (2013)
11	Perception about health risk	Prathamesh (2019)

3.5 OPERATIONALIZATION AND MEASUREMENTS OF INDEPENDENT VARIABLES

3.5.1 Age

Age is operationalized as the number of years completed by the vegetable farmer respondents at the time of interview. It was measured as the total number of

years completed by the farmer respondent at the time of interview and classified based on census report, GOI (2021). The results were presented in terms of frequency and percentages.

Sl. No.	Category	Age range
1	Young age	Up to 35 years
2	Middle age	35 to 55 years
3	Old age	55 years and above

3.5.2 Education

Education is operationalized as the level of formal education attained by the vegetable farmer respondent. It was measured basis of the scoring procedure formulated by Supe (2007) with slight modification. The results were presented in terms of frequency and percentages.

Sl. No.	Category	Level of education
1	Illiterate	No education
2	Primary education	Up to 7^{th} standard
3	Secondary education	8^{th} and 10^{th} standard
4	Higher secondary education	11^{th} and 12^{th} standard
5	Graduate and above	Degree

3.5.3. Farming Experience

Farming experience refers to the total number of years a vegetable farmer respondent has been engaged in farming. It was measured on the basis of Scale formulated by Silvakumar (1988). The results were presented in terms of frequency and percentages.

3.5.4. Labour availability

It refers to labour availability for cultivation of vegetable crops particularly for

pesticides application in vegetable crop. Scale formulated by Pundalikrao (2018) with modifications was used to measure the labour availability. The results were presented in terms of frequency and percentages. Scores were allotted as follows:

Sl. No.	Labour availability	Score
1	Hired labour	1
2	Family members	2
3	Hired + family labour	3

3.5.5. Economic orientation

It refers to the degree to which a vegetable farmer respondent was oriented towards profit enhancement through cultivation and the relative value placed by the farmer on economic ends. It was measured with the scale formulated by Supe (1969). The scale consist of six statements out of which one statement is negative. The responses were obtained in a three- point continuum scale ranging from agree, undecided and disagree. The positive and negative statements were scored as follows:

Category	Agree	Undecided	Disagree
Score for positive statements	2	1	0
Score for negative statement	0	1	2

Total score was calculated by taking the sum total of scores of all the six statements and the score varies from 0 to 12. Further it was classified into low, medium, and high by using quartile deviation.

3.5.6. Environmental orientation

It is operationalized as the degree to which a vegetable farmer respondent has responsibility for his environment. It was measured using the scale formulated by Sreevalsan (1995). The scale consists of six statements. The responses were recorded on bipolar alternatives as agree or disagree with scores of 1 & 0 respectively. Total score was calculated by taking the sum total of scores of all the six statements and the

score varies from 0 to 6. Further it was classified into low, medium, and high by using quartile deviation.

3.5.7. Risk orientation

It is operationalized as the degree to which vegetable farmer respondent is oriented towards experience in risk taking and un-predictability in adopting new farming ideas. It was measured with the scale formulated by Supe (1969). The scale consists of six statements out of which two statements were negative. The responses were obtained in a three-point continuum scale ranging from agree, undecided and disagree. The positive and negative statements were scored as follows:

Category	Agree	Undecided	Disagree
Score for positive statements	2	1	0
Score for negative statement	0	1	2

Total score was calculated by taking the sum total of scores of all the six statements and the score varies from 0 to 12. Further it was classified into low, medium, and high by using quartile deviation.

3.5.8. Innovativeness

Innovativeness refers to the degree to which vegetable farmer respondents oriented to adopt the modern farm practices first in the village. The scale formulated by Reddy (2013) was used to measure the innovativeness. The scale consist of seven statements out of which two statement were negative. The responses were obtained in a three-point continuum scale ranging from yes, undecided and no. The positive and negative statements were scored as follows:

Category	Yes	Undecided	No
Score for positive statements	2	1	0
Score for negative statement	0	1	2

Total score was calculated by taking the sum of scores of all the seven statements and the score varies from 2 to 12. Further it was classified into low,

medium, and high by using quartile deviation.

3.5.9. Perception about the health risk

It refers to vegetable farmer's risk perception about unsafe usage of agrochemicals. The scale formulated by Prathamesh (2019) was used to measure the perception. The scale consists of seven statements. The statements were asked as dichotomous questions and the response was recorded as yes or no with scores of 2 and 1, respectively. Total score was calculated by taking the sum of scores of all the seven statements and the score varies from 7 to 14. Further it was classified into low, medium, and high by using quartile deviation.

3.5.10. Training received

This refers to teaching or developing in oneself or others, any skills and knowledge that relate to specific useful competencies. Scale formulated by Amle (2016) with slight modifications were used to measure the training received. Results were expressed in terms of frequency and percentage.

Sl. No.	Category	Training received
1	No training	0
2	Low	1-3
3	Medium	4-6
4	High	Above 7

3.5.11. Information source utilization.

Information source utilization refers to the frequency of communication of the farmer respondents to different information sources for obtaining the agricultural information. It was one of the major factors that influenced the knowledge, attitude and adoption of safe pesticide handling by the vegetable farmers. The scoring was done based on the frequency as always, sometimes, and never with scores of 3, 2 and 1 respectively. Based on quartiles categorization was done as low, medium and high

3.5.12. Major vegetable crop grown

Major vegetable crop grown is operationalized as the number of vegetable crops grown by an individual respondent. Measurement Scale adopted was scale developed by Pundalikrao (2018). Different crops cultivated were documented and corresponding frequency and percentages were calculated.

3.6 OPERATIONALIZATION AND MEASUREMENTS OF DEPENDENT VARIABLES

3.6.1 Knowledge of the farmers about the safe handling procedures of pesticides

Knowledge of the vegetable farmers on safe pesticide handling was measured using a teacher made test. Questions on safe handling procedures of pesticides were prepared after consulting with subject matter experts and review of literature. The questions were asked in objective manner. There were 40 questions under eight subcomponents. Each question was given a score of 2 for correct answer and 1 for incorrect answer. There were 12 negative statements out of 40 statements. As there are unequal number of questions under each subcomponent, weighted score was taken for the calculation. Then the Knowledge score was converted into knowledge index with the help of the formula given below:

$$KNOWLEDGE\ INDEX = \frac{ACTUAL\ OBTAINTED\ KNOWLEDGE\ SCORE}{MAXIMUM\ POSSIBLE\ OBTAINABLE\ SCORE} \times 100$$

Total score was calculated by taking the sum of scores of all the forty statements. Further it was classified into low, medium and high by using quartile deviation.

3.6.2 Extent of adoption of safe handling procedures of pesticides by the farmers

Extent of adoption of the safe pesticide handling practices was measured using guidelines on good practices on pesticide used by FAO and the scale formulated by Jasna (2018) with modifications as per the requirements of the study. Questions on safe handling procedures of pesticides were prepared after consulting with subject matter experts and review of literature. The responses were obtained in a five-point

continuum of always, most often, sometimes, rarely and never. There were 36 questions under six subcomponents. There were 7 negative statements out of 36 statements. As there are unequal number of questions under each subcomponent, weighted score was taken for the calculation. The total score was converted into adoption quotient with formula given below

$$AQ = \frac{\sum_{I=1}^{N} \frac{EI}{PI} \times 100}{N}$$

(Singh and Singh, 1967)

Where,

AQ = Adoption Quotient

ei = Extent of adoption of each practice

pi = Potentiality of adoption of each practice

N = Total number of practices selected

The scores was given as follows:

Category	Always	Most often	Sometimes	Rarley	Never
Positive Statements	5	4	3	2	1
Negative Statements	1	2	3	4	5

Total score was calculated by taking the sum of scores of all the 36 statements. Further it was classified into low, medium, and high by using quartile deviation.

3.6.3 Attitude of farmers about safe handling procedures of pesticide

Attitude of vegetable farmers towards safe pesticide handling practices was measured using the scale formulated by Jasna (2018). There were 19 statements, and the responses were obtained in a Likert scale of strongly agree, agree, undecided, disagree and strongly disagree, and the score was given 5, 4, 3, 2 and 1, respectively.

Total score was calculated by taking the sum of scores of all the 19 statements. Further it was classified into low, medium, and high by using quartile deviation.

3.7 CONSTRAINTS EXPERIENCED BY THE FARMER IN FOLLOWING THE SAFE HANDLING PROCEDURES OF PESTICIDES

The constraints faced by the farmers which restrict them from adoption of the safe handling practices were recorded. A well-structured interview schedule was administrated. The constraints suggested by the respondents were also documented and categorised as technical, economical, occupational, infrastructural and marketing. Then the ranking was done based on total score.

3.8 STATISTICAL TOOLS

3.8.1 Mean

Mean was calculated by dividing the total value of the items with total number of items.

$$Mean = \frac{sum\ of\ the\ values}{total\ number\ of\ items}$$

3.8.2 Quartile deviation

Quartile deviation was used to measure the deviation in the middle of the data. It measures the dispersion of the data

3.8.3 Standard deviation

Standard deviation was obtained by taking the square root of the average of squares of deviations.

3.8.4 Percentage analysis and frequency

It was obtained by dividing the frequency of responses of each group with the total number of responses and then dividing it with 100.

3.8.5 Karl pearson correlation

Karl Pearson Correlation was used to determine the relationship between the dependent and independent variables. It was calculated by dividing the covariance of

two variables with product of standard deviations of two variables

3.8.6 Chi square

Chi square was used to find the relationship between the categorical variables and the dependent variables.

Results and Discussion

CHAPTER IV

RESULTS AND DISCUSSION

The data collected were analyzed using statistical tools and the findings were derived and its interpretations are presented under the following subheadings.

4.1 Profile characteristics and distribution of farmers.

4.2 Knowledge of farmers about safe handling procedures of pesticides.

4.3 Adoption of safe handling procedures of pesticides by the farmers.

4.4 Attitude of farmers towards safe handling procedures of pesticides.

4.5 Correlation between profile characteristics of farmers and dependent variables.

4.6 Constraints experienced by the farmers in following safe handling practices of pesticides.

4.1 PROFILE CHARACTERISTICS OF THE FARMERS

It contains the distribution of farmers based on profile characteristics like age, education, information source utilization, farming experience, labour availability, economic orientation, risk orientation, environmental orientation, perception about health risk, major vegetable crop grown, and innovativeness.

4.1.1 Distribution of respondents based on age

Age refers to the total number of years completed by the vegetable farmer respondent at the time of interview. Based on quartiles respondents were categorized into three groups viz. young, middle, and old age. Distribution of respondents based on age is given in table 2.

Table 2: Distribution of respondents based on age

N =120

Sl.No.	Age	Frequency	Percentage
1	Young age (≤35)	11	9.2
2	Middle age (36- 55)	54	45.0
3	Old age (≥56)	55	45.8
Mean - 52.2 SD - 11.1			

From table 2 it is evident that majority of the farmers (45.8%) were old aged followed by middle aged (45%) and then young age (9.2%). The maximum and minimum age of the respondents were 84 and 27, respectively. The results were in line with the findings of Devi (2009) and Chaudhary (2010). The results reflect the lower participation of younger generation in vegetable cultivation and it might be due to the fact that younger generation is more focused towards white collared job. The results are represented in fig. 1.

4.1.2 Distribution of respondents based on education

Education was operationalized as the level of formal education attained by the farmer respondent. It was classified based on quartiles Distribution of respondents according to their educational status is given in table 3.

Table 3: Distribution of respondents based on education

N =120

Sl.no.	Education	Frequency	Percentage
1	$<10^{TH}$	11	9.2
2	10^{TH}	85	70.8
3	Higher Secondary	6	5.0
4	Degree & above	18	15.0

Majority of the vegetable farmers (70.8%) were educated up to tenth standard followed by 15 per cent who had degree and above qualifications, 9.2 per cent had below tenth standard qualification and only 5 per cent had higher secondary level qualifications. Also, none of the farmers were illiterate. The results were in line with the findings of Devi (2009), Rathod (2009), and Choudary (2010) where majority of the respondents had studied up to 7^{th} standard and only few respondents had studied up to university level and most of the respondents were able to read and write the local language. Figurative representation of the result is given in fig. 2.

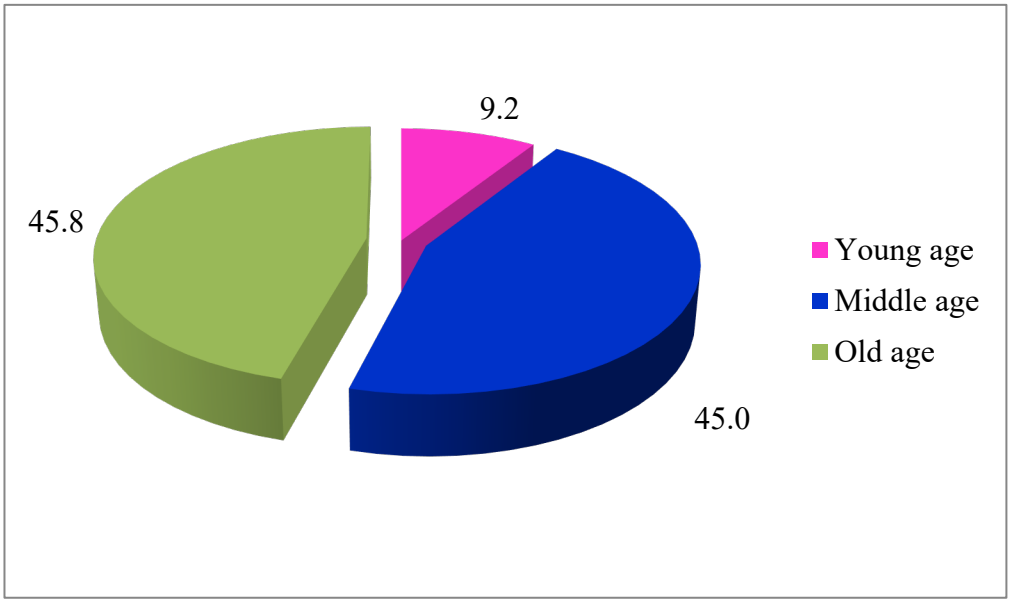


Fig. 1: Distribution of respondents based on age

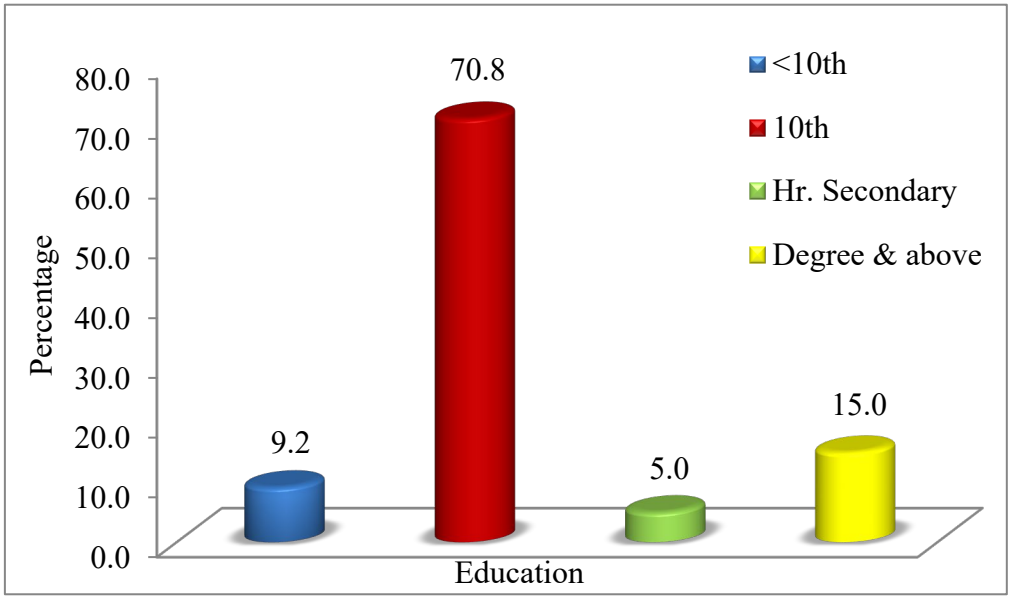


Fig. 2: Distribution of respondents based on education

4.1.3 Distribution of respondents based on farming experience

It refers to the total number of years a vegetable farmer respondent had been engaged in farming. It is classified into five groups using quartiles. Categorization according to the farming experience is given in table 4.

Table 4: Distribution of respondents based on farming experience

N =120

Sl.no.	Farming experience	Frequency	Percent
1	≤10	10	8.3
2	11 - 20	36	30.0
3	21 - 30	49	40.8
4	31 - 40	18	15.0
5	>40	7	5.8
Mean- 24.5 SD- 11.3			

From the table 4 it can be inferred that majority of the respondents (40.8%) were having experience between 21 to 30 years, followed by 30 per cent with 11 to 20 years, 15 per cent with 31 to 40 years, 8.3 per cent with less than 10 years of farming experience and only 5.8 per cent had above 40 years of farming experience. The results are presented in fig. 3.

It could be inferred from the above table that most of the farmers had 21 to 30 yearsof farming experience followed by 11 to 20 years, 31 to 40 years and only a few respondents had up to 10 years of farming experience. The possible reason for this type of distribution may be because the majority of the respondents were belonging to old and middle age category. Younger generation were more interested in white collar jobs and showed very less interest towards agriculture. The results were in line with the findings of Devi (2009), Shirke *et al*, (2011) and Arpit (2015), where the majority of the farm workers had more than 10 years of experience in pesticide use.

4.1.4 Distribution of respondents based on labour availability

Labour availability in the study refers to availability of labour for cultivation of vegetable crops especially pesticides application in vegetable crop. It is classified into three groups viz. hired, family and both (hired +family) labourers. Distribution of respondents according to the labour availability is given in table 5.

Table 5: Distribution of respondents based on labour availability

N =120

Sl.no.	Labour availability	Frequency	Percent
1	Hired labour	36	30.0
2	Family labour	57	47.5
3	Hired + family labour	27	22.5

From the table 5 it can be inferred that majority of the respondents (47.5%) utilised family members as their labours followed by 30 per cent had hired labours and only 22.5 per cent had both family members and hired labourers. The results are presented in figure 4.

It could be inferred from the figure 4 that majority of the respondents had family members as their main labour force and a lesser number of respondents had both family members and hired labours. Possible reason of this distribution could be because of the higher wage rate of hired labour resulting in less economic gain hence engaging more family members to make the enterprise more viable.

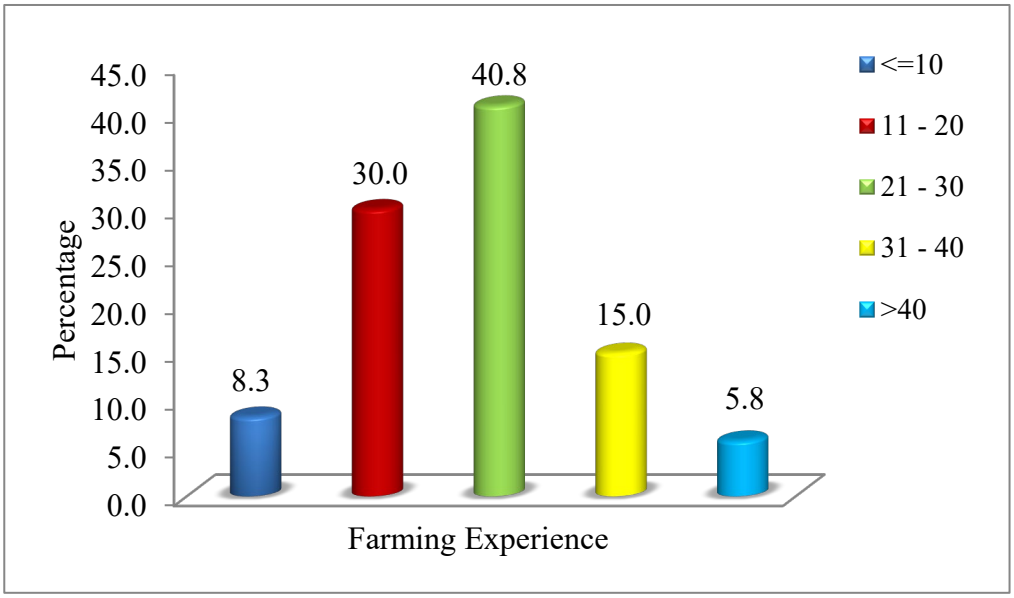


Fig. 3: Distribution of respondents based on farming experience

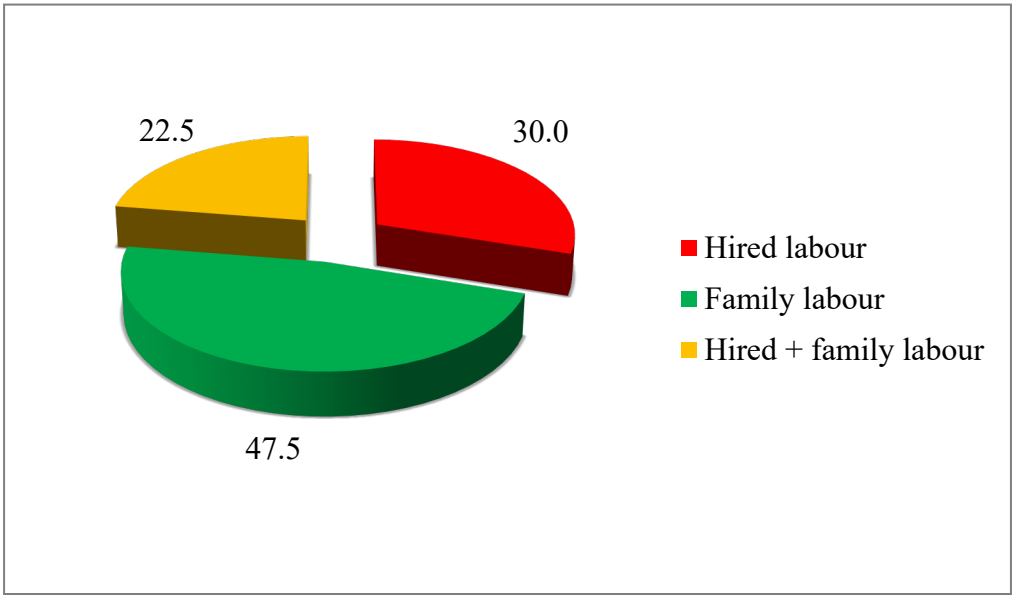


Fig. 4: Distribution of respondents based on labour availability

4.1.5 Distribution of respondents based on economic orientation

It refers to the degree to which a vegetable farmer respondent was oriented towards profit enhancement from vegetable cultivation and the relative value placed by the farmer on economic ends. It was classified based on the quartiles. Categorization according to the economic orientation is given in table 6.

