BUYING BEHAVIOUR OF COTTON FARMERS TOWARDS PESTICIDES IN GUNTUR DISTRICT OF ANDHRA PRADESH

BY

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B.Sc. (Hons.) Ag.

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DECLARATION

I, **Mr. L. SRAVAN KUMAR**, hereby declare that the thesis entitled **"BUYING BEHAVIOUR OF COTTON FARMERS TOWARDS PESTICIDES IN GUNTUR DISTRICT OF ANDHRA PRADESH"** submitted to the **Acharya N.G. Ranga Agricultural University** for the degree of **Master of Business Administration (Agribusiness Management)** is the result of original research work done by me. I also declare that no material contained in the thesis has been published earlier in any manner.

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CERTIFICATE

Mr. L. SRAVAN KUMAR has satisfactorily prosecuted the course of research and that thesis entitled **"BUYING BEHAVIOUR OF COTTON FARMERS TOWARDS PESTICIDES IN GUNTUR DISTRICT OF ANDHRA PRADESH"** submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that neither the thesis nor its part there of has been previously submitted by him for a degree of any University.

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CERTIFICATE

This is to certify that the thesis entitled **"BUYING BEHAVIOUR OF COTTON FARMERS TOWARDS PESTICIDES IN GUNTUR DISTRICT OF ANDHRA PRADESH"** submitted in partial fulfilment of the requirements for the degree of **'MASTER OF BUSINESS ADMINISTRATION (AGRIBUSINESS MANAGEMENT)'** of the Acharya N.G. Ranga Agricultural University, Guntur is a record of the bonafide original research work carried out by **Mr. L. SRAVAN KUMAR** under our guidance and supervision.

No part of the thesis has been submitted by the student for any other degree or diploma. The published part and all assistance received during the course of the investigations have been duly acknowledged by the author of the thesis.

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L. SRAVAN KUMAR…

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LIST OF SYMBOLS AND ABBREVIATIONS

%	:	per cent
<	:	Less than
>	:	Greater than
CS	:	Capsule Suspension
EC	:	Emulsifying Concentrate
etc.	:	and so on
F	:	Frequency
Fig.	:	Figure
et al.	:	and others
i.e.	:	that is
gms	:	Grams
Kg	:	Kilogram
kg ha^{-1}	:	Kilogram per hectare
ml	:	Milli liter
MT	:	Metric tons
S.No.	:	Serial Number
SC	:	Soluble Concentrate
SG	:	Soluble Granules
SP	:	Soluble Powder
WG	:	Wettable Granules
WP	:	Wettable Powder
viz.,	:	Namely
IPM	:	Integrated Pest Management

ABSTRACT

Author of the project	:	**LADI SRAVAN KUMAR**
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The present study entitled “Buying behaviour of cotton farmers towards pesticides in Guntur district of Andhra Pradesh” was designed to study the awareness of pesticide application, pesticide consumption pattern, buying behavior toward pesticides and constraints that occurred while purchasing pesticides by the farmers in Guntur district of Andhra Pradesh.

Guntur district was intentionally chosen for the study, as the district occupied a pride place in the consumption of pesticides, area and production of cotton in the state of Andhra Pradesh. Among the 58 mandals in the Guntur district the cotton growing mandals were listed out and two mandals were randomly selected for the study. Five villages were selected randomly from each mandal thus making a total of 10 villages. The list of cotton growing farmers from these 10 villages were obtained from agricultural departments and 10 cotton farmers selected randomly from the list, thus making a sample size of 100. The villages were Pakalapadu, Pedamakkena, Panidam, Rentapalle, Nandigama from Sattanapalli mandal, Uppalapadu, Srigiripadu, Rachamallipadu, Patlaveedu, Mandadi from Veldurti mandal were selected randomly. The required data relating to the study were collected from the farmers through a pre-tested schedule through repeated personal visits. The collected data were analyzed by using descriptive statistics, Chi-square test, Garrett’s ranking technique and Likert’s scale to achieve the set objectives of the study.

Most of the farmers were of middle aged, education up to intermediate level, having medium size family with low income grouped, having small operational land holding and medium farming experience, mass media exposure, primary and secondary occupation of the cotton farmers.