Table 6: Distribution of respondents based on economic orientation

N =120

Sl. No.	Category	Frequency	Percentage
1	Low (≤5)	42	35
2	Medium (5 to 8)	55	45.8
3	High (>8)	23	19.2
Q1 = 5 Min = 2 Q3 = 8 Max = 11 Mean = 6.4 SD = 2			

From the table 6 it can be inferred that majority of the farmers were having medium level of economic orientation (45.8%) followed by low (35%) and high (19.2%) level of economic orientation. The results are represented in figure 5.

It could be inferred from the figure that most of the farmers had medium level of economic orientation. The possible reason for this type of distribution might be the fact that the price of agricultural inputs were highly fluctuating, and farmers were cautious in taking risky decision. It also shows their lesser interest in profit maximization from farming, they were much more interested in traditional methods hence they need to be convinced to act further. Also, majority of the farmers were considering farming as a subsistence occupation and not commercially. The findings were in line with the results of Kumar (2012) and Gopinath (2005).

4.1.6 Distribution of respondents based on environmental orientation

Environmental Orientation is operationalized as the degree to which a farmer has responsibility for his environment. It was classified based on the quartiles. Categorization according to the environmental orientation is given in table 7.

Table 7: Distribution of respondents based on environmental orientation

N =120

Sl. No.	Category	Frequency	Percentage
1	Low (≤3)	40	33.3
2	Medium (3 to 5)	78	65
3	High (>5)	2	1.7
Q1 = 3 Min = 0 Q3 = 5 Max = 6 Mean = 3.8 SD = 1.4			

From the table 7 it can be inferred that majority of the farmers were having medium level of environmental orientation (65%) followed by low (33.3%) and high (1.7%) level of environmental orientation. The results are represented in figure 6.

It could be inferred from the figure that most of the farmers had low to medium level of environmental orientation. This might be due to the lower education level, medium level of information utilization and knowledge about these aspects. The findings were in line with the results of Preethi (2014) and Pundalikrao (2018).

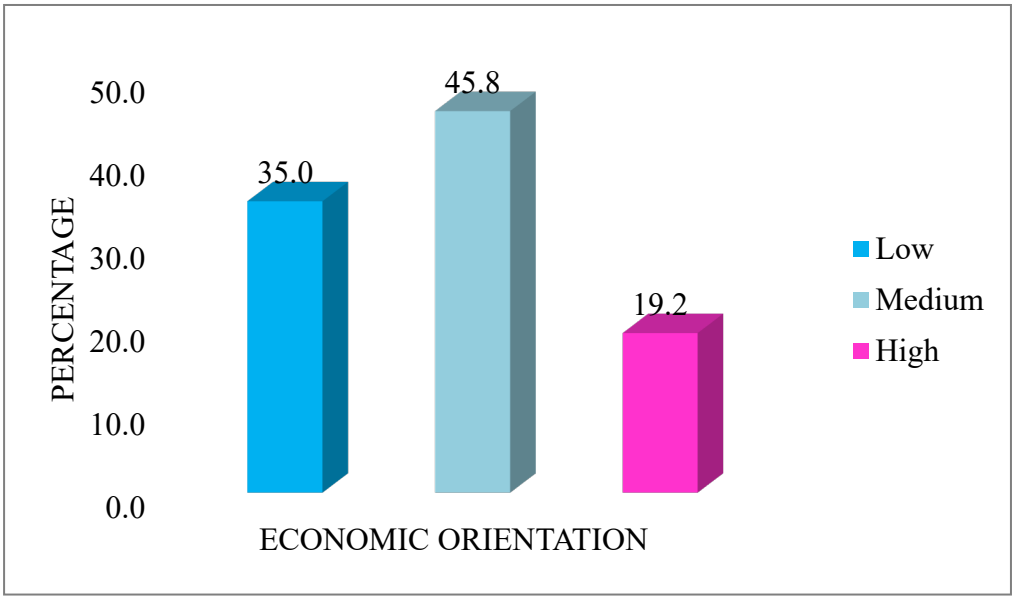


Fig. 5: Distribution of respondents based on economic orientation

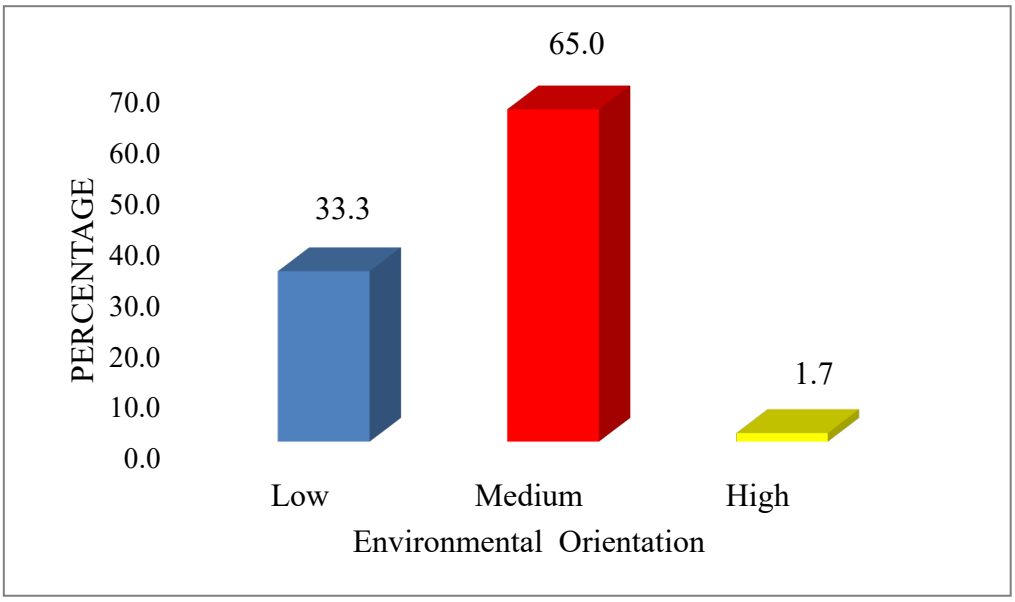


Fig. 6: Distribution of respondents based on environmental orientation

4.1.7 Distribution of respondents based on risk orientation

Risk Orientation is operationalized as the degree to which a vegetable farmer respondent is oriented towards experience in risk and unpredictability in adopting new ideas in agriculture. It was classified based on the quartiles. Categorization according to the risk orientation is given in table 8.

Table 8: Distribution of respondents based on risk orientation

N =120

Sl. No.	Category	Frequency	Percentage
1	Low (≤5)	31	25.8
2	Medium (5 to 9)	78	65
3	High (>9)	11	9.2
Q1 = 5 Min = 0 Q3 = 9 Max = 12 Mean = 7 SD = 2.4			

From the table 8 it can be inferred that majority of the farmers were having medium level of risk orientation (65%) followed by low (25.8%) and high (9.2%) level of risk orientation. The results are represented in figure 7.

It could be inferred from the figure that most of the farmers had medium level of risk orientation. The possible reason for this type of distribution may be because of their economic conditions, medium level of information source utilization and involvement in subsidiary occupations. The findings were in line with the findings of Rabari (2006) and Gopinath (2005).

4.1.8 Distribution of respondents based on innovativeness

Innovativeness refers to the degree to which vegetable farmer respondent is oriented to adopt to the modern farm practices first in the village. It was classified based on the quartiles. Categorization according to the innovativeness is given in table 9.

Table 9: Distribution of respondents based on innovativeness

N =120

Sl. No.	Category	Frequency	Percentage
1	Low (≤6)	38	31.7
2	Medium (6 to 9.5)	52	43.3
3	High (>9.5)	30	25
Q1 = 6 Min = 2 Q3 = 9.5 Max = 12 Mean = 7.9 SD = 2.1			

From the table 9 it can be inferred that majority of the farmers were having medium level of innovativeness (43.3%) followed by low (31.7%) and high (25%). The results are represented in figure 8.

It could be inferred from the figure that most of the farmers had medium level of innovativeness. The possible reason could be because of the fact that the majority of the respondents were middle aged and old age category and also most of them had SSLC level education. Higher education level and experience gained as they aged might have influenced their innovativeness. The findings were in line with the results of Naik (2006) and Gopinath (2005).

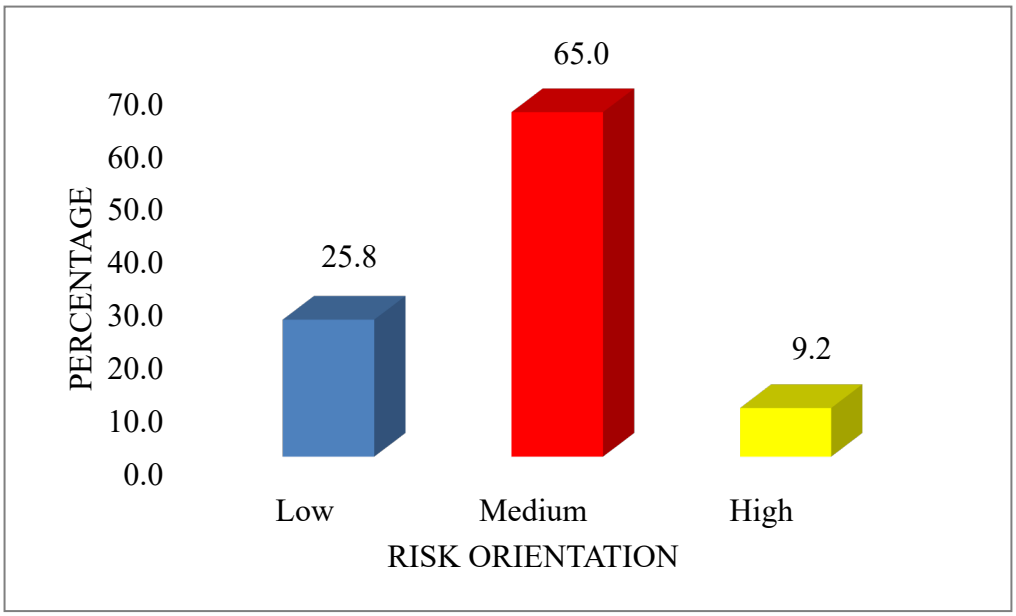


Fig. 7: Distribution of respondents based on risk orientation

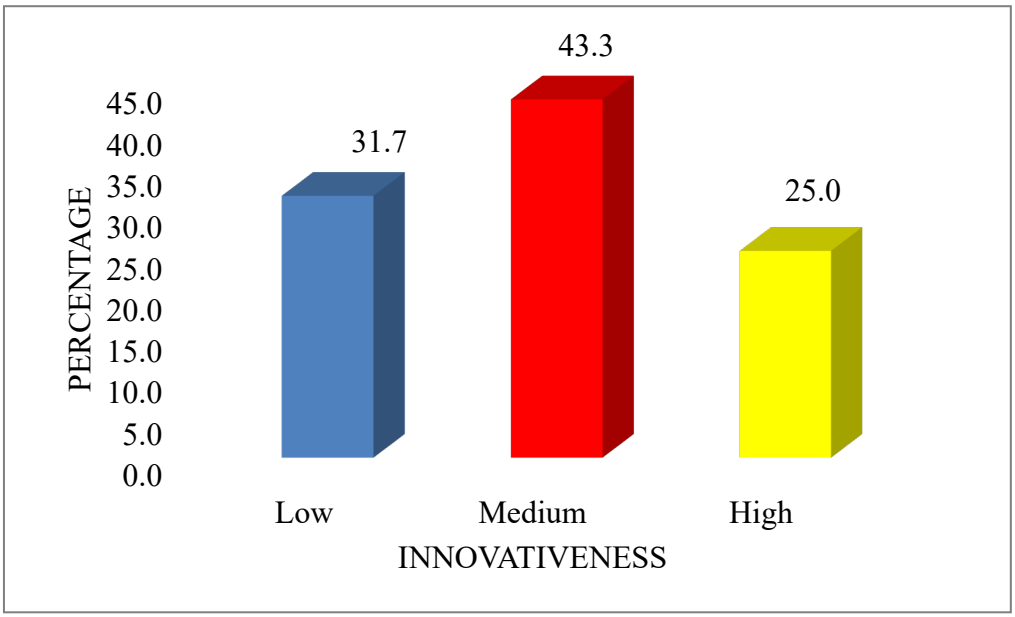


Fig. 8: Distribution of respondents based on innovativeness

4.1.9 Distribution of respondents based on perception about health risk

Perception about health risk refers to the applicators risk perception about unsafe use of pesticides. It was classified based on the quartiles. Categorization according to the perception about health risk is given in table 10.

Table 10: Distribution of respondents based on perception about health risk

N =120

Sl. No.	Category	Frequency	Percentage
1	Low (≤10)	38	31.7
2	Medium (10 to 12)	68	56.7
3	High (>12)	14	11.7
Q1 = 10 Q3 = 12 Mean = 11.1 SD = 1.3		Min = 7 Max = 14	

From the table 10 it can be inferred that majority of the farmers were having medium level of perception about health risk (56.7%) followed by low (31.7%) and high (11.7%). The results are represented in figure 9.

It could be inferred from the figure that most of the farmers had medium level of perception about health risk. The possible reason for this type of distribution could be the medium level of knowledge, information source utilization and the majority of the respondents were of medium and old age group. The findings were in line with the findings of Silapanuntakul *et al.* (2016).

4.1.10 Distribution of respondents based on training received

Training in the study refers to teaching or developing in oneself or others, any skills and knowledge that relate to specific useful competencies. It was classified based on the quartiles. Categorization according to the training received is given in table 11.

Table 11: Distribution of respondents based on training received

N =120

Sl. No.	Training Received	Frequency	Percent
1	1 - 3	55	45.8
2	4 - 6	51	42.5
3	7 - 10	14	11.7
Mean - 3.9 SD - 2.2			

From the table 11 it can be inferred that majority of the farmers had attended 1-3 trainings (45.8%) followed by 4-6 (42.5%) and 7-10 (11.7%). The results are represented in figure 10.

It could be inferred from the figure that most of the farmers had attended 1-3 trainings. The result was because of the medium level of information source utilization and the majority of the respondents were middle aged and old aged who were not interested in acquiring new skills. The findings were in line with the results of Shinde (2011).

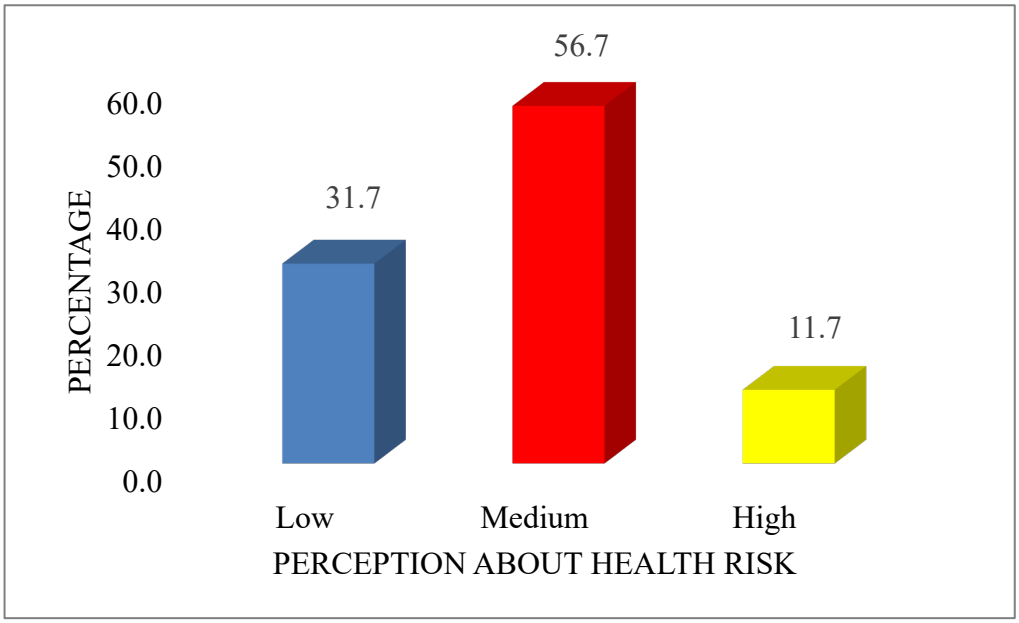


Fig. 9: Distribution of respondents based on perception about health risk

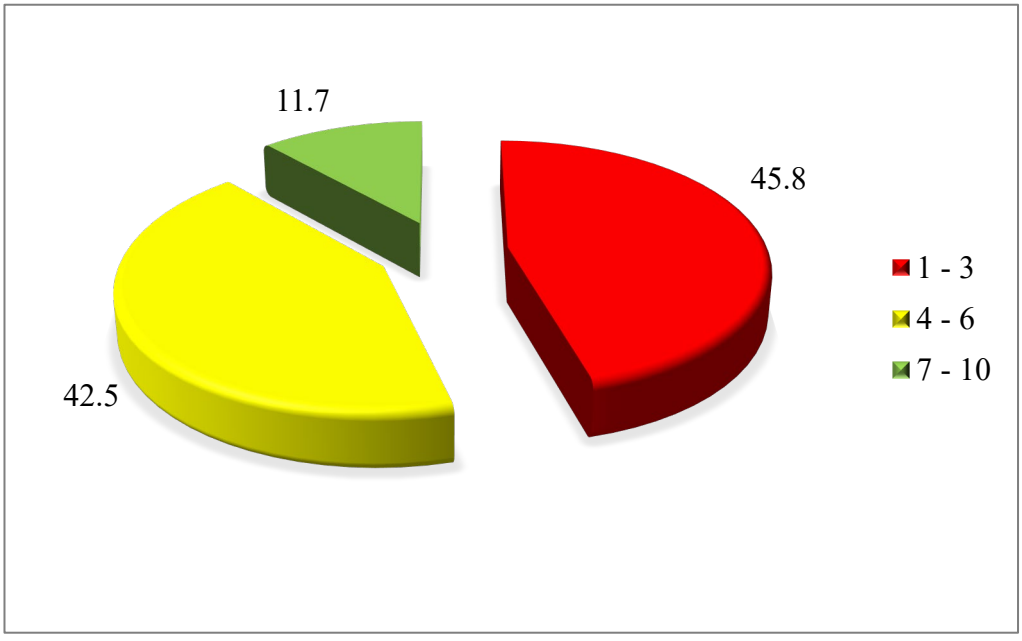


Fig. 10: Distribution of respondents based on training received

4.1.11 Distribution of respondents based on information source utilization

Information source utilization refers to the frequency of contact or exposure of the respondents to different information sources for obtaining the agricultural information. To study the frequency of utilization of different source of information the results were categorized in different levels of information source utilization. It was classified based on the quartiles. Categorization according to the source of information is given in table 12.

Table 12: Distribution of respondents based on information source utilization.

N =120

Sl. No.	Category	Frequency	Percentage
1	Low (≤ 32.3)	30	25
2	Medium (32.3 to 44.8)	60	50
3	High (>44.8)	30	25
Q1 = 32.3 Min = 22 Q3 = 44.8 Max = 52 Mean = 38.2 SD = 7.7			

From the table 12 it can be inferred that half of the farmers were having medium level of information source utilization (50%) followed by an equal of respondents in low (25%) and high (25%) categories. It can be inferred that higher percentage of the respondents (50%) had medium level of information source utilization. The findings were in conformity with the findings of Pundalikrao (2018). The results are represented in figure 11.

4.1.12 Distribution of farmers according to frequency of information source utilized.

It is important for a farmer to get the latest knowledge about farming practices and scientific tools and techniques of plant production and protection. Therefore, the necessity of a good reliable source is required for getting useful information. It was classified based on the frequency and percentages. The information sources for pesticide use were studied and the result is presented in the table 13.

Table 13: Distribution of respondents according to their frequency of use of different information source utilization.

N =120

Sources	Never		Sometimes		Regular		Total	Rank
	F	%	F	%	F	%		
Friends	61	50.8	31	25.8	28	23.3	207	10
Neighbor's	65	54.2	38	31.7	17	14.2	192	12.5
Relatives	96	80.0	8	6.7	16	13.3	160	20
Progressive farmers	54	45.0	12	10.0	54	45.0	240	8
Local farmers	93	77.5	13	10.8	14	11.7	161	19
Input dealers	37	30.8	16	13.3	67	55.8	270	3
Agricultural officer	10	8.3	5	4.2	105	87.5	335	1
Agricultural assistant	23	19.2	15	12.5	82	68.3	299	2
Crop specialist	84	70.0	12	10.0	24	20.0	120	21
Agri. Scientist	74	61.7	22	18.3	24	20.0	190	14
Subject specialist	80	66.7	19	15.8	21	17.5	181	15
KVK scientist	78	65	26	21.7	16	13.3	178	16
Meetings	34	28.3	25	20.8	61	50.8	267	4
Demonstrations	35	29.2	28	23.3	57	47.5	262	5
Field visits	43	35.8	13	10.8	64	53.3	261	6
Agricultural exhibitions	41	34.2	18	15.0	61	50.8	260	7
Television	67	55.8	14	11.7	39	32.5	212	9
News paper	87	72.5	14	11.7	19	15.8	172	18
Farm magazine	89	74.2	9	7.5	22	18.3	173	17
Exhibition	72	60.0	21	17.5	27	22.5	195	11
Krishi mela	73	60.8	22	18.3	25	20.8	192	12.5

Here from the table, it is observed that Agriculture Officer was the first and

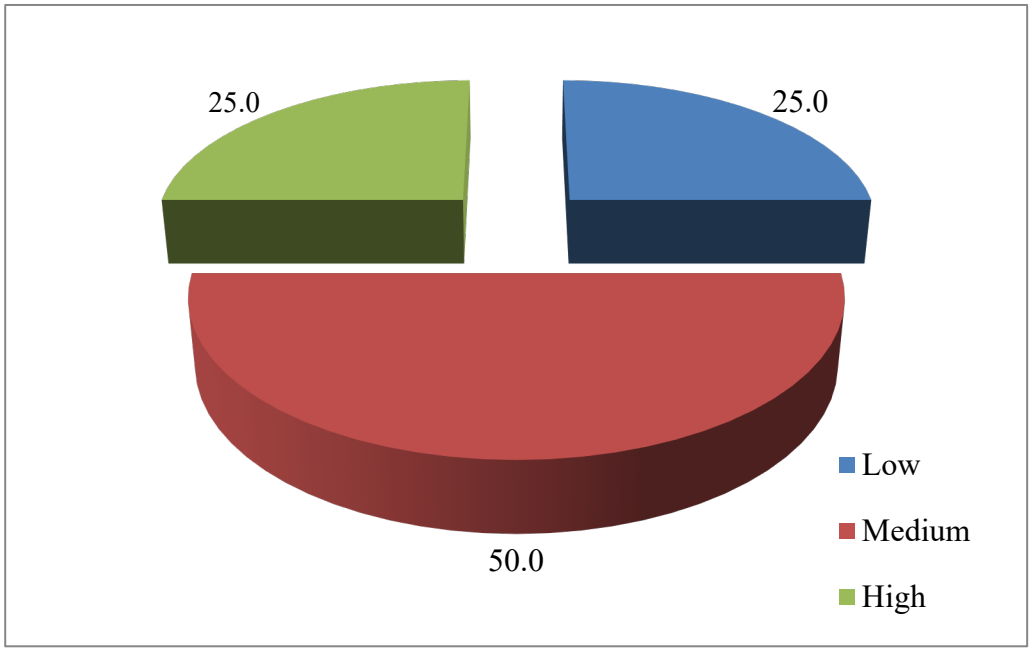


Fig. 11: Distribution of respondents based on information source utilization

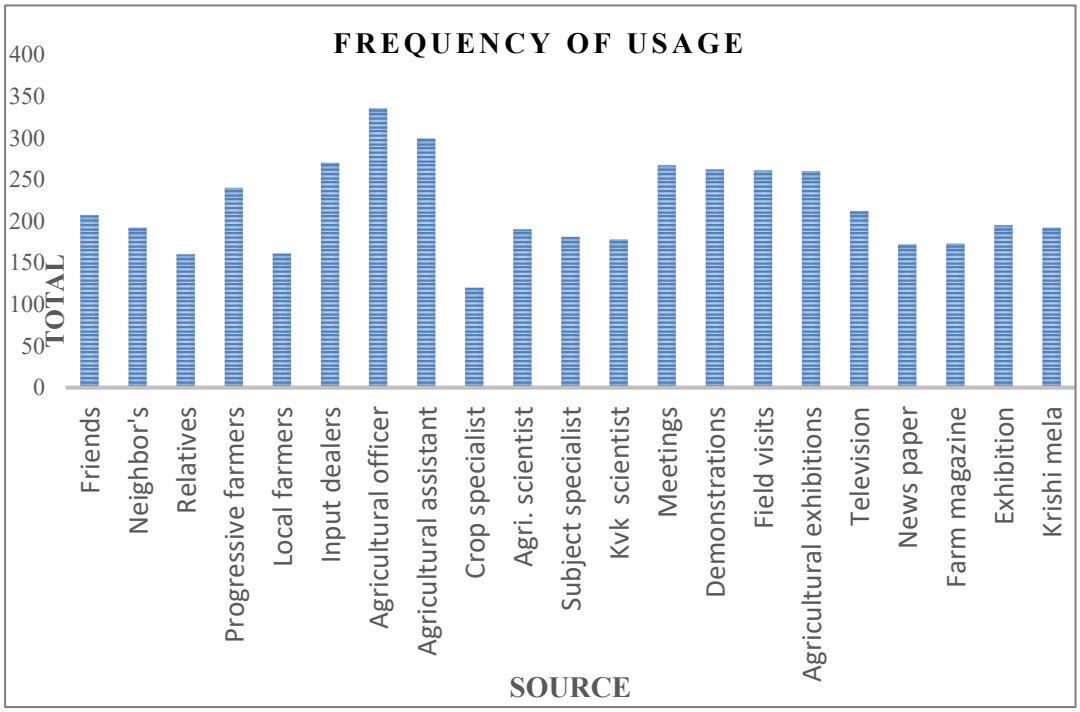


Fig. 12: Distribution of respondents according to their frequency of use of different information source utilization

foremost information source followed by Agricultural Assistants and Input dealers. The least utilized were crop specialist, relatives, and local farmers. From personal locality sources farmers were utilizing progressive farmers the most, from personal cosmopolite sources agricultural officer was the most utilized and from mass media exposure meetings was most utilized source of information. Thus, it can be inferred that the respondents were utilizing information sources to some extent for getting information regarding the handling of pesticides. The findings were in conformity with the findings of Shetty (2010). The results are represented in fig. 12.

4.2 DISTRIBUTION OF RESPONDENTS BASED ON KNOWLEDGE ABOUT SAFE HANDLING PROCEDURES OF PESTICIDES

Knowledge is facts, information or skills acquired through experience or education, regarding a particular subject**.** The vegetable farmer's knowledge on safe pesticide handling practices were assessed with teacher made knowledge test developed for the study. It consisted of 40 questions under eight subcomponents. As there were unequal number of questions under each subcomponent, weighted score was taken for the calculation. It was classified based on the quartiles. Categorization according to the knowledge of farmers about safe handling procedures of pesticides is given in table 15.

Table 14: Distribution of respondents based on knowledge about safe handling procedures of pesticides

N =120

Sl. No.	**Category**	**Frequency**	**Percentage**
1	Low (≤80)	26	21.7
2	Medium (80 to 86.3)	65	54.2
3	High (>86.3)	29	24.2
Q1 = 80 Min = 72.5 Q3 = 86.3 Max = 93.8 Mean = 83.2 SD = 4.5			

From the table 14 it can be inferred that majority of the farmers were having medium level of knowledge about safe handling procedures of pesticides (54.2%), followed by high (24.2%) and low (21.7%) level of knowledge about safe handling procedures of pesticides. The results are represented in figure 13.

From the figure it is inferred that most of the farmers had medium level of knowledge about safe handling procedures of pesticides**.** The possible reason for this type of distribution may be because majority of the respondents got good trainings on the safe handling of pesticides and the source of information they received were authentic. The findings were in line with the study of Madhu (2013) and Mishra (2016).

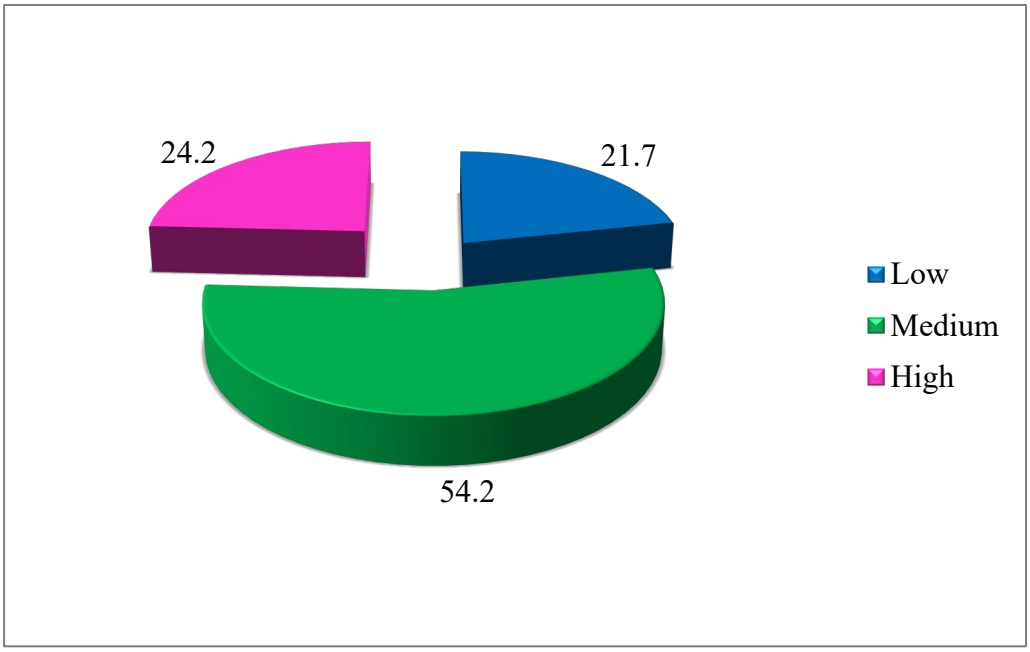


Fig. 13: Distribution of respondents based on knowledge about safe handling procedures of pesticides

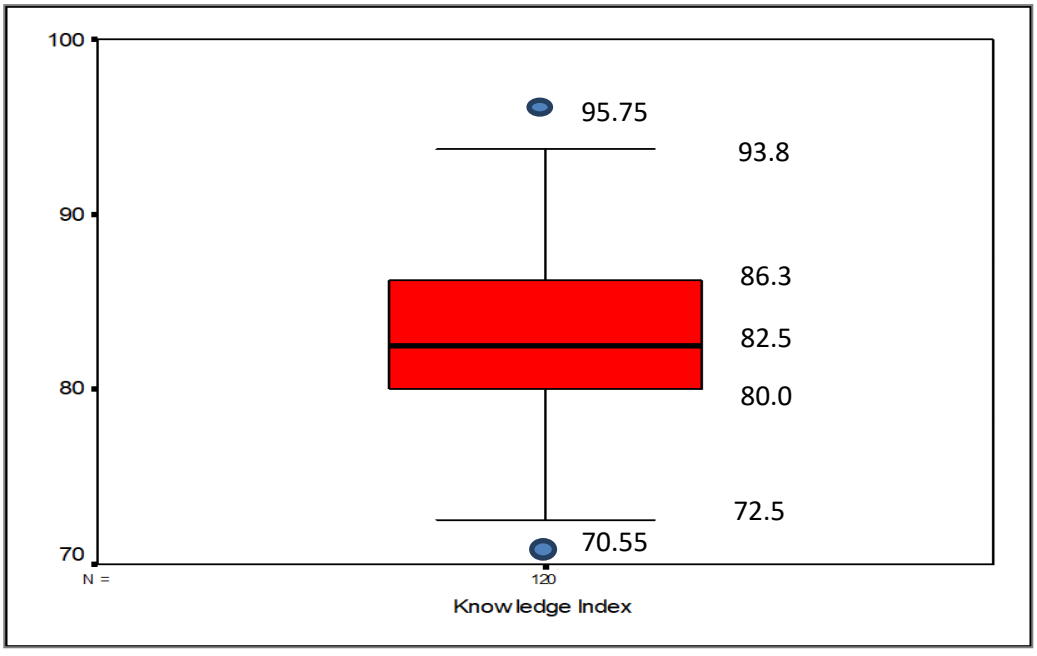


Fig. 14: Box Plot of Knowledge about safe handling procedures of pesticides

Fig. 14 shows the box-plot diagram of knowledge of the farmers about the safe handling of pesticides. The upper extreme is 93.8, lower extreme is 72.5, median is 82.5, q3 is 86.3 and q1 is 80. There are two outliers one is at 95.75 and the other 70.55. The graph is positively skewed as most of the responses were between median and q3. So, the majority were having medium to high knowledge level about the safe handling procedures of pesticides.

4.2.1 Distribution of respondents based on practices recommended for safe handling of pesticides

Component wise knowledge index shows the respondent's understanding about various aspects in safe handling practices. Component wise knowledge index of the respondents is given in the table 16.

Table 15: Component wise knowledge index of the respondents

N=120

Sl.No.	Components	Knowledge index	Rank
1	Use of PPE	77.39	7
2	Cleaning and maintenance of sprayer	83.41	5
3	Spraying the pesticide	85.68	4
4	Buying pesticide	86.38	2
5	Usage of pesticide	81.01	6
6	Personal hygiene	86.11	3
7	Storage of pesticide	92.5	1
8	Disposal of pesticide	67.70	8

Highest knowledge index was seen in the component storage of pesticide (92.5), followed by buying pesticides (86.38) and the respondents had least knowledge about disposal of pesticides (67.70) followed by use of personal protective equipment (77.39). The possible reason for the result may be because all of the respondents were trained and educated, thus they have better level of knowledge.

4.3 DISTRIBUTION OF RESPONDENTS BASED ON EXTENT OF ADOPTION OF SAFE HANDLING PROCEDURES OF PESTICIDES

Adoption is the decision to take up practices or innovation and make full use of that as the best course of action. The vegetable farmer's adoption of safe pesticide handling practices was assessed with the scale developed by Jasna (2019) with modifications for the study. There were 36 questions under six subcomponents. As there were unequal number of questions under each subcomponent, weighted score was taken for the calculation. It were classified based on the quartiles. Categorization according to the adoption of safe handling procedures of pesticides by the farmers is given in table 16.

Table 16: Distribution of respondents based on adoption of safe handling procedures of pesticides

N =120

Sl. No.	Category	Frequency	Percentage
1	Low (≤49.6)	30	25
2	Medium (49.6 to 59.4)	58	48.3
3	High (>59.4)	32	26.7
Q1 = 49.6 Min = 38.9 Q3 = 59.4 Max = 81.7 Mean = 54.8 SD = 7.4			

From the table 16 it can be inferred that majority of the farmers were having medium level of adoption of safe handling procedures of pesticides (48.3%) followed by high (26.7%) and low (25%) level of adoption. The results are represented in figure 15.

It could be inferred from the figure 16 that most of the farmers had medium level of adoption of safe handling procedures of pesticides**.** The result was because of the credible information source utilized and every respondents got at least one to three trainings. The findings are in line with the study of Al-zyoud (2014) and Mishra(2016).

Fig. 16 shows the box-plot diagram of adoption of the safe handling procedures of pesticides. The upper extreme is 81.7, lower extreme is 38.9, median is

55.6, q3 is 59.4 and q1 is 49.6. The graph is negatively skewed as most of the responses were between median and q1. So, the majority were having medium to high level of adoption of thesafe handling procedures of pesticides.

4.3.1. Distribution of respondents based on practices recommended for safe handling of pesticides

Component wise adoption quotient shows the respondent's best adopted and the least resorted safe handling practices. Component wise adoption quotient of the respondents is given in the table 17.

Table 17: Component wise adoption quotient of the respondents

N=120

Sl.no.	Components	AQ	Rank
1	Use of PPE	37.90	6
2	Cleaning the sprayer	49.53	5
3	Spraying the pesticide	64.35	1
4	Personal hygiene	60.86	3
5	Storage of pesticide	61.54	2
6	Disposal of empty pesticide containers	50.77	4

From the above table the most adopted practice was care taken while spraying the pesticide, it had an adoption quotient of 64.35 which is followed by storage of pesticide with an adoption quotient of 61.54. The least adopted practice was usage of personal protective equipment (37.90). Here all the practices has got adoption quotient less than 65. The possible reason for the result obtained maybe the low level of environmental orientation and low perception about health risk of the respondents. Because of the discomfort in working while wearing the safety aids and not having much concern about the environments they were poor in the adoption of PPE and its disposal. As they have credible source of information and almost all have got at least one training about the handling of pesticides might be the reason for better adoption safe practices while spraying and storing the pesticides. The finding is in agreement with the findings of Salameh, *et al*. (2004), Asongwa *et al*. (2014) and Al-zyoud (2014).