Monocrotophos 36% soluble liquid (SL) and Acephate 75% soluble powder (SP) (100%) followed by Fipronil and Pendimethalin 30% Emulsifible Concentrate (EC) were used for the crop. The farmers had a significant knowledge on factors like spraying techniques, different kinds of brands available in the market. Chi-square test helped in understanding the significant association between educational level, annual income, operational land holding, farming experience of the farmers to their level of awareness towards pesticides selection and it was interpreted that there was significant difference in annual income, farming experience and there was no significant difference between education and operational land holding.

The major source of information was gathered from input dealers (74.16) and progressive farmers (67.28). The previous usage experience (73.96), pesticide dealer recommendations (67.38) were the main basis for the pesticide application. The major mode of payment by the farmers was done through both credit and cash (37%). If the credit is not available the alternate was to switch to the other dealers who provided credit (53%)and even though there was a change in the price of pesticides, farmers wanted to purchase the same brand and apply the same quantity of pesticides (48%). The damage symptoms observed, intensity of pest and diseases were the factors that influenced the quantity of pesticide application by the farmers.

The availability of choice product (3.73) and accessibility for input stores (3.68) were the major satisfactory factors towards pesticides and supporting services. The top three constraints faced by the farmers were high price of pesticides (72.28), high interest on credit (69.10) and lack of credit availability (64.44). The overall problems faced by the farmers towards pesticide usage were lack of information regarding usage and unavailability of product during peak time.

Chapter - I

Introduction

Chapter I

INTRODUCTION

Agriculture is an important sector of the Indian economy, accounting for approximately 18 per cent of total GDP and employing more than 60 per cent of population (https://statista.com/). Over the last few decades, Indian agriculture has grown at a rapid pace standing third in the world in terms of agricultural commodity production, including paddy, wheat, pulses, cotton, fruits and vegetables, sugarcane, tea, Jute, tobacco leaves, and so on. With the commercialization of agriculture there is an increased usage of agricultural inputs in India.

Introduction of high-yielding varieties, and fertilizer responsive varieties have also influenced the incidence of pests and diseases. It is estimated that, insects cause major damage as high as 50 per cent followed by weeds 30-40 per cent and pathogens 24 per cent. Pesticides are the chemicals (natural or synthetic) employed in various agricultural practices to control pests, weeds, and diseases in plants. Pesticides are classified based on their nature of chemical into herbicides, insecticides, fungicides, rodenticides, nematicides. Pesticides are crucial for increasing production and decreasing losses. A wide variety of pesticides must be used effectively to manage pests and enable increased crop production because insect infestations result in the loss of about 45 per cent of world's annual food production. According to the United Nations Food and Agriculture Organization, pests damage about 40 per cent of crops in developing nations in the fields and 6-7 per cent of crops after harvest.

Other options for controlling crop loss due to insect damage, such as the use of various bio pesticides, transgenic technology to generate pest-resistant crop varieties. However, chemical pesticides are chosen over other alternatives for protecting crops against yield loss. Currently, around 2 million tonnes of pesticides were used globally, with 47.5 percent being herbicides,

29.5 percent being insecticides, 17.5 per cent being fungicides, and 5.5 percent being other pesticides. Top ten pesticide-consuming countries in the world are China, the United States, Argentina, Thailand, Brazil, Italy, France, Canada, Japan, and India. Moreover, by the year 2020, global pesticide usage was increased up to 3.5 million tonnes.

India is the fourth-largest global producer of pesticides with an estimated market size of around 4.9 billion USD after the United States, Japan, and China with market of 10 per cent globally (2017). India is one among the lowest pesticides consumption country in the world, with a per hectare consumption of just 0.6 kg, compared to the US (5-7 kg/ha) and Japan (11-12 kg/ha). Plant protection chemicals used in India were 62193 metric tonnes which account for 0.3 per cent (0.6Kg/hectare) of world pesticide consumption, including 1559 metric tonnes (0.36Kg/hectare) in Andhra Pradesh state (Department of plant protection, quarantine, and storage, 2020-21). Consumption of pesticide use has climbed at approximately 12 per cent yearly for the last two decades (Kumar *et al*., 2017).