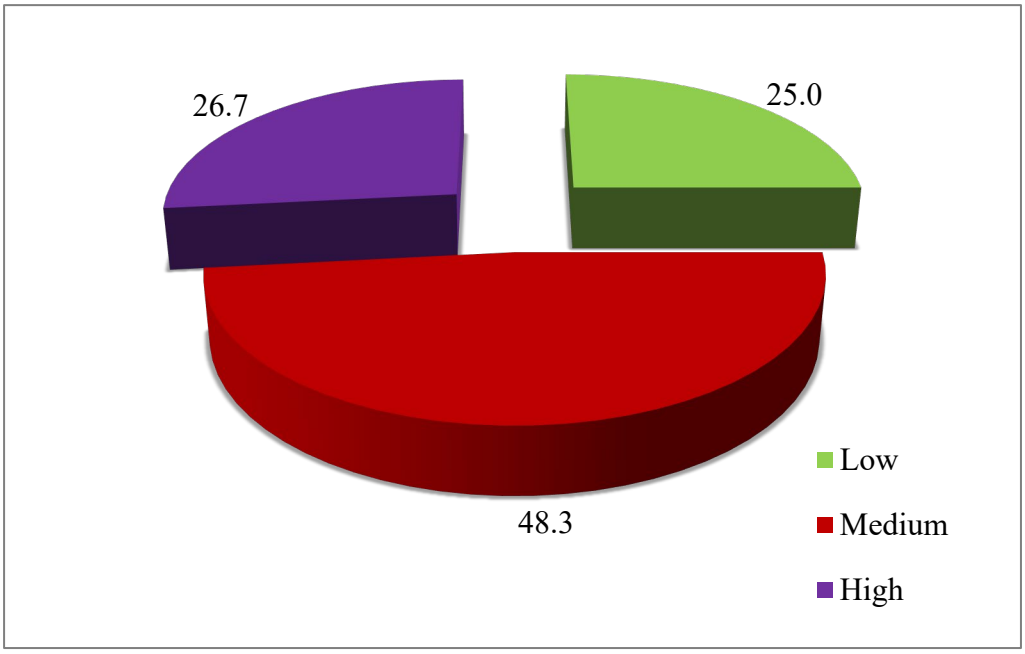


Fig. 15: Distribution of respondents based on adoption of safe handling procedures of pesticides

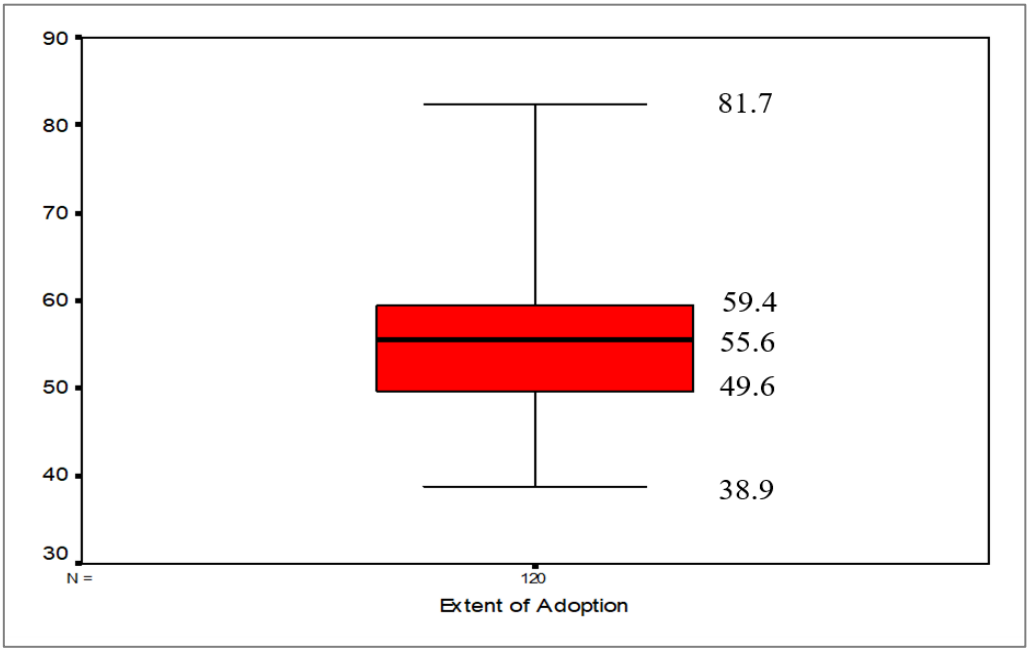


Fig. 16: Box Plot for extent of adoption of safe handling procedures of pesticides

4.4 DISTRIBUTION OF RESPONDENTS BASED ON ATTITUDE TOWARDS SAFE HANDLING PROCEDURES OF PESTICIDE

Attitude is the way of thinking or feeling and behaving about something. The vegetable farmer's attitude towards safe pesticide handling practices were assessed with scale developed by Jasna (2019). It consists of 19 questions. It was classified based on the quartiles. Distribution according to the attitude of farmers about safe handling procedures of pesticides is given in table 18.

Table 18: Distribution of respondents based on attitude towards safe handling procedures of pesticide

N=120

Sl. No.	Category (Years)	Frequency	Percentage
1	Low (≤62)	24	20
2	Medium (62 To 70)	69	57.5
3	High (>70)	27	22.5
Q1 = 62 Q3 = 70		Min = 50 Max = 78 Mean = 65.9 SD = 5.7	

From the table 18 it can be inferred that majority of the farmers were having medium level of attitude towards safe handling procedures of pesticides (57.5%), followed by high (22.5%) and low (20%) level of attitude towards safe handling procedures of pesticides. The results are represented in figure 17.

It could be inferred from the above figure that most of the farmers had medium level of attitude towards safe handling procedures of pesticides**.** The possible reason for this type of distribution may be because most of the respondents have been trained regarding pesticide effects and its safe handling and their source of information were highly reliable and their perception about health risk had positive impact on their attitude. The findings were in line with the studies of Amle (2016), Choudhary (2010) and Mishra (2016).

Fig. 18 shows the box-plot diagram of attitude of the farmers towards the safe

handling procedures of pesticides. The upper extreme is 78, lower extreme is 50, median is 66, q3 is 70 and q1 is 62. There is one outlier at 82. The graph is normally distributed as the responses were equally distributed between q1, median and q3 and the majority were having medium to high attitude level towards the safe handling procedures of pesticides.

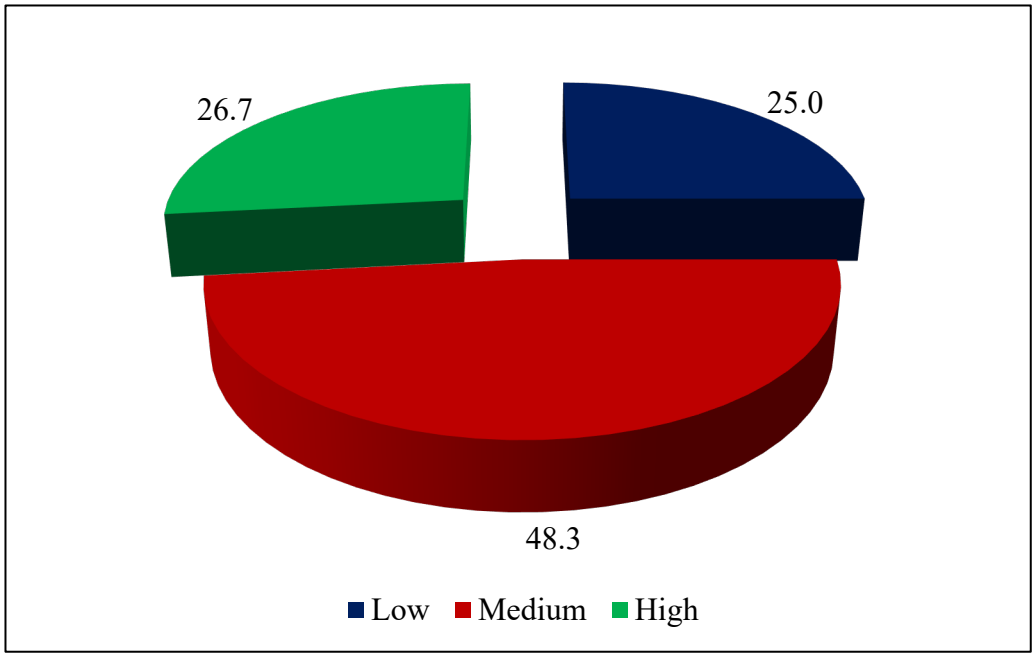


Fig. 17: Distribution of respondents based on attitude towards safe handling procedures of pesticide

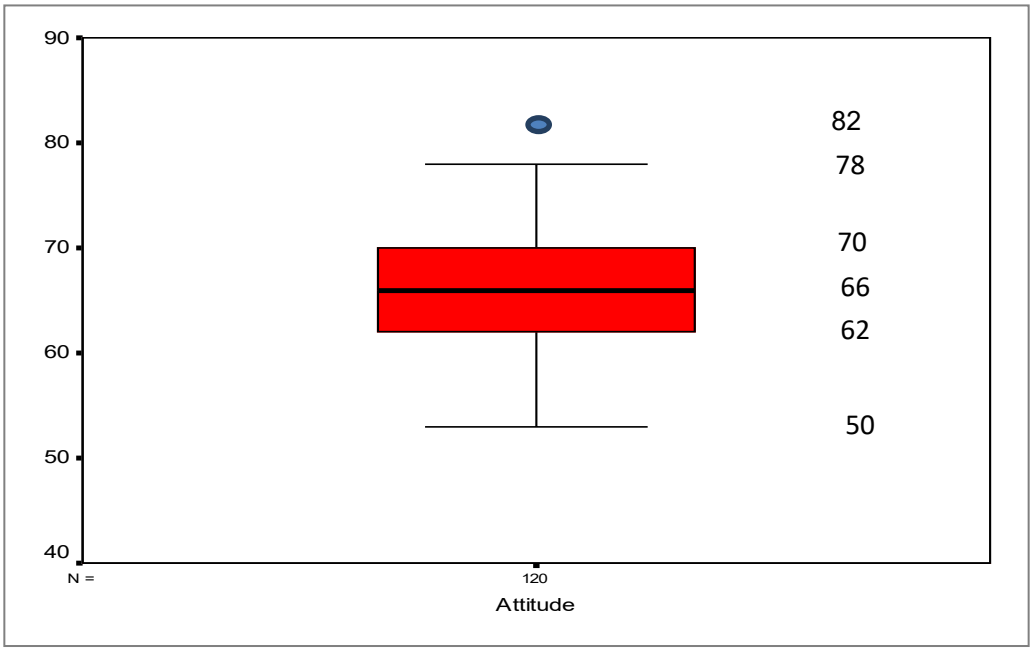


Fig. 18: Box Plot on attitude towards safe handling procedures of pesticides

4.5 CORRELATION BETWEEN PROFILE CHARACTERISTICS OF FARMERS AND DEPENDENT VARIABLES.

4.5.1 Relationship between knowledge about safe handling procedures of pesticides and independent variables

A correlation study was done to analyse the relationship of the profile characteristics of farmers with knowledge about safe handling procedures of pesticides. Correlation coefficient was calculated for finding the significance. The factors that associated with the knowledge about safe handling procedures of pesticides are presented in the table below.

Table 19: Factors that associated with the knowledge about safe handling procedures of pesticides

N=120

Sl. No.	Independent variables	Correlation coefficient (r)
1	Age	-0.026
2	Farming Experience	-0.059
3	Economic Orientation	0.041
4	Environment Orientation	0.108
5	Risk Orientation	0.128
6	Innovativeness	0.235*
7	Perception about health	0.049
8	Training received	0.223 *
9	Information source utilization.	0.234*

* -significant at 0.05 level

From the above table it is clear that, variables like innovativeness, training received, and information source utilization had positive and significant relationship with knowledge of the farmers about safe handling of pesticides at 0.05 percent level of significance. Conversely other variables like age, farming experience, economic orientation, environmental orientation, risk orientation and perception about health risk were not significantly related with the knowledge of the farmers. Here, the analysis revealed that the respondents with high innovativeness, training received, and information source utilization. also had high knowledge about safe handling procedures of pesticides.

Innovativeness is a significant factor that contribute to the greater knowledge about the safety practices. An innovative farmer will always gather knowledge about what he is doing and get advanced through his paths. They will always march for quality and safety. So, the result obtained is logical and because of the innovativeness the respondents had more knowledge about the safety. Training received is the most significant factor for improving the knowledge especially in the case of safety practices a person who had undergone more number of trainings will have good quality knowledge than others who hasn't undergone any training. The farmers who got quality trainings on safety practices had good knowledge about the handling of pesticides. So, the result obtained is logical and because of the training received the respondents had more knowledge about the safety. Information source utilization is also a significant factor that influence the knowledge of the farmers. Proper and good quality source of information will always elevate the knowledge of the peoples. Here, the agricultural officers and agricultural assistants were the major source of information, are authentic and dependable so the knowledge gained from them were very useful and important.

A chi square analysis was done to find the relationship of the profile characteristics of farmers with knowledge about safe handling procedures of pesticides. It was calculated for finding the significance. The factors that associated with the knowledge about safe handling procedures of pesticides are presented in the table below.

Table 20: Association of education and labour availability with the knowledge about safe handling procedures of pesticides

N=120

Sl. No.	Categorical variables		Low / Medium	High	$\chi 2$ (calculated)	P
1	Education	<=10th	72	24	10.30**	0.09×10^{-4}
		Above 10th	19	5		
2	Labour Availability	Hired labour	24	12	5.08	0.084
		Family labour	50	7		
		Hired + family labour	17	10		

** - significant at 0.01 level

Review of above table reveals that education had a positive, significant relation at 0.01 per cent level of significance and is much pronounced with knowledge of the farmer about safe handling procedures and variable labour availability does not have any significant relationship. Education is a major factor that influence knowledge of a person.

4.5.2 Relationship between attitude towards safe handling procedures of pesticides and independent variables

A correlation study was done to analyse the relationship of the profile characteristics of farmers with their attitude towards safe handling procedures of pesticides. Correlation coefficient was calculated for finding the significance. The factors that associated with the attitude towards safe handling procedures of pesticides are presented in the table below.

Table 21: Factors that associated with the attitude towards safe handling procedures of pesticides

N=120

Sl. No.	Independent variables	Correlation coefficient (r)
1	Age	0.017
2	Farming Experience	-0.033
3	Economic Orientation	0.094
4	Environment Orientation	0.09
5	Information source utilization.	0.241*
6	Risk Orientation	0.13
7	Innovativeness	0.029
8	Perception about health	0.256 *
9	Training received	0.238 *

* -significant at 0.05 level

From the above table, variables like perception about health risk, training received, source of information had positive and significant relationship with attitude of the farmers about safe handling of pesticides at 0.05 percent level of significance. Conversely other variables like age, farming experience, economic orientation, environmental orientation, risk orientation and innovativeness were not significantly

related with the attitude of the farmers. Here, the analysis revealed that the respondents with high perception about health risk, training received, and information source utilization also had high attitude towards safe handling procedures of pesticides.

Perception about the health risk is a significant factor that contribute to the greater attitude towards the safety practices. A person who is conscious about health and health risks will have good attitude towards safety practices while handling pesticides. So, the result obtained is logical and because of the perception about health risks the respondents had more favorable attitude towards the safety measures. Training received is the most significant factor for improving the attitude especially in the case of safety practices a person who had undergone more number of trainings will definitely have more favorable attitude than others who hasn't undergone any training. The farmers who got quality trainings on safety practices had favorable attitude towards the handling of pesticides. So the result obtained is logical and because of the training received the respondents had more positive attitude towards the safety. Information source utilization is also a significant factor that influence the attitude of the farmers. Proper and good quality source of information will always elevate the attitude of the people.

A chi square analysis was done to find the relationship of the profile characteristics of farmers with attitude towards safe handling procedures of pesticides. It was calculated for finding the significance. The factors that associated with the attitude towards safe handling procedures of pesticides are presented in the table below.

Table 22: Association of education and labour availability with the attitude towards safe handling pesticides

N=120

Sl. No.	Categorical variables		Low / Medium	High	$\chi 2$ (calculated)	P
		<=10th	72	24		

1	Education	Above 10th	21	3	1.72	0.190
2	Labour availability	Hired labour	26	10	0.91	0.634
		Family labour	46	11		
		Hired + family labour	21	6		

From the table, we can see that variables education and labour availability doesn't had any significant relationship with the farmer's attitude towards the safe handling procedures.

4.5.3. Relationship between extent of adoption of safe handling procedures of pesticides and independent variables

A correlation study was done to analyze the relationship of the profile characteristics of farmers with adoption of safe handling procedures of pesticides. Correlation coefficient was calculated for finding the significance. The factors that associated with the adoption of safe handling procedures of pesticides are presented in the table.

Table 23: Factors that associated with the adoption of safe handling procedures of pesticides

N=120

Sl. No.	Independent variables	Correlation coefficient (r)
1	Age	0.05
2	Farming Experience	0.06
3	Economic Orientation	0.128
4	Environment Orientation	0.007
5	Risk Orientation	0.129
6	Innovativeness	0.006
7	Perception about health	0.376*
8	Training received	0.294*
9	Information source utilization	0.253*

* -significant at 0.05 level

From the above table, it is clear that variables like perception about health risk, training received and source of information had positive and significant relationship with adoption of the safe handling procedures of pesticides at 0.05 percent

level of significance. Conversely other variables like age, farming experience, economic orientation, environmental orientation, risk orientation and innovativeness are not significantly related with the adoption of the practices. Here, the analysis revealed that the respondents with high perception about health risk, training received, and information source utilization also had higher adoption of the safe handling practices of pesticides.

Perception about the health risk is a significant factor that contribute to the greater adoption of the safety practices. Respondents who were conscious about their health and the risk associated with the usage of pesticides adopts the safety practices much better than the people who were not bothered about their health. So, the result obtained is logical and because of the perception about health risks the respondents had better adoption of the safety measures. Training received is one of the prime factor that influence the adoption of the safety practices. A person who had undergone more number of trainings shows a better adoption of the practices than other. So, the result obtained is logical and because of the training received the respondents had greater adoption of the safety practices. Information source utilization is a serious influencer of the adoption of safe handling practices. Different sources influence the peoples in different ways. Authentic sources help to gain more awareness and knowledge on safety practices. So, this helps the respondents to better adopt the safety practices.

A chi square analysis was done to find the relationship of the profile characteristics of farmers with adoption of safe handling procedures of pesticides. It was calculated for finding the significance. The factors that associated with the adoption of safe handling procedures of pesticides are presented in the table.

Table 24: Association of education and labour availability with the adoption of safe handling procedures of pesticides

N=120

Sl. No.	Categorical variable		Low	Medium	High	$\chi 2$ (calculated)	P
1	Education	<=10th	24	43	29	3.5	0.173
		Above 10th	6	15	3		

2	Labour availability	Hired labour	13	13	10	4.48	0.345
		Family labour	11	30	16		
		Hired + family labour	6	15	6		

From the table, we can see that variable education and labour availability doesn't have any relationship with the farmer's adoption of safe handling procedures.

4.6 DOCUMENTATION OF MAJOR VEGETABLE CROPS GROWN BY THE RESPONDENTS

Major vegetable crops grown is operationalized as the number of vegetable crops grown by an individual respondent. It was classified based on the frequency and percentages. Categorization according to the major vegetable crop grown is given in table 25

Table 25: Distribution of respondents based on major vegetable crop grown

N =120

Sl. No.	**Major vegetables**	**Respondents**	
		Frequency	**Percentage**
1	Cucumber	46	38.33
2	Amaranthus	42	35.00
3	Yard long bean	57	47.50
4	Ash gourd	04	3.33
5	Bitter gourd	28	23.33
6	Ladies finger	17	14.17
7	Brinjal	06	5.00
8	Tomato	03	2.50
9	Chilli	04	3.33

From the table 25 it can be inferred that majority of the farmers (47.50%) were growing Yard Long Bean followed by 38.33 per cent cultivating Cucumber, 35 per cent Amaranthus and the least cultivated crops were chilli and ash gourd (3.3%) and tomato (2.50%). The results are represented in figure 19.

It could be inferred from the above figure that most of the farmers were cultivating Yard Long Bean, Cucumber and Amaranthus. Least cultivated crop was

Tomato, Chilli and Ash Gourd. The result is because of the reason that most of the vegetable growing tracts in Thiruvananthapuram were showing the same trend of cultivating more cucurbitaceous crops, amaranthus and yard long beans as reported by Raj (2018).

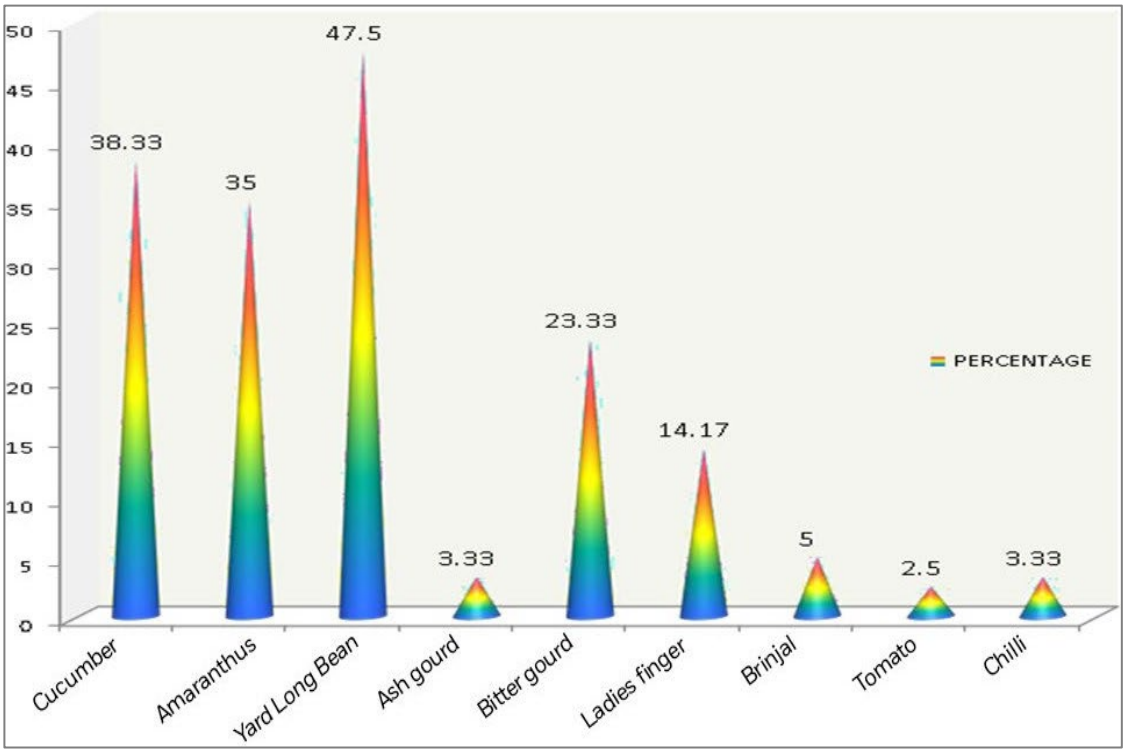


Fig. 19: Distribution of respondents based on major vegetable crop grown

4.7 CONSTRAINTS EXPERIENCED BY THE FARMER IN FOLLOWING THE SAFE HANDLING PROCEDURES OF PESTICIDES

Adoption of safe handling practices is so relevant for health of farmers, farm workers, their families, and the consumers too. The major hindrance in adoption is associated with the constraints faced by the farmer in following the safety practices. The prime solution for this issue is to find the constraints and filling the deficiencies. Five different categories of constraints were selected from the scale of Jasna (2019) and pulled out the most critical constraints as perceived by the respondents. Total score was taken to rank out all the constraints. Major categories of constrains were occupational, technical, marketing, infrastructural and economic.

Table 26: Constraints faced by the farmers in following safe handling procedures while using pesticides

N =120

Sl. No.	Constraints	Total score	Mean Score	Total rank
A.	**Technical constraints**			
1	Limited availability of eco-friendly methods	375	3.13	13
2	Lack of awareness on need for the safety measures	678	5.65	27.5
3	Unskilled labour	319	2.66	10
4	Damaged sprayer	708	5.90	29
5	Faking with adulterated/ banned pesticides	437	3.64	17
6	Labelling in English language	678	5.65	27.5
7	Lack of training	378	3.15	14.5
B.	**Economic constraints**			
1	High cost of eco-friendly methods	140	1.17	2
2	Increased expenditure on protection equipment's	314	2.62	7.5
3	Labour cost	482	4.02	20
4	Increased cost on construction of deep pits for disposal of empty containers/surplus pesticides	530	4.42	22.5
5	Heavy loss occurred after following safe pesticide doses	640	5.33	26
6	Lack of credit facilities	318	2.65	9
C.	**Marketing constraints**			

1	Market is not assured	447	3.98	19
2	Consumers are not aware	530	4.42	22.5
3	No premium price for safe vegetables	183	1.53	4
4	Lack of labeling facilities	296	2.47	6
5	Mistrust on pesticide safety of vegetables	314	2.62	5
D.	**Infrastructural constraints**			
1	Lack of storage structures, building to keep pesticides, sprayers, and other materials	341	2.84	11
2	Lack of safe transportation facilities	412	3.43	16
3	Lack of protection equipment, sprayers and materials availability	221	1.84	5
4	Lack of pesticide residue analysis facilities and capabilities	378	3.15	14.5
5	Limited option for recycling the pesticide containers	449	3.74	18
E.	**Occupational constraints**			
1	Discomfort in wearing the protection equipment's	120	1.00	1
2	Additional time and effort required for following safety measures	342	2.85	12
3	Reduced efficiency in work	149	1.24	3
4	Difficulty in calibration and maintenance of sprayer	589	4.91	24
5	Complexity involved	596	4.97	25
6	Unable to skip drinking / eating in between spraying as it takes long hours for spraying	498	4.15	21

It is clear from the table that, in case of the overall constraints faced by the vegetable farmers in option of safe pesticide handling practices, one of the occupational constraints that is discomfort in wearing the protection equipment has got the first rank with a total score of 120, it is followed by increased expenditure on protection safety aids(140), reduced efficiency in work after wearing the safety equipment(149), no premium price for safety aids (183) have got consecutive ranks. The respondents regarded the least relevant constraint that reduces the adoption as the labelling in English (678), lack of awareness on need for safety measures (678) and heavy loss occurred after following safety dose (640). Among the technical constraints unskilled labourers were the major issue, with total score of 319 and got tenth rank among overall constraints. Damaged sprayer with 708 total score was the least preventing factor in adoption. Increased expenditure on protection equipment was the most undesirable constraint (140) and heavy loss occurred after following the safety practices (640) was the least severe constraints among the economic constrains. No premium price for safe vegetables (183) was the serious issue from marketing constraints. Consumers are not aware got least rank with a total score of 530. Among infrastructural constraints, lack of protective aids, sprayers, and other materials availability (221) was the principal constraint and lack of pesticide residue analysis facilities got least preference (449). When we consider the occupational constraints discomfort in wearing the safety aids ranks first and complexity involved was the least ranked one. The findings were in line with the findings of Mahantesh and Singh (2009) and Henry *et al.* (2013). Most of the farmers had medium to low level of environmental orientation and perception about health risk this may be one of the reason for their poor adoption and also the discomfort caused by the protective aids especially wearing it in hot sun and also the farmers are not ready to invest in buying these safety measures and did not considering it as a necessary factor. And also there is not much subsidies provided by the government to encourage the adoption of these safety measures. These could be the probable reasons for the constraints experienced by farmers as perceived by them.

Plate 2: Empirical Model

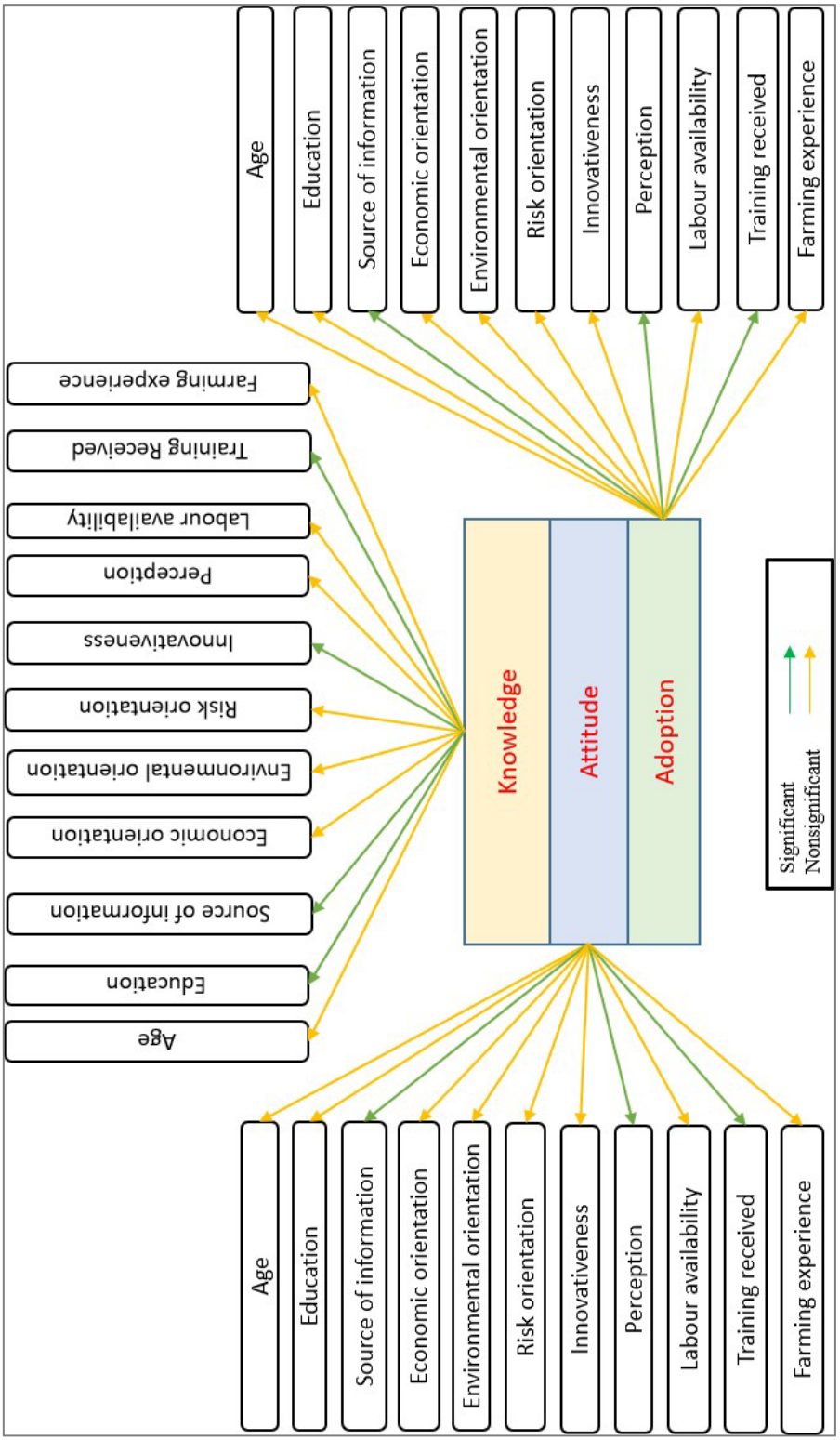


Plate 3: Interaction with farmers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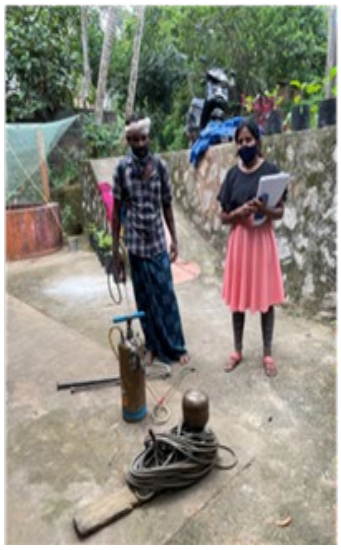


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Summary

CHAPTER V

SUMMARY

India occupies second position in vegetable production. The total horticulture production in 2020-21 is the highest ever that is 329.8 million tons, increase in production over the previous years (DAC&FW 2020-21) has major contribution from vegetable production (58.7%). The major problem faced by farmers in vegetable production is pest infestation, its destructive effects in the field. Totally a 35-40% of vegetable crop loss is occurring due to pest infestation (Sardana, *et al*., 2005). The one stop solution the farmers of our county prefer is pesticides. India is the 4th largest producer of pesticides after US, Japan, and China (Devi *et.al*.,2017). Pesticides causes several acute and chronic diseases. Unscientific use of pesticides and improper disposal mechanism were the major causes of the pesticide poisoning. The present study entitled "Pesticide handling behaviour of vegetable farmers - A Multidimensional Analysis" was conducted in Thiruvananthapuram in order to assess the knowledge, attitude and adoption of farmers about the safe handling procedures of pesticides and to enumerate the constraints in following the safety practices.

The investigation was done in Thiruvananthapuram district of Kerala. Four AEU's which are the main vegetable growing belts of the district is selected out of five AEU. From the four AEU two panchayath were selected purposively which are having maximum area under vegetable cultivation. From each panchayath 15 respondents were selected through random sampling, thus forming a total of 120 respondents.

OBJECTIVE

Measurement of knowledge, extent of adoption and attitude of vegetable farmers on safe handling procedures of pesticides and analyze the constraints in adopting the safe handling procedures.

The independent variables studied were age, education, information source utilization, farming experience, labour availability, economic orientation, risk

orientation, environmental orientation, perception about health risk, major vegetable crop grown, and innovativeness. Dependent variables studied were knowledge, attitude, and adoption of the safe handling procedures of pesticides.

A structured interview schedule was administered for data collection. Statistical tools such as mean, standard deviation, quartile deviation, percentage analysis, frequency, Karl Pearson correlation and chi square were used for the analysis.

The major findings of the study are given below:

- Majority of the respondent vegetable farmers belong to old age category (45.8%).
- Most of the respondents had SSLC level of education (70.8%).
- A large proportion (40.8%) of the respondents had 21 to 30 years of farming experience.
- A large number of respondents (47.5%) had utilized family members as their labour.
- A whole majority of the respondent vegetable farmers (45.8%) had medium level of economic orientation.
- The level of environmental orientation among the 65 per cent of respondents was medium.
- Majority of the farmer respondents (65%) had medium level of risk orientation.
- Innovativeness of 43.3 per cent of the farmers was medium level.
- Information source utilization of the majority respondents (50%) was medium.
- Overall, 56.7 per cent of the vegetable farmer respondents had medium level of perception about health risk.
- Agriculture Officer was the highest ranked source of information by the respondents followed by Agricultural Assistant and input dealers.
- The 45.8 per cent of respondents had attended 1 to 3 trainings.
- With respect to major vegetable crop grown, majority of the respondents were

growing Yard Long Bean that is 47.50 per cent followed by 38.33 per cent were growing Cucumber as the major crop.

- More than half of the respondents (54.2%) had medium level of knowledge about safe handling of pesticides followed by 24.2 per cent who had high level of knowledge and only 21.7 per cent had low level of knowledge about safe handling practices.
- In the distribution of respondents based on knowledge on practices recommended for safe handling of pesticides storage of pesticide had the highest knowledge index and disposal of empty containers had the least knowledge index.
- Majority of the respondents (48.3%) had medium level of adoption of safe handling of pesticides followed by 26.7 per cent who had high level of adoption and only 25 per cent had low level of adoption of safe handling practices.
- In the distribution of respondents based on adoption of safe handling practices spraying of pesticide had the highest adoption quotient among other components and usage of personal protective equipment had the least adoption quotient.
- More than half of the respondents (57.5%) had medium level of attitude towards safe handling of pesticides followed by 22.5 per cent who had high level of attitude and only 20 per cent had low level of attitude towards safe handling practices.
- Out of 9 independent variables selected for the study, three variables were significantly related to the dependent variable knowledge they are innovativeness, training received and information source utilization. The results of chi square analysis with knowledge and education showed positive and significant relationship.
- Perception about health risk, training received, and information source utilization was observed to be positively influencing the adoption of safe handling practices.
- The relationship between attitude and nine independent variables selected for the study, three variables that is perception about health risk, training received, and information source utilization were significant all the remaining variables were non-significant.
- Discomfort in wearing safety equipment's while work, increased expenditure on protection equipment, reduced efficiency in work after wearing the safety equipment

and no premium price for safe vegetables were the major constrains faced by the respondents.

SUGGESTIONS FOR FUTURE RESEARCH

Since this study was conducted in only Trivandrum district of Kerala with reference to the knowledge, attitude and adoption level of the vegetable farmers in relation to the safe handling practices of pesticides with few selected characteristics, it can be extended to do similar research works in vegetables to generalize the results and findings, additional variables can also be included. Related studies can be recurred after some duration of time interval and in different locations. Future studies can help to map the adoption of safety practices among the farmers and to find the constrains faced by them which retards their adoption, and also this could help to draw conclusion of actions to be taken for improving the adoption of safety practices. The study can be extended with various stakeholders and their perception and impacts in the scenario.

References

CHAPTER VI

REFERENCES

Abang, M., Kouame, C.M. and Abang, M. 2013. Vegetable growers perception of pesticide use practices, cost and health effects in tropical region of Cameroon. *Int. J. Agron. Plant Prod.* 4(5): 873-883.

Aktar, W., Sengupta, D. and Chowdhury, A. 2009. Impact of pesticides use in agriculture: their benefits and hazards. *Interdisciplinary Toxicology.* 2(1): 1-12.

Aldosari, F., Mubushar, M. and Baig, M. 2018. Assessment of farmers knowledge on pesticides and trainings on pesticide waste management in central Punjab. *J.Biol. Agric. Sci.* 6: 168-175.

Al-Zyoud, F. 2014. Indiscriminate use and improper application of pesticides by Jordanian vegetable and fruits farmers. *Bull. Fac. Agric. Cairo Univ*. 65:334-359.

Amera, T., Mensah, R.K. and Belay, A. (2017) Integrated pest management in a cotton- growing area in the Southern Rift Valley region of Ethiopia: development and application of a supplementary food spray product to manage pests and beneficial insects, *Int. J. Pest Manag.* 63(2): 185-204.

Amle, S.D. 2016. Safety measures adopted by vegetable growers in pesticide application. M.Sc. thesis, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra,185p.

Arathy, B. 2011. Constraint analysis of rice farmers of Trissur district of Kerala. M.Sc. thesis, Acharya N.G. Ranga Agricultural University, Hyderabad.125p.

Arpit, D.J. 2015. Knowledge of vegetable growers about the side effects of pesticides in Tapi district of south Gujarat. M.Sc. thesis, Nausari Agricultural University, Nausari,133p.

Asongwe, G.A., Yerima, B.P., and Tening, A.S. 2014. Vegetable production and the

livelihood of farmers in Bamenda municipality, Cameroon, *Int. J. Curr. Microbiol. Appl. Sci.* 3(12): 682-700.

Atreya, K. 2007. Pesticide use knowledge and practices: gender differences in Nepal, *Environ. Res*. 104 (2): 305-311.

Babu, L.S. 2015. Awareness of farmers towards effect of pesticides on human health. M.Sc. thesis, Vasantrao Naik Marathawada Krishi Vidyapeeth, Parbhani,115p.

Badhe, D.K. 2012. Farmers perception regarding environmental risk in use of pesticides in Anand district of Gujarat state. M.Sc. thesis, Anand Agricultural University, Anand, Gujarat.133p.

Bano, F. 2019. Farmer's knowledge & practices about agro chemical use on selected crops in Jammu & Kashmir state. Ph.D thesis, Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu. 243p.

Benal, D., Patel, M.M., Jain, M.P. and Singh, V.B. 2010. Adoption of dry land technology. *Indian J. Dryland Agric. Res. Dev*. 25(1): 111-116.

Borhade, S.M. 2017. Livelihood sustainability of suicide prone farmers families of Vidarbha, Ph.D thesis, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra, 230p.

Chand, B.G., Banerjee, P.K. and Bandi, S. 2017. Constrains in marketing vegetables and suggestions as perceived by growers for improving vegetable marketing. *Agric. Update*. 12:1427-1429.

Chaudhari, P.N. 2012. Socio- economic determinates of farmer-oriented technology packages for sericulture: a field study. *Indian J. Seric*. 40(1):96-99.

Choudhary, A., 2014. Adverse Health Effects of Organophosphate Pesticides among Occupationally Exposed Farm Sprayers: A Case Study of Bhopal Madhya Pradesh, India. *Asian J. Biomedical Pharma. Sci.* 4(35): 30-35.

Choudhary, J.G. 2013. Farmer's awareness regarding agricultural pollution in Anand

district. M.Sc. thesis, Anand Agricultural University, Anand, Gujarat,118p.

Choudhary, M.L. 2010. A Study on pesticide using behaviour of paddy growers in Khambhat taluk of Anand district. *Int. J. Sci*. 6: 168-175.

DAC&FW [Department of Agriculture, Cooperation & Farmers' Welfare]. 2021. Annual report. [on-line]. Available: https://agricoop.nic.in [6 march 2020].

Damalas, C.A. and Hashemi, S.M. 2010. Pesticide risk perception and use of personal protective equipments among young & old cotton growers in Northern Greece. *Agro*. 44: 363-371.

Darandale, A. 2010. Attitude of tribal farmers towards organic farming practices in maize crop. M.Sc. thesis, Anand Agricultural University, Anand, Gujarat.120p.

Devi, P.I. 2009. Health risk perceptions, awareness, and handling behavior of pesticides by farm workers. Agric. *Econ. Res. Rev*. 22:203-268.

Devi, P.I., Thomas, J., and Raju, R.K. 2017. Pesticide consumption in India: A spatiotemporal analysis. *Agric. Econ. Res. Rev. 30*(1): 163-172.

DES [Directorate of Economics and Statistics]. 2015. State of Indian Agriculture 2014-15. [Online]. Available: http://eands.dacnet.nic.in/PDF/ State_of_Indian_Agriculture,2015-16.pdf [6 march 2020].

Desai, S.B. 2005. Knowledge and adoption of recommended package of practices of brinjal, M.Sc. thesis, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra.120p.

Desale, M.M. 2009. Extent of adoption of hybrid castor production technology by the farmers in Kheda district of Gujarat state. M.Sc. thesis, Anand Agricultural University, Anand, Gujarat.123p.

FAO [Food and Agriculture Organization]. 2020. Pesticides use statistics - global, regional and country trends 1990–2018 [on-line]. Available: http://www.fao.org/economic /ess/environment/data/pesticides- use/en/. [8 Dec.

2020].

Farouque, G. and Takeya, H. 2007. Farmer's perception of integrated soil fertility and nutrient management for sustainable crop production. *J. Agric. Educ*. 48(3): 111- 122.

George, S.M., Hegde, R. and Doijode, S.D. 2012. Adoption of integrated pest management practices in vegetable crops in Karnataka. Pest management in horticultural eco systems. 18(1): 118-119.