The crops like paddy, cotton and chilli are mostly responsible for this demand. India has recently surpassed China as world's top producer of cotton. India's cotton area dwarfs that of any other nation, making up over 40 per cent of world total even though yields are well below the average. (USDA economic research service, https://www.ers.usda.gov).

India, has the largest area under cotton cultivation in the world, and ranks 2nd (19 per cent) in the consumption of pesticides for cotton among agricultural crops. Cotton has about 5 per cent gross cropped area in the country but consumes about 36-50 per cent of total pesticides. Cotton farmers' usual solution is to drench crops in Rs. 200-300crores worth of pesticides annually - Rs. 81.9 crore of which is so toxic that it is classified as hazardous by the World Health Organization. Andhra Pradesh ranks 1st in the production of cotton of 19 lakh bales, cultivated under the area of 6.06 lakh hectares. Cotton production pumps thousands of tons of pesticides into the environment

each year. Most people think of cotton as a “natural” product. The reality was Cotton was one of the most chemically intensive crops in the world.

Consumption of pesticides is not even and also low pesticide consumption has led to crop yield losses. At the same time, excessive use of pesticide causes some ill-effects to crop and humans. To avoid crop losses farmers have to use pesticides in optimum level at appropriate time. To achieve high yields without crop losses, farmers must have proper knowledge about the product and its usage such as the right pesticide, right time of usage and the right method of spraying, etc. Therefore, farmers’ buying decision of pesticides is very important for crop production.

Hence, consumption of pesticides was highest for cotton crop, thus this study was focused on understanding the cotton growing farmer awareness, factors influencing the buying behavior and constraints faced by the cotton farmers during their decision making of pesticides. This study was concentrated to understand the factors influencing the buying behavior of farmers to better fulfill the plant protection chemicals market needs of farmers. Hence, this study is taken with the following objectives.

Objectives of Investigation:

1. to analyze awareness of cotton farmers towards pesticides usage.
2. to study the factors influencing the buying behavior towards pesticides among cotton farmers.
3. to identify the constraints faced by the cotton farmers in purchasing of pesticides.

1.2 SCOPE OF THE STUDY:

The findings of the study will help in getting information regarding farmers’ buying behaviour and the dealers’ influence on the buying pattern of farmers on pesticides. It is also believed that, the research will help the pesticide companies adopt the required action to rectify the problems that

come in the supply of pesticides to farmers. Likewise, it will assist in the formulation of the pesticide companies' marketing and design strategies. The study will help the government agencies in considering how best to approach the farmers who use the pesticides.

1.3 LIMITATIONS OF THE STUDY:

1. Using a random sampling technique, the study was limited to two mandals in the Andhra Pradesh district of Guntur, with a total sample of 100 farmers.
2. The survey was based on the respondents' expressed opinions, that may not be free from personal biases and assumptions.
3. Only the study's findings can be applied to the workplace and regions with similar socio-economic features.

1.4 ORGANIZATION OF THE STUDY:

The research is divided into five chapters. The introduction, objectives, scope, and limitations of the study were studied in chapter one. The review of literature has been discussed in chapter two. The theoretical framework of the study which includes the period of study, collection of data, and method of analysis adopted for the study were discussed in chapter three. A critical analysis of results and discussion were dealt with in chapter four. The summary and conclusions of the study along with suggestions were discussed in chapter five.

Chapter - II

Review of Literature

Chapter II

REVIEW OF LITERATURE

In this chapter an critical attempt has been made to review the past literature. The main aim of review of literature is to acquire knowledge on the earlier studies undertaken by the researchers in the given field of study. It gives a hypothetical foundation for the research and helps the researcher to establish the nature and direction of proposed research activity. Considering these merits, the review of literature covering the various aspects of the present research investigation are presented under the following headings.

2.1 Studies on awareness of cotton farmers towards pesticides chemicals usage

2.2 Study on factors influencing the buying behavior of Pesticides by the Cotton Farmers

2.3 Studies on constraints faced by the Cotton Farmers in purchasing of Pesticides

2.1 STUDIES ON AWARENESS OF COTTON FARMERS TOWARDS PESTICIDES USAGE

Kumar and Pani (2000) studied on frequency, intensity and determinants of pesticide use in rainfed cotton, by using farm level cross sectional