Giri, Y.P.; Thapa, R.B.; Shrestha, S.M.; Pradhan, S.B.; Maharjan, R.; Sporleder, M.; Kroschel, J. 2014. Pesticide use pattern and awareness of pesticides users with special reference to potato growers in Nepal. *Int. J. Dev. Res.* 4(1):2297-2302.

GOI [Government of India] .2021. Consumption of chemical pesticides in various states/UTs during 2016-17 to 2020-21. Directorate of plant protection, quarantine and storage, statistical database.

GOI [Government of India] .2021. Census of India: Age structure and marital status. Registrar General and Census Commissioner of India.

GoK [Government of Kerala] .2020. Agricultural Statistics Report 2019-20. GoK. pp.43.

Gopinath, M. 2005. Knowledge and adoption of Bengal gram farmers in Kurnool district of Andhra Pradesh. M.Sc. thesis, Acharya N.G. Ranga Agricultural University, Hyderabad.150p.

Gore, M. and Aryan, P. 2015. Study of farmer's perception about methods of plant protection and their effects on health and environment in western Uttar Pradesh. *Indian J. Agric. Res.* 2(4): 286-292.

Gupta, B.K. and De, D.A. 2006. Study on pesticide use of vegetable growers in Varanasi district of eastern Uttar Pradesh, Ph.D thesis, Banaras Hindu University Varanasi, 220p.

Gupta, V., Singh, D., Mishra, A.K., Singh, B.P., Kumar, R. and Pandey, R.K. 2017. A study on constraints faced by cauliflower growers in cauliflower cultivation in western Uttar Pradesh. *Inter. J. Curr. Microbiol. Appl. Sci*. 6(7): 2646-2651.

Harilal, J. 2013. A study about problem faced by vegetable growers in using pesticides in Murshidabad district of West Bengal. *Indian J. Ext. Edu*. 21: 1-5.

Henry, D. and Feola, G. 2013. Pesticide handling practices of small holder coffee farmers in eastern Jamanica. *J. Agric. Rur. Dev. Trop. Subtro*. 114(1): 59-67.

Huda, S., Husna, A.M., Rahman, S.M., Mohammad, N. and Noman, R.F. (2015). Attitude towards pesticide risk reduction of the mango growers. Haji Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh. 135p.

Iyagba, A.G., Eze, G.I., and Isirima, B.C. 2017. Acceptability and practice of organic agriculture in Etche and Omuma local government area of rivers state, Nigeria. *Inter. J. Sci. Envir. Tech*. 1(6): 20-32.

Jasna, V.K. 2018. Pesticide use behaviour of vegetable farmers with special focus on food and environmental safety: a multidimensional study. Ph.D thesis, Indian Agricultural Research Institute, New Delhi,306p.

Jyotika, 2011. Farmer have decreased, farm labours increased census report. Down to earth .[on-line].Available: https://www.downtoearth.org.in/news/farmers -have-decreased-farm-labourers-increased-census-report. [25th January 2021]

Kalyan, N.V. 2011. Impact analysis of groundnut production technologies in Chittoor district of Andhra Pradesh. M.SC. thesis, Acharya N.G. Ranga Agricultural University, Hyderabad.120p.

Kenyon, L. and Sefa, A. 2015. Pesticide use practices and perception of vegetable farmers in the cocoa belts of the Ashanti and western region of Ghana. *Adv. Crop Sci. Technol*. 3: 3p.

Kerlinger, F.N. 1973. Foundations of behavioural research. Winston publishers, New

York, 379p.

Khan, M., Akram, N., Husnain, M.I., Padda, I.H. and Qureshi, S.A. 2011. Poverty environment nexus: use of pesticides in cotton zone of Punjab, Pakistan. J. Sustain. Dev. 4(3):163-173.

Kodandaram, M., Saha, S., Rai, A.B. & Naik, P. (2013). Compendium on Pesticide Use in Vegetables. *Ext. Bull. No. 50* Indian Institute of Vegetable Research, Varanasi, Uttar Pradesh. 1-3p.

Krishnamurthy, A.T., Meti, S.K., Satheesh H.S. and Nagesh. 2016. Constraints perceived, and suggestions offered by the farmers in adoption of improved production technologies of tomato. *Int. J. Sci. Nat*. 7(1): 112-115.

Kumar, G.A. 2012. Knowledge and adoption of system of rice intensification (SRI) among farmers in Nagapattinam district of Tamil Nadu. M.SC. thesis, Acharya N.G. Ranga Agricultural University, Hyderabad.132p.

Kumari, L. and Reddy, G. 2013. A Study on knowledge and practices of safety use of pesticides among farm workers in Acharya Ranga Agricultural University. *Agric. Vet. Sci.* 6: 1-8.

Kumar, R., Sengupta, A. and Singh, A.K. 2010. Health promotion programme for safe use of pesticides among Ranchi farmers of Jharkhand state. *J. Interact*. 14(1): 90-93.

Kumar, S.K. 2004. Adoption of recommended packages of practices by the coconut farmers of Mahe region in union territory of Pondicherry. M.Sc. thesis, AcharyaN.G. Ranga Agricultural University, Hyderabad. 116p.

Madhu, K.B. 2013. Farmers perception about environmental risk in pesticidal use. M.Sc. thesis, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra.118p.

Mahantesh, N. and Singh, A. 2009. A study on farmers knowledge, perception and intensity of pesticide use in vegetable cultivation in western Uttar Pradesh, *Pusa*

Agri. Sci. 32: 63-69.

Maheriya, H.N. 2013. Technology utilization behaviour of paddy growers in Anand district of Gujarat. M.Sc. thesis, Anand Agricultural University, Anand, Gujarat.128p.

Malgie, W. 2001. A study of pesticide usage and pesticide safety awareness among farmers in Commeewijne in Suriname. *J. Agric. Technol*. 11(3): 621-636.

Mane, S.S. 2012. Knowledge and Adoption of recommended production technology of green gram. M.Sc. thesis. Vasantrao Naik Marathawada Krishi Vidyapeeth, Parbhani.130p.

Mathews, G. 2007. Attitude and behaviour regarding use of crop protection products-a survey of more than 8500 small holders in 26 counties. *Crop Prot*. 27(3-5): 834- 846.

Mekonnen, Y. and Agonafir, T. 2002. Pesticide Sprayers' Knowledge, Attitude and Practice of Pesticide Use on Agricultural Farms of Ethiopia. *Occup. Med*. 52: 311-315.

Mihireth, T.A. 2008. Farmer evaluation and adoption of improved onion production package in Fogera district. M.Sc. thesis, Haramaya University, Dire Dawa, Ethiopia. 120p.

Mishra, D. 2016. An evaluative study of vegetable farmers on safe plantation protection measures in Eastern Uttar Pradesh. Ph.D thesis, Banaras Hindu University Varanasi. 83-125p.

Mohanty, A.K., Lepch, B. and Kumar, A. 2013. Constrains analysis in adoption of vegetable production technologies for livelihood perspectives of tribal farmers in north Sikkim. *Indian Res. J. Ext. Edu*. 13(2): 51-56.

Mustapha, F.A. and Jallow. 2017. Pesticide knowledge and safety practices among farm workers in Kuwait. *Int J. Environ. Res. Public Health*. 14(4) :340p.

Nagendirajah, S. and Thiruchelvam, S. 2008. Knowledge of farmers about pest management practices in Pambaimedu, Vavuniya district; An ordered probit model approach. *Sabaramuwa Univ. J.* 8(1):78-89.

Naik, K.P. 2006. Training needs of groundnut farmers in Anantapur district of Andhra Pradesh. M.Sc. thesis, Acharya N.G. Ranga Agricultural University, Hyderabad.114p.

Oesterlund, A.H., Thomson, J.F., Sekimpi, D.K., Maziina, J., Rachel, A. and Erik, A. 2014. Pesticide knowledge, practices and attitude and how it affects the healthof small scale farmers in Uganda; A cross sectionals study. *African Health Sci.* 14(2): 420-433.

Pandit, J. C. and Basak, N. C. 2013. Constrains faced by the farmers in commercial cultivation of vegetables. *J. Bangla. Agri. Uni.* 11(2) : 193-198.

Parsa, S., Morse, S., Bonifacio, A., Chancellor, T.C.B., Condori, B., Crespoperez, B., Hobbs, S.L.A., Kroschel, J.B.M., Rebaudo, F., Sherwood, S.G., Vanek, S.J., Faye, E., Herrera, M.O. and Danggles, O. 2014. Obstacles to integrated pest mangament adoption in developing countries. *Pro. Nat. Aca. Sci*. 111(10): 3889- 3894.

Patel, D.F. 2006. A study on attitude of paddy growers towards the use of pesticides in Tarapur, Sojitra and Petlad taluk of Anand district of Gujarat state. *Agric. Ext. Rev*. 51-61p.

Patel, S.N., Chowhan, N.B. and Korat, D.M. 2007. Consequences of farmer attribute on the attitude towards integrated pest management strategy Karnataka. *J. Agric. Sci*. (20): 797-799.

Prathamesh, S.D. 2019. Awareness, health risk perception and handling behavior of pesticides by farm workers. M.Sc. thesis, Dr. Balasaheb Swant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra,114p.

Preethi, M.S., Nataraju and Laxmininarayanan, M.T. 2014. Development of a scale to

measure perception of farm youth towards agriculture. *Int. J. Ext. Educ*. 10: 165-167.

Pundlikrao, N.J. 2018. Perception of green chilli growers regarding environmental risk in use of pesticides in Vidarbha region. Ph.D thesis, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra,220p.

Quinteiro, S.L., Perez, M.F.M., Sobrino, C.C. and Rioja, M.B. (2013). Analysis of pesticide application and applicators training level in green house farms in Galicia, Spain. *Agri. Econ. Rev.* 14(2):5-13

Rabari, S.N. 2006. A study on adoption of tomato recommended technology by tomato growers in Anand district of Gujarat. M.Sc. thesis, Anand Agricultural University, Anand, Gujarat,123p

Rahimi, M.E. 2018. Awareness among vegetable growers regarding effects of pesticide residues. M.Sc. thesis, Mahatma Phule Krishi Vidyapeeth Rahuri, Ahmednagar, Maharashtra,123p.

Rahman, M.M. 2012. Problems and suggestions for farmers adoption of IPM practices in rice (Oryza sativa L.) cultivation. *J. Agri. Res.* 37(1): 121-128.

Raj, N. 2018. Entrepreneurial behaviour of lease land vegetable growers in Thiruvananthapuram district. M.Sc. thesis, Kerala Agricultural University, Thrissur, 172p.

Ramalakshmi, S. 2012. Impact analysis of sugarcane production technologies in Chittoor district of Andhra Pradesh. M.Sc. thesis, Acharya N.G. Ranga Agricultural University, Hyderabad.124p.

Ram, K. 2015. Perception of paddy growers about environmental hazards caused through judicious use of chemicals in paddy cultivation. M.Sc. thesis, Anand Agricultural University, Anand, Gujarat.112p.

Rao, M.S. and Dubey, V.K. 2001. A study of farmers perception of environmental risk in pesticide use. *Manage Ext. Res. Rev*. 47-61.

Rathod, J.J. 2009. A Study on adoption of recommended plant protection measures by chilli growers in anand district of Gujarat state. M.Sc. thesis, Anand Agricultural University, Anand, Gujarat.138p.

Raut, V.K. 2016. Perception of brinjal growers about use of pesticides. M.Sc thesis, Dr.Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra,117p.

Reddy, P.N. 2013. Knowledge of cotton farmers on health hazards of pesticides in Kurnool district of Andhra Pradesh. M.Sc. thesis, Acharya N.G. Ranga Agricultural University, Rajendranagar Hyderabad,173p.

Sahu, R.P., Sachan, V.K. and Singh, R.J. 2013. Constrains in adoption of vegetable production technology in Uttarakhand hills. *J. Multidis. Adv. Res*. 2(2): 31-34.

Salameh, P.R., Baldi, I. Brochard, P. and Saleha, B.A. 2004. Pesticides in Lebanon: A knowledge , attitude and practice study. *Environ. Res.* 94(1): 1-6.

Sam, K.G., Hira, H., Andrade, Pradhan, L., Pradhan, A., Sones, J., Rao and Sudhakar,C. 2008. Effectiveness of an educational program to promote pesticide safety among pesticide handlers of south India. *Int. Arch. Occup. Environ. Health*. 81: 787-795

Sangeetha, V. 2004. Training needs of cotton growers of Madurai district of Tamil Nadu. M.Sc.. thesis, Acharya N.G. Ranga Agricultural University, Hyderabad.152p.

Santhi, S. 2006. A Study of system of rice intensification (SRI) among rice farmers of Tirunelveli district. M.Sc. thesis, Annamalai University.103p.

Sardana, H.R., Kadu, L.N., Singh, D.K., and Singh, R.V. 2005. Knowledge of vegetable growers on pest management practices. *Indian J. Ext. Educ. 41*: 80-83.

Selvarajah, A. and Thiruchelvam, S. 2007. Factors affecting pesticide use by farmers in Vavuniya district of Peradeniya, Srilanka. *Trop. Agric*. Res. 19: 380-388.

Shafiee, F., Rezvanfar, A. and Hashemi, F. 2012. Vegetable growers in southern Tehran, Iran; Pesticide types, poisoning symptoms, attitude towards pesticide specific issues and environmental safety. *African J. Agric. Res*. 7(5); 790-796.

Shashidhara, K.K. 2006. A Study on management of ecofriendly practices by vegetable growers of north Karnataka. Ph.D thesis, University Of Agricultural Sciences, Dharwad, Karnataka.141p.

Sharma, P. 2020. Attitude and knowledge of farmers towards use of agrochemicals on selected crops in Punjab. Ph.D thesis, Punjab Agricultural University.210p.

Sheikh and Hoque. 2014. Unsafe use of pesticide and its impact on health of farmers; a case study in Burichong Upazila, Bangladesh. *J. Environ. Sci. Toxicol. Food Technol*. 8(1): 57-67.

Shetty, P. M.,Hiremath, M.,Murugan, N. and Nerli, R. 2011. Farmer's Health Externalities in Pesticides use Predominant Regions in India. *World J. Sci. Technol*. 1(4):1-11.

Shetty, P.K., Murugan, M., Hiremanth, M.B., and Sreeja, K.G. 2010. Farmers education and perception on pesticide use and crop economies in Indian agriculture. *J. Exp. Sci.* 1(1):3-8

Shinde, M.P. 2011. Attitude of the cotton growers towards integrated pest management. M.Sc. thesis, Anand Agricultural University, Anand, Gujarat.105p.

Shirke, V.S., Sonawane, H.P. and Tarde, V.J. (2011). A study of knowledge of storage management practices to the onion growers from Pune district. *Asian J. Ext. Edu*. 29:154-58

Shitre, V.R. 2010. A Study on adoption of improved technology of potato by potato growers in Anand district of Gujarat state. M.Sc. thesis, Anand Agricultural University, Anand, Gujarat.136p.

Silapanununtakul, S., Srihabut, T. and Thet, M.K. 2016. A study on pesticide use

practice and its related factors among farmers in Myanmar. *Int. J. Health Sci*. 4(1):48-58.

Silvakumar, B. 1988. Information support utilization for awareness, conviction and adoption of cotton whitefly control measures by contact and non-contact farmers.M. Sc. Thesis, Tamil Nadu Agricultural University, Coimbatore.120p.

Sindhu, N. 2016. Impact of agrochemicals on human health and environment. Ph.D thesis, Haryana Agricultural University, Hisar.230p.

Singh, K.M.P. and Singh, R.P. 1967. Ginger cultivation in Himachal Pradesh. *Indian* FMG 30(11):25-26

Singh, P.K., Barman, K.K. and Varshaney, J.G. 2010. Adoption behavior of vegetable growers towards improved technologies. *Indian Res. J. Ext. Edu.* 11(1); 62-65.

Sonawane, A.D. 2010. Management ability of banana growers regarding drip irrigation system in Anand and Vadodara districts of Gujarat state. M.Sc. thesis, Anand Agricultural University, Anand, Gujarat.128p.

Sreevalsan, J.M. 1995. Taxonomic analysis of agricultural modernity of farmers. MSc.Thesis, Kerala Agricultural University, Thrissur,120p.

Supe, S.V. 2007. Measurement techniques in social sciences. *Aggrotech Publ. Acad.*Udaipur.138p.

Supe, S.V. 1969. Factors related to different degrees of rationality in decision making among farmers. Ph.D thesis, IARI, New Delhi,190p.

Tandi, T.E., Wook, C.J., Shendeh, T.T., Eko, E.A. and Afoh, C.O. 2014. Small scale tomato cultivator's perception on pesticide usage and practices in Buea Cameroon. *Health.* 6:2945-2958.

Thompson, B., Coronado, G. D., Grossman, J. E., Puschel, K., Solomon, C. C., Islas, I., Curl, C. L., Shirai, J. H., Kissel, J.C., and Fenske, R.A. 2003. Pesticide take-home pathway among children of agricultural workers: study design, methods,

and baseline findings. *J. Occup. Environ. Med. 45*(1): 42-53.

Thomsen and Sekimpi. 2014. Pesticide knowledge, practice anad attitude of how it affects the health of small-scale farmers in Uganda. *African Health Sci.* 14(20):420-433.

Tidke, G.R., Rathod, M.K., and Manadve, R.P. 2012. Knowledge and adoption of farmers about the management of pod borer complex in pegion pea. *Int. J. Ext. Educ*. 8: 71-76.

Tyagi, H., Goutam, T. and Prashar, P. 2015. Survey of pesticide use patterns and farmers perception; A case study from qualiflower and tomato cultivating areas of district Faridabad, Haryana. Manav Rachna International University. 1(3): 139-146.

Vihariya, P.H. 2015. Awareness and adoption of vegetable growers about hazardous effect caused through pesticide residues in vegetables. M.Sc. thesis, Anand Agricultural University, Anand, Gujarat.116P.

Waichman, V.A., Eve, E. and Nina, C.S. 2007. Do farmers understand the information displayed on pesticide product labels? A Key solution to reduce pesticides exposure and risk of poisoning in the Brazilian Amazon. Crop Prot. 26(4): 576- 583.

Wankhade, P.P., Kale, N.M., Mankar, D.M., Deshmukh, J.P. 2014. Adoption of herbicide application practices by soya bean and cotton farmers in Vidarbha. Research review committee project. Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra. 940-948p.

Walke, A.S. 2008. A study on technological gap in brinjal cultivation. M.Sc. thesis, Mahatma Phule Krishi Vidyapeeth, Rahuri. 110p.

WHO [World Health Organization]. 2010. International code of conduct on the distribution and use of pesticides [On-line]. Available: http://whqlibdoc.who.int/hq/2010/WHO_HTM_NTD_WHOPES_2010.7_ eng.

[26 Nov. 2020].

Yabe, O.M. and Khai, M. 2012. Farmers perception, knowledge, and pesticide usage practices: A case study of tomato production in inlay lake Myanmar. *J. Fac.Agric. Kyushu Univ.* 57(1): 327- 331.

Yao, A. 2013. Survey of pesticide application on vegetables in the littoral area of Togo.*An. Agric. Environ. Med.* 20(4): 715-720.

Yassin, M.M., Mourad, A. and Safi, J.M. 2002. Knowledge, attitude, practice and toxicity symptoms associated with pesticide use among farm workers in the Gaza strip. *Occup. Environ. Med*. 59: 387-394.

Abstract

PESTICIDE HANDLING BEHAVIOUR OF VEGETABLE FARMERS - A MULTIDIMENSIONAL ANALYSIS

by

ARATHY B S

(2019-11-234)

ABSTRACT

Submitted in partial fulfillment of the

requirements for the degree of

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Faculty of Agriculture

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DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF AGRICULTURE

VELLAYANI, THIRUVANANTHAPURAM-695522

KERALA, INDIA

2022

KERALA AGRICULTURAL UNIVERSITY
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MASTER'S DEFENCE SEMINAR
ABSTRACT

ARATHY B. S. **Date: 28-12-2021**
2019-11-234 **Time: 11.00 am**

Pesticide handling behaviour of vegetable farmers- A Multidimensional analysis

The study entitled "Pesticide handling behaviour of vegetable farmers- A Multidimensional analysis" was conducted in Thiruvananthapuram district of Kerala during the year 2019-21 among the vegetable growers. The objective of the research was to measure the knowledge, extent of adoption and attitude of vegetable farmers on safe handling procedures of pesticides in Thiruvananthapuram and also analyze the constraints in adopting the safe handling procedures.

Two panchayaths were selected from each 4 AEU's and from each panchayath 15 respondents were picked out thus forming a total of 120 respondents. Independent variables measured in the study were selected through judges rating. The selected variables were age, education, source of information, farming experience, training received, economic orientation, environmental orientation, innovativeness, perception about health risk, risk orientation and labour availability and dependent variables were attitude, knowledge and adoption.

A structured interview schedule was administrated for data collection. Statistical tools such as mean, standard deviation, quartile deviation, percentage analysis, frequency, Karl Pearson correlation and chi square were used for the analysis.

Based on analysis of data, it was found that majority (45.8%) of the farmers belonged to old age category followed by middle age (45%) and young age (9.2%). Most of the respondents (70.8%) had SSLC level education followed by 15 per cent of the respondents who had degree and above level of education and 9.2 per cent and

5 per cent had below 10th level and higher secondary level of education, respectively. A large proportion (40.8%) of the respondents had 21 to 30 years of farming experience followed by 30 per cent having 11-20 years of experience and 15 per cent having 31 to 40 years of experience and a very low of 8.3 per cent and 5.8 per cent of the respondents had less than 10 and greater than 40 years of experience, respectively. A large number of respondents (47.5%) had utilized family members as their labour followed by 30 per cent of the respondents who had hired labour and only 22.5 per cent had both hired and family labour. Majority of the respondents (45.8%) had medium level of economic orientation, (65%) environmental orientation, (65%) risk orientation, (43.3%) innovativeness, (50%) information source utilization and (56.7%) perception about health risk. Agriculture Officer was the highest ranked source of information by the respondents followed by Agricultural Assistant and input dealers. The findings revealed that 45.8% of the respondents had attended 1 to 3 trainings followed by 42.5 per cent of the respondents having attended 4-6 training and only 11.7 per cent of the respondents had attended 7 to 10 trainings. With respect to major vegetable crop grown, majority of the respondents were growing yard long bean that is 47.50 per cent followed by 38.33 per cent were growing cucumber as the major crop and a very less percentage (2.50%) were growing tomato.

Knowledge was measured by a teacher made test, that had 40 statements, and the correct statements were given a score of 2 and incorrect statement 1. The knowledge score so arrived was converted into knowledge index. The 40 statements of knowledge test were divided into 8 different components. Since each component had uneven number of questions, weighted overall knowledge index is calculated. More than half of the respondents (54.2%) had medium level of knowledge about safe handling of pesticides followed by 24.2 per cent who had high level of knowledge and only 21.7 per cent had low level of knowledge about safe handling practices. In the distribution of respondents based on knowledge on practices recommended for safe handling of pesticides storage of pesticide had the highest knowledge index and disposal of empty containers had the least knowledge index.

The adoption level of the respondents was measured using the formula developed by Singh and Singh (1967).There were 36 statements under 6 different

components in the adoption scale. Since each component had uneven number of questions, weighted overall adoption quotient was calculated. Majority of the respondents (48.3%) had medium level of adoption of safe handling of pesticides followed by 26.7 per cent who had high level of adoption and only 25 per cent had low level of adoption of safe handling practices. In the distribution of respondents based on adoption of safe handling practices spraying of pesticide had the highest adoption quotient among other components and usage of personal protective equipment had the least adoption quotient.

The attitude of the farmers was analyzed with the scale developed by Jasna (2018). More than half of the respondents (57.5%) had medium level of attitude towards safe handling of pesticides followed by 22.5 per cent who had high level of attitude and only 20 per cent had low level of attitude towards safe handling practices.

The results of Karl Pearson correlation analysis with knowledge and independent variables revealed that out of 9 independent variables selected for the study, three variables were significantly related to the dependent variable knowledge. Innovativeness, training received and source of information were significant at 0.05 level of significance. The results of chi square analysis with knowledge and education showed significant relationship at 0.01 level of significance. Perception about health risk, training received and source of information was observed to be positively influencing the adoption of safe handling practices. The findings showed that the association of attitude and nine independent variables selected for the study, three variables that is perception about health risk, training received and source of information had 0.05 level of significance.

The constraints experienced by the farmer in following the safe handling procedures of pesticides were categorized into five categories viz. technical, occupational, economic, marketing and infrastructural. Discomfort in wearing safety equipment's while work, reduced efficiency in work after wearing the safety equipment and no premium price for safe vegetables were the major constrains faced by the respondents.

From the study it can be concluded that usage of personal protective equipment had the least adoption (37.90%) among the respondents, it was mainly due to the discomfort in wearing it while working and additional time and effort needed in following the safety measures. To improve the adoption of safe handling practices of pesticides, the attitude towards safe handling measures should be improved and focused training on safe handling practices are to be given.

കേരള അഗ്രികൾച്ചറൽ യൂണിവേഴ്സിറ്റി

കോളേജ് ഓഫ് അഗ്രികൾച്ചർ, വെള്ളായണി

അഗ്രികൾച്ചറൽ എക്സ്റ്റൻഷൻ വകുപ്പ്

മാസ്റ്റേഴ്സ് ഡിഫൻസ് സെമിനാർ

അബ്സ്ട്രാക്റ്റ്

ആരതി ബി.എസ്.

തീയതി: 28-12-2021

2019-11-234

സമയം: 11.00 am

പച്ചക്കറി കർഷകരുടെ കീടനാശിനി കൈകാര്യം ചെയ്യുന്ന സ്വഭാവം- ഒരു ബഹുമുഖ വിശകലനം

"പച്ചക്കറി കർഷകരുടെ കീടനാശിനി കൈകാര്യം ചെയ്യുന്ന സ്വഭാവം- ഒരു ബഹുമുഖ വിശകലനം" എന്ന തലക്കെട്ടിലുള്ള പഠനം കേരളത്തിലെ തിരുവനന്തപുരം ജില്ലയിൽ 2019-21 വർഷത്തിൽ പച്ചക്കറി കർഷകർക്കിടയിൽ നടത്തിയിരുന്നു. തിരുവനന്തപുരത്തെ കീടനാശിനികൾ സുരക്ഷിതമായി കൈകാര്യം ചെയ്യുന്നതിനുള്ള നടപടിക്രമങ്ങളെക്കുറിച്ചുള്ള പച്ചക്കറി കർഷകരുടെ അറിവ്, ദത്തെടുക്കലിന്റെ വ്യാപ്തി, മനോഭാവം എന്നിവ അളക്കുകയും സുരക്ഷിതമായ കൈകാര്യം ചെയ്യൽ നടപടിക്രമങ്ങൾ അവലംബിക്കുന്നതിലെ പരിമിതികൾ വിശകലനം ചെയ്യുകയുമാണ് ഗവേഷണത്തിന്റെ ലക്ഷ്യം.

ഓരോ 4 കാർഷിക പരിസ്ഥിതി യൂണിറ്റുകൾ -കളിൽ നിന്നും

രണ്ട് പഞ്ചായത്തുകൾ വീതം തിരഞ്ഞെടുത്തു, ഓരോ പഞ്ചായത്തിൽ നിന്നും 15 പ്രതികരിക്കുന്നവരെ തിരഞ്ഞെടുത്തു, അങ്ങനെ മൊത്തം 120 പേർ പ്രതികരിച്ചു. പഠനത്തിൽ അളക്കുന്ന സ്വതന്ത്ര വേരിയബിളുകൾ ജഡ്ജിമാരുടെ റേറ്റിംഗ് വഴി തിരഞ്ഞെടുത്തു. തിരഞ്ഞെടുത്ത വേരിയബിളുകൾ പ്രായം, വിദ്യാഭ്യാസം, വിവരങ്ങളുടെ ഉറവിടം, കൃഷി പരിചയം, ലഭിച്ച പരിശീലനം, സാമ്പത്തിക ദിശാബോധം, പരിസ്ഥിതി ആഭിമുഖ്യം, നൂതനത, ആരോഗ്യ അപകടസാധ്യതയെക്കുറിച്ചുള്ള ധാരണ, അപകടസാധ്യത, തൊഴിൽ ലഭ്യത എന്നിവയും ആശ്രിത വേരിയബിളുകൾ മനോഭാവം, അറിവ്, ദത്തെടുക്കൽ എന്നിവയായിരുന്നു.

വിവരശേഖരണത്തിനായി ഘടനാപരമായ അഭിമുഖ ഷെഡ്യൂൾ ഉപയോഗിച്ചു. ശരാശരി, സ്റ്റാൻഡേർഡ് ഡീവിയേഷൻ, കോർട്ടെൽ ഡീവിയേഷൻ, ശതമാനം വിശകലനം, ഫ്രീകോൻസി, കാൾ പിയേഴ്സൺ കോറിലേഷൻ, ചി സ്കയർ തുടങ്ങിയ സ്റ്റാറ്റിസ്റ്റിക്കൽ ടൂളുകൾ വിശകലനത്തിനായി ഉപയോഗിച്ചു. ഡാറ്റ വിശകലനം ചെയ്തതിന്റെ അടിസ്ഥാനത്തിൽ, കർഷകരിൽ ഭൂരിഭാഗവും (45.8%) വാർദ്ധക്യ വിഭാഗത്തിൽ പെട്ടവരാണെന്ന് കണ്ടെത്തി, തുടർന്ന് മധ്യവയസ് (45%), ചെറുപ്പക്കാർ (9.2%). പ്രതികരിച്ചവരിൽ ഭൂരിഭാഗവും (70.8%) എസ്എസ്എൽസി തലത്തിലുള്ള വിദ്യാഭ്യാസം നേടിയവരാണ്, തുടർന്ന് പ്രതികരിച്ചവരിൽ 15% ബിരുദവും അതിനുമുകളിലുള്ള വിദ്യാഭ്യാസവും ഉള്ളവരും 9.2%, 5% എന്നിവർ യഥാക്രമം 10-ാം തലത്തിലും ഹയർ സെക്കൻഡറി തലത്തിലും താഴെയുള്ള വിദ്യാഭ്യാസം നേടിയവരാണ്. പ്രതികരിച്ചവരിൽ വലിയൊരു

വിഭാഗത്തിന് (40.8%) 21 മുതൽ 30 വർഷം വരെ കൃഷിപരിചയമുണ്ട്, 30% പേർക്ക് 11-20 വർഷത്തെ പരിചയവും 15% പേർക്ക് 31 മുതൽ 40 വർഷത്തെ പരിചയവും 8.3%, 5.8% പ്രതികരിച്ചവർക്ക് യഥാക്രമം 10-ൽ താഴെയും 40-ലധികം വർഷത്തെ പരിചയവുമുണ്ടായിരുന്നു. പ്രതികരിച്ചവരിൽ വലിയൊരു വിഭാഗം (47.5%) കുടുംബാംഗങ്ങളെ അവരുടെ അധ്വാനമായി വിനിയോഗിച്ചു, തുടർന്ന് പ്രതികരിച്ചവരിൽ 30% പേർ കൂലിപ്പണിക്കാരായിരുന്നു, 22.5% പേർ മാത്രമാണ് കൂലിപ്പണിയും കുടുംബവേലയും ചെയ്തിരുന്നത്. പ്രതികരിച്ചവരിൽ ഭൂരിഭാഗം പേർക്കും (45.8%) ഇടത്തരം സാമ്പത്തിക ദിശാബോധം, (65%) പാരിസ്ഥിതിക ആഭിമുഖ്യം, (65%) അപകടസാധ്യത, (43.3%) നൂതനത്വം, (50%) വിവര ഉറവിട വിനിയോഗം, (56.7%) ആരോഗ്യത്തെക്കുറിച്ചുള്ള ധാരണ എന്നിവ ഉണ്ടായിരുന്നു. അപകടം. അഗ്രികൾച്ചറൽ അസിസ്റ്റന്റും ഇൻപുട്ട് ഡീലർമാരും തൊട്ടുപിന്നാലെ പ്രതികരിച്ചവരുടെ വിവരങ്ങളുടെ ഏറ്റവും ഉയർന്ന സ്രോതസ്സാണ് കൃഷി ഓഫീസർ. 45.8% പേർ 1 മുതൽ 3 വരെ പരിശീലനങ്ങളിൽ പങ്കെടുത്തിട്ടുണ്ടെന്നും 42.5% പേർ 4-6 പരിശീലനങ്ങളിൽ പങ്കെടുത്തിട്ടുണ്ടെന്നും പ്രതികരിച്ചവരിൽ 11.7% പേർ മാത്രമാണ് 7 മുതൽ 10 വരെ പരിശീലനങ്ങളിൽ പങ്കെടുത്തതെന്നും കണ്ടെത്തലുകൾ വെളിപ്പെടുത്തി. കൃഷി ചെയ്യുന്ന പ്രധാന പച്ചക്കറി വിളയെ സംബന്ധിച്ചിടത്തോളം, സർവേയിൽ പങ്കെടുത്തവരിൽ ഭൂരിഭാഗവും മുറ്റത്തെ നീളമുള്ള പയർ കൃഷി ചെയ്തു, 47.50%, 38.33% പ്രധാന വിളയായി വെള്ളരിയും, വളരെ കുറച്ച് ശതമാനം (2.50%) തക്കാളിയും കൃഷി ചെയ്തു.

40 പ്രസ്താവനകളുള്ള ഒരു അദ്ധ്യാപകൻ ടെസ്റ്റ് നടത്തിയാണ് അറിവ് അളക്കുന്നത്, ശരിയായ പ്രസ്താവനകൾക്ക് 2 സ്കോർ നൽകി, തെറ്റായ പ്രസ്താവന 1. അങ്ങനെ വന്ന വിജ്ഞാന സ്കോർ വിജ്ഞാന സൂചികയാക്കി മാറ്റി. വിജ്ഞാന പരിശോധനയുടെ 40 പ്രസ്താവനകൾ 8 വ്യത്യസ്ത ഘടകങ്ങളായി തിരിച്ചിരിക്കുന്നു. ഓരോ ഘടകത്തിനും അസമമായ ചോദ്യങ്ങൾ ഉള്ളതിനാൽ, വെയ്റ്റഡ് മൊത്തത്തിലുള്ള വിജ്ഞാന സൂചിക കണക്കാക്കുന്നു. പ്രതികരിച്ചവരിൽ പകുതിയിലധികം പേർക്കും (54.2%) കീടനാശിനികൾ സുരക്ഷിതമായി കൈകാര്യം ചെയ്യുന്നതിനെക്കുറിച്ച് ഇടത്തരം അറിവുണ്ടായിരുന്നു, തുടർന്ന് 24.2% പേർക്ക് ഉയർന്ന തലത്തിലുള്ള അറിവും 21.7% പേർക്ക് മാത്രമേ സുരക്ഷിതമായ കൈകാര്യം ചെയ്യൽ രീതികളെക്കുറിച്ചുള്ള അറിവ് കുറവാണ്. കീടനാശിനികൾ സുരക്ഷിതമായി കൈകാര്യം ചെയ്യുന്നതിനായി ശുപാർശ ചെയ്യുന്ന സമ്പ്രദായങ്ങളെക്കുറിച്ചുള്ള അറിവിന്റെ അടിസ്ഥാനത്തിൽ പ്രതികരിച്ചവരുടെ വിതരണത്തിൽ, കീടനാശിനി സംഭരണത്തിന് ഏറ്റവും ഉയർന്ന വിജ്ഞാന സൂചികയും ശൂന്യമായ പാത്രങ്ങൾ നീക്കം ചെയ്യുന്നതിൽ ഏറ്റവും കുറഞ്ഞ വിജ്ഞാന സൂചികയും ഉണ്ടായിരുന്നു.

സിംഗും സിംഗും (1967) വികസിപ്പിച്ചെടുത്ത ഫോർമുല ഉപയോഗിച്ചാണ് പ്രതികരിച്ചവരുടെ ദത്തെടുക്കൽ നില അളക്കുന്നത്. ദത്തെടുക്കൽ സ്കെയിലിൽ 6 വ്യത്യസ്ത ഘടകങ്ങൾക്ക് കീഴിൽ 36 പ്രസ്താവനകൾ ഉണ്ടായിരുന്നു. ഓരോ ഘടകത്തിനും അസമമായ ചോദ്യങ്ങൾ ഉള്ളതിനാൽ, വെയ്റ്റഡ് മൊത്തത്തിലുള്ള ദത്തെടുക്കൽ ഘടകം കണക്കാക്കി.

പ്രതികരിച്ചവരിൽ ഭൂരിഭാഗവും (48.3%) കീടനാശിനികൾ സുരക്ഷിതമായി കൈകാര്യം ചെയ്യുന്നതിനുള്ള ഇടത്തരം നിലവാരം സ്വീകരിച്ചു, തുടർന്ന് 26.7% ഉയർന്ന ദത്തെടുക്കൽ ഉള്ളവരും 25% പേർക്ക് മാത്രമേ സുരക്ഷിതമായ കൈകാര്യം ചെയ്യൽ രീതികൾ അവലംബിക്കുന്നുള്ളൂ. സുരക്ഷിതമായ കൈകാര്യം ചെയ്യൽ രീതികൾ അവലംബിച്ചതിന്റെ അടിസ്ഥാനത്തിൽ പ്രതികരിച്ചവരുടെ വിതരണത്തിൽ, കീടനാശിനി തളിക്കുന്നതിനാണ് മറ്റ് ഘടകങ്ങൾക്കിടയിൽ ഏറ്റവും ഉയർന്ന ദത്തെടുക്കൽ ഘടകം, വ്യക്തിഗത സംരക്ഷണ ഉപകരണങ്ങളുടെ ഉപയോഗം ഏറ്റവും കുറഞ്ഞ ദത്തെടുക്കൽ ഘടകം.

ജസ്ന (2018) വികസിപ്പിച്ചെടുത്ത സ്കെയിൽ ഉപയോഗിച്ചാണ് പ്രതികരിച്ചവരുടെ മനോഭാവം അളന്നത്. പ്രതികരിച്ചവരിൽ പകുതിയിലധികം പേർക്കും (57.5%) കീടനാശിനികൾ സുരക്ഷിതമായി കൈകാര്യം ചെയ്യുന്നതിനോട് ഇടത്തരം മനോഭാവമുണ്ടായിരുന്നു, തുടർന്ന് 22.5% ഉയർന്ന മനോഭാവമുള്ളവരും 20% പേർക്ക് സുരക്ഷിതമായ കൈകാര്യം ചെയ്യൽ രീതികളോട് കുറഞ്ഞ മനോഭാവവും ഉണ്ടായിരുന്നു.

അറിവും സ്വതന്ത്ര വേരിയബിളുകളുമായുള്ള കാൾ പിയേഴ്സൺ പരസ്പര ബന്ധ വിശകലനത്തിന്റെ ഫലങ്ങൾ പഠനത്തിനായി തിരഞ്ഞെടുത്ത 9 സ്വതന്ത്ര വേരിയബിളുകളിൽ മൂന്ന് വേരിയബിളുകളും ആശ്രിത വേരിയബിൾ വിജ്ഞാനവുമായി കാര്യമായി ബന്ധപ്പെട്ടിരിക്കുന്നുവെന്ന് വെളിപ്പെടുത്തി. 0.05 ലെവൽ പ്രാധാന്യത്തിൽ നൂതനതയും ലഭിച്ച പരിശീലനവും വിവരങ്ങളുടെ ഉറവിടവും

പ്രാധാന്യമർഹിക്കുന്നു. അറിവും വിദ്യാഭ്യാസവും ഉപയോഗിച്ചുള്ള ചി സ്കയർ വിശകലനത്തിന്റെ ഫലങ്ങൾ 0.01 ലെവൽ പ്രാധാന്യത്തിൽ കാര്യമായ ബന്ധം കാണിക്കുന്നു. ആരോഗ്യപരമായ അപകടസാധ്യത, ലഭിച്ച പരിശീലനം, വിവരങ്ങളുടെ ഉറവിടം എന്നിവയെക്കുറിച്ചുള്ള ധാരണകൾ സുരക്ഷിതമായ കൈകാര്യം ചെയ്യൽ രീതികൾ സ്വീകരിക്കുന്നതിൽ നല്ല സ്വാധീനം ചെലുത്തുന്നതായി നിരീക്ഷിച്ചു. പഠനത്തിനായി തിരഞ്ഞെടുത്ത മനോഭാവവും ഒമ്പത് സ്വതന്ത്ര വേരിയബിളുകളും തമ്മിലുള്ള ബന്ധം, ആരോഗ്യ അപകടത്തെക്കുറിച്ചുള്ള ധാരണ, ലഭിച്ച പരിശീലനം, വിവരങ്ങളുടെ ഉറവിടം എന്നിവയെക്കുറിച്ചുള്ള മൂന്ന് വേരിയബിളുകൾ 0.05 ലെവൽ പ്രാധാന്യത്തിൽ പ്രാധാന്യമർഹിക്കുന്നതായി കണ്ടെത്തലുകൾ കാണിച്ചു.

കീടനാശിനികളുടെ സുരക്ഷിതമായ കൈകാര്യം ചെയ്യൽ നടപടിക്രമങ്ങൾ പാലിക്കുന്നതിൽ കർഷകന് അനുഭവപ്പെടുന്ന നിയന്ത്രണങ്ങളെ അഞ്ച് വിഭാഗങ്ങളായി തരംതിരിച്ചിട്ടുണ്ട്. സാങ്കേതികവും തൊഴിൽപരവും സാമ്പത്തികവും വിപണനവും അടിസ്ഥാന സൗകര്യവും. ജോലി സമയത്ത് സുരക്ഷാ ഉപകരണങ്ങൾ ധരിക്കുന്നതിലെ അസ്വസ്ഥത, സുരക്ഷാ ഉപകരണങ്ങൾ ധരിച്ചതിന് ശേഷം ജോലിയിലെ കാര്യക്ഷമത കുറയുക, സുരക്ഷിതമായ പച്ചക്കറികൾക്ക് പ്രീമിയം വിലയില്ല എന്നിവയായിരുന്നു പ്രതികൾ അഭിമുഖീകരിച്ച പ്രധാന തടസ്സങ്ങൾ.

പ്രതികരിച്ചവരിൽ വ്യക്തിഗത സംരക്ഷണ

ഉപകരണങ്ങളുടെ ഉപയോഗത്തിന് ഏറ്റവും കുറവ് ദത്തെടുക്കൽ (37.90%) ഉണ്ടെന്ന് പഠനത്തിൽ നിന്ന് നിഗമനം ചെയ്യാം, ജോലി ചെയ്യുമ്പോൾ അത് ധരിക്കുന്നതിലെ അസ്വാസ്ഥ്യവും സുരക്ഷാ നടപടികൾ പാലിക്കുന്നതിന് ആവശ്യമായ അധിക സമയവും പരിശ്രമവുമാണ് ഇതിന് കാരണം. കീടനാശിനികളുടെ സുരക്ഷിതമായ കൈകാര്യം ചെയ്യൽ രീതികൾ സ്വീകരിക്കുന്നത് മെച്ചപ്പെടുത്തുന്നതിന്, സുരക്ഷിതമായ കൈകാര്യം ചെയ്യൽ നടപടികളോടുള്ള മനോഭാവം മെച്ചപ്പെടുത്തുകയും സുരക്ഷിതമായ കൈകാര്യം ചെയ്യൽ രീതികളിൽ ശ്രദ്ധ കേന്ദ്രീകരിച്ചുള്ള പരിശീലനം നൽകുകയും വേണം.

Appendices

APPENDIX-I

KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE
Department of Agricultural Extension
Vellayani - 695 522
Thiruvananthapuram

Dr. Bindu Podikunju
Assistant Professor Aricultural Extension
KVK Sadanandapuram

Date: 15-03-2021

Sir/Madam,

Ms. Arathy B. S. (Ad. No. 2019-11-234), the post graduate scholar in the Department of Agricultural Extension, College of Agriculture, Vellayani is undertaking a research study entitled "**Pesticide Handling Behaviour of Vegetable Farmers - A Multidimensional Analysis**" as part of her research work. Variables supposed to have close association with the study have been identified after extensive review of literature.

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

Thanking you,

Yours faithfully

(Dr. Bindu Podikunju)

Pesticide Handling Behaviour of Vegetable Farmers - A Multidimensional Analysis

Objectives

Measurement of knowledge, extent of adoption and attitude of vegetable farmers on safe handling procedures of pesticides and also analyse the constraints in adopting the safe handling procedures.

Personal, Social, Economic and Psychological variables taken for the study

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

Sl. No.	Variable	Operational definition	Relevancy rating (R - relevant)				
			Most R	More R	R	Less R	Least R
1.	**Age**	Operationalized as actual age of the farmer in completed years at the time of interview.					
2.	**Annual income**	Refers to the total earning of the farmer from all the sources in rupees					
3.	**Education**	Defined as the level of formal education attained by the respondent.					
4.	**Marital status**	Refers to the position of an individual with respect to members married life at the time of interview					
5.	**Social participation**	Refers to the content and nature of participation of farmer in various activities					
6.	**Duration of**	Operationalized as the					

	work in a season	number of days respondents undertake spraying operations in a season					
7.	**Information seeking**	Refers to the processs or activity of attempting to obtain information in both human and technology context					
8.	**Family size**	Refers to the number of family members in each farmer's household.					
9.	**Land holding**	Refers to the total land owned by the farmer					
10.	**Training received**	Refers to teaching or developing in oneself or others, any skills and knowledge that relate to specific useful competencies					
11.	**Source of information**	Refers to frequency of contact or exposure of the respondents to different information sources for obtaining the agricultural information					
12.	**Extension agency contact**	Refers to the frequency of contact with the different extension personals and agencies					
13.	**Mass media exposure**	Refers to the degree to which the different mass media namely television, newspaper, magazines, bulletins, books and films were utilised by the farmer for getting information					

14.	**Economic orientation**	Refers to the degree to which a farmer was oriented towards profit maximization in farming and the relative value placed by the farmer on economic ends.					
15.	**Scientific orientation**	Refers to the degree to which a farmer is oriented to the use of scientific methods in his cultivation					
16.	**Farming experience**	Total number of years a respondent had been engaged in farming					
17.	**Environmental orientation**	Operationalized as degree to which a farmer has concern for his environment.					
18.	**Irrigation facility**	Refers to different sources available with vegetable growers for irrigating vegetable crops					
19.	**Risk Orientation**	Operationalized as degree to which farmer is oriented towards encountering risk & uncertainity in adopting new ideas in farming					
20.	**Major vegetable crop grown**	Operationalized as the number of crops grown by an individual respondents and the cropping pattern followed.					
21.	**Labour availability**	Refers to labour availability for cultivation of vegetable					

		crops especially pesticides application in vegetable crops					
22.	**Number of sprays per vegetable crop**	Refers to number of sprays carried out by the vegetable growers for the control of insect and pest.					
23.	**Perception about health risk**	Refers to applicators risk perception about unsafe use of pesticides					
24.	**Extent of pesticide use**	Conceptualized as the rate of pesticide applied per acre of land					
25.	**Buying behaviour of pesticide**	Refers to the behaviour of farmers while purchasing the pesticide					
26.	**Health hazard**	Refers to the response of pesticide applicators about symptoms of mild and acute pesticide poisoning					
27.	**Innovativeness**	Refers to the degree to which farmer is oriented to adopt the latest farm practices first in the village					
28.	**Farm Mechanisation**	Degree of automation in respondent field					
29.	**Use of personal protective measures**	Refers to the use of personal protective measures by the farmer while handling the pesticides including mask, gloves, boots, hat, full sleeve shirt, and pants					

30.	**Comorbidities**	Refers to the existence of any underlying co morbidities					
31.	**Pesticide mixing behaviour**	It refers to the pesticide mixing behavior of farmer including solvent used for mixing active ingredient, mode of mixing, equipment used to mix and spraying equipment used					
32.	**Family type**	Refers to the type of family in which the respondents lives ie, nuclear or joint					
33.	**Practices followed by the farmer regarding the use of pesticide**	Refers to the practices followed by the farmer with regards to the pesticide use including economic threshold level, site specific application, use of safety measures and disposal mechanism of empty containers					
34.	**Hygiene and sanitation practice**	Refers to the pattern of hygiene and sanitation practice followed by the farmer					
35.	**Others if any please specify**						

APPENDIX-II

DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE VELLAYANI

"PESTICIDE HANDLING BEHAVIOUR OF VEGETABLE FARMERS
A MULTIDIMENTIONAL ANALYSIS"

INTERVIEW SCHEDULE FOR

PART 1

1. NAME OF THE FARMER: _____
2. ADDRESS: _____
3. AGE: _____
4. EDUCATION: _____
5. FARMING EXPERIENCE
   i. farming (years)_____
   ii. vegetable cultivation (years) _____
6. MAJOR VEGETABLE CROP GROWN (acres)_____

7. SOURCE OF INFORMATION

Sl. no	**Source of information**	FREQUENCY		
		Regular	Sometimes	Never
A.	**Local sources**			
1	Friends			
2	Neighbor's			
3	Relatives			
4	Progressive farmers			
5	Local farmers			
6	Input dealers			
B.	**Cosmopolite sources**			
I.	**Single window system**			
1	Agricultural officer			
2	Agricultural supervisor			
3	Agricultural assistant			
II.	**Panchayat raj**			
1	Gramsevak			
2	Agri. Extension officer			

3	Block development officer			
III.	**University scientists**			
1	Crop specialist			
2	Agri. scientist			
IV.	**KVK scientist**			
1	Subject specialist			
2	KVK coordinator			
C.	**Extension methods**			
1	Meetings			
2	Demonstrations			
3	Field visits			
4	Agricultural exhibitions			
D.	**MEDIA**			
1	media			
2	Radio			
3	Television			
4	News paper			
5	Farm magazine			
6	Exhibition			
7	Krishi mela			
8	Any other			

8. LABOUR AVAILABILITY

SL.NO	LABOUR AVAILABILITY	YES IF YES NUMBER	NO
1	Hired labour		
2	Family labour		
3	Hired + family labour		

9. ECONOMIC ORIENTATION

SL.NO	STATEMENTS	RESPONSE		
		A	UD	DA
1	A farmer should work towards more yields and economic profits			

2	The most successful farmer is one who makes more profit			
3	A farmer should grow cash crops to increase monetary profits in comparison to growing food crops for home consumption			
4	The farmer should try the new farming ideas which may earn him more money			
5	It is difficult for the farmer children to make good start unless he provides them with economic assistance			
6	A farmer must earn his living but the most important thing in life cannot be defined in economic terms			

10. TRAINING RECEIVED

Number of trainings attended by the respondents

11. ENVIRONMENTAL ORIENTATION

SL.NO	STATEMENTS	AGREE	DISAGREE
1	Indiscriminate use of pesticides causes environmental hazards		
2	Man is exploiting the earth too much		
3	Man has to be greatly concerned about environmental issues like soil, air, 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 farming methods were more safer than present ones		
6	Agricultural produce obtained without use of chemicals are more tastier and healthier		

12. RISK ORIENTATION

SL.NO	STATEMENTS	RESPONSE		
		A	UD	DA
1	A farmer should grow variety of crops to avoid higher risk involved in growing one or two crops			

2	A farmer should rather take more of a change in making a big profit than to be content with a smaller but less risky profits			
3	A farmer who is willing to take greater risks than the average farmer usually does have better financial condition			
4	It is good for a farmer to take risks when he knows his chance of success is high			
5	It is better for a farmer not to try new farming methods unless most other farmers have used them with success			
6	Trying an entirely new method in farming by a farmer involves risk, but it is worth			

13. INNOVATIVENESS

SL. NO	STATEMENTS	RESPONSE CATEGORIES		
		YES	UNDECIDED	NO
1	Do you want to learn new ways of farming			
2	If the agricultural extension worker gives a talk on improved cultivation aspects will you attend it			
3	If the govt. helps you in establishing a farm elsewhere, will you accept the deal			
4	Do you want a change in your life			
5	A farmer should try to do farming the way his parents did			
6	Do you believe that man's future is the hands of god			
7	Do you want your sons to become farmers			

14. PERSCEPTION ABOUT HEALTH

SL.NO	QUESTION	RESPONSE (YES/NO)
1	In your opinion, how harmful the pesticides are for the human health.	
2	Do you have any information about pesticide exposure and their harmful effects on your health	
3	Do you know lack of knowledge, inadequate understanding of toxicity level, unscientific handling	

	practices and poor personal mechanisms are directly effects on your health	
4	When using pesticides or being exposed to them do you experienced any mild or acute health issues	
5	Do you take any preventive measures for avoiding pesticide exposure and health risk	
6	If had any incidence of poisoning in farm, can available any medical help immediately after the incidence	
7	Do you know any first aid measures	

PART 2

KNOWLEDGE OF THE FARMERS ABOUT THE SAFE HANDLING PROCEDURES OF PESTICIDES

SL.NO	STATEMENTS	YES	NO
I.	**USE OF PERSONAL PROTECTIVE EQUIPMENTS**		
1.	Pesticides are mixed with bare hands before filling the sprayer		
2.	Mask and gloves should be used to protect face and hand		
3.	Wear goggles or glasses to protect eyes		
4.	Mask, apron and boots were worn before spraying		
II.	**CLEANING AND MAINTAINING SPRAYER**		
1.	If there is any blockage in the nozzle of sprayer a small wire or brush is used to remove it		
2.	After application excess pesticide is buried in deep pits spread with charcoal base		
3.	Spraying equipment are washed after usage		
4.	Sprayer can be filled without calibration		
5.	During cleaning the sprayer the rinsinate can be poured to the water source		
III.	**WHILE SPRAYING**		
1.	Used to smoke while pesticide application		
2.	Concentrated formulations were handled with care		
3.	Pesticides should be applied along the wind direction		
4.	In case of any leakage in the sprayer it can be corrected after completing the application		
5.	Will eat and drink while spraying		
6.	Symptoms of mild and acute pesticide poisoning noticed (Headache, Fatigue, weakness, dizziness, nausea, cough, excessive sweating, muscle cramps, diarrhoea, breathing difficulty, stomach cramps, intense thirst, moodiness, soreness in joints, skin irritations, eye irritations, irritation on nose or throat)		
7.	First aid will accept at any emergency		
8.	If there is insecticide in the eyes: rinse the eyes with large quantities of clean water for at least five minutes		
9.	Wash the hands and face with soap and water each time the pump has been refilled		

10.	Touch any part of the body with gloves while handling pesticides		
11.	Leaking equipment should be repaired and skin should be washed after any accidental contamination		
IV.	**WHILE BUYING PESTICIDE**		
1.	Pesticide are selected through expert recommendation		
2.	Source of pesticide purchase are only from govt agricultural departments, if no specify the source		
3.	Does the retailer provide any information's about the method of use and timing of application of pesticide		
V.	**USAGE OF PESTICIDE**		
1.	Used to read instructions on container before using it		
2.	Red coloured triangle on the pesticide bottle shows it is an extremely toxic one		
3.	Use to apply pesticides every day or alternate days		
4.	Used to apply pesticide as per requirement (prescribed)		
5.	For getting more production it is better to apply chemical dosage		
	a. more than instruction		
	b. less than instruction		
	c. according to packet		
	d. according to expert advice		
6.	_____ is the dosage using for my _____ crop		
7.	Have an agrochemical application schedule		
8.	Recommended dose of pesticide should be used by taking exact measurement with provided measuring cup		
9.	Dose of pesticide to be sprayed will be fixed by fellow farmers		
VI	**PERSONAL HYGIENE**		
1.	After pesticide application hand washing with soap is done before having food		
2.	Taking bath after pesticide application is a must		
3.	Clothes worn during application is washed separately		
VII	**STORAGE OF PESTICIDES**		
1.	Pesticides are stored in a separate room		
2.	Containers were kept out of the reach of children's		
3.	Pesticides are dangerous to animals		
VIII	**DISPOSAL OF EMPTY CONTAINERS**		

1.	Pesticide empty containers can be washed and reused as household utensil		
2.	Empty containers were disposed as per the instruction on the label		

PART 3

EXTENT OF ADOPTION OF SAFE HANDLING PROCEDURES OF PESTICIDES BY THE FARMERS

SL.NO	STATEMENT	ALWAYS	MOST OFTEN	SOMETIMES	RARELY	NEVER
I. USE OF PERSONAL PROTECTION EQUIPMENT WHILE HANDLING PESTICIDE						
1.	Wearing gloves for protecting hands					
2.	Wearing glass or goggles for protecting eyes					
3.	Wearing long pants and boots					
4.	Wearing long sleeves					
5.	Wearing hats					
6.	Wearing disposable mask or respirator					
7.	Wearing water proof apron or large plastic bag to cover body					
II. CLEANING AND MAINTAINING PESTICIDE SPRAYER						
1.	After spraying the sprayer is washed every time					
2.	Sprayer washing remains are poured in pit made with charcoal or stones					
3.	Resinate after washing the sprayer is used as diluent for next spray					
4.	Sprayer and pesticides were kept in safe and clean places and away from food items					
5.	After spraying a warning sign is placed in the field until the re-entry period					
III. WHILE SPRAYING						
1.	Reading of the label carefully					

2.	Spraying procedures like mixing, loading, and handling are done as per the instructions given in the label					
3.	Spraying during raining					
4.	Spraying during hot sun					
5.	Spraying during high wind					
6.	Entering in the pesticide applied field only after the withholding period					
7.	The waiting period is followed between last spray and harvest					
IV. PERSONAL HYGIENE						
1.	Eating, drinking, chewing and smoking while spraying					
2.	Using separate clothes during spraying					
3.	After spraying washing hands and face with soap before having food					
4.	Washing hands immediately after direct contact with pesticides					
5.	Washing the clothes that is used while spraying separately from other clothes.					
6.	Immediately bathing after spraying					
V. STORAGE OF PESTICIDE CONTAINERS						
1.	Storing pesticides away from children					
2.	Storing pesticides away from food stuffs and kitchen premises					
3.	Storing pesticide away from water source					
4.	Storing pesticide away from animals					
5.	Storing pesticide in a well-ventilated room					
6.	Storing pesticide in an empty cupboard and locked					

7.	Storing pesticide in their original containers					
8.	Decanting the excess pesticides into any beverage bottles or oil bottles					
VI. DISPOSAL OF THE EMPTY CONTAINERS						
1.	Returning outdated pesticides					
2.	Empty containers are washed and returned for recycling / crushed / buried					
3.	Using empty containers for storing food products or other purposes					

PART 4

CONSTRAINTS EXPERIENCED BY THE FARMER IN FOLLOWING THE SAFE HANDLING PROCEDURES OF PESTICIDES.

TECHNICAL

SL. NO	STATEMENT	RANK
1.	Limited availability of eco-friendly methods	
2.	Lack of awareness on need for the safety measures	
3.	Unskilled labuor	
4.	Damaged sprayer	
5.	Faking with adulterated/ banned pesticides	
6.	Labelling in english language	
7.	Lack of training	

OCCUPATIONAL

SL. NO	STATEMENT	RANK
1.	Discomfort in wearing the protection equipment's	
2.	Additional time and effort required for following safety measures	
3.	Reduced efficiency in work after wearing these equipment's	
4.	Difficulty in calibration and maintenance of sprayer	
5.	Complexity involved	
6.	Unable to skip drinking / eating in between spraying as it takes long hours for spraying	

ECONOMIC

SL. NO	STATEMENT	RANK
1.	High cost of eco friendly methods	
2.	Increased expenditure on protection equipment's	
3.	Labour cost	
4.	Increased cost on construction of deep pits for disposal of empty containers/surplus pesticides	
5.	Heavy loss occurred after following safe pesticide doses	

6.	Lack of credit facilties	

INFRASTRUCTURAL

SL. NO	STATEMENT	RANK
1.	Lack of storage structures, building to keep pesticides, sprayers and other materials	
2.	Lack of safe transportation facilities	
3.	Lack of protection equipments, sprayers and materials availability	
4.	Lack of pesticide residue analysis facilities and capabilities	
5.	Limited option for recycling the pesticide containers	

MARKETING

SL. NO	STATEMENT	RANK
1.	Market is not assured	
2.	Consumers are not aware	
3.	No premium price for safe vegetables	
4.	Lack of labeling facilities	
5.	Mistrust on pesticide safety of vegetables	

PART 5

ATTITUDE OF FARMERS ABOUT SAFE HANDLING PROCEDURES OF PESTICIDE.

SL.NO	STATEMENTS	SA	A	UD	DA	SDA
1.	Pesticide safe vegetables will find new consumer markets					
2.	Safe pesticide practices should be strictly followed because it is unethical to pollute natural resources					
3.	One should use personal protective equipments while handling the pesticides					
4.	Hands and face should be washed before eating anything after applying pesticide					
5.	Consideration should be given for re-entry and with holding period after spraying pesticides					
6.	Safe pesticide practices should be strictly followed because it is unethical to damage health of others					
7.	Pesticide products should be stored away from the home premises					
8.	Pesticides spilled over skin should be washed off immediately					
9.	Clothing used while spraying need not be washed separately from other clothes					
10.	Bathing after spraying is an important safety practices for health					
11.	It is important to avoid the leakage of sprayers immediately					
12.	Safe pesticide practices demand more time and effort					
13.	Legislative controls are required to stop indiscriminate pesticide application					
14.	Heavy crop loss occurs when pesticides are applied in recommended quantities					
15.	Training programed are necessary to impart basic skills on safe pesticide handling practices					

16.	Lack of availability of required inputs is a hindrance in adoption of safe pesticide practices					
17.	Safe handling practices cannot be followed because of lack of adequate knowledge on practices					
18.	The best practice to dispose pesticide containers is to return the empty containers to the dealers					
19.	Individuals, who adopt safe pesticide handling practices should be rewarded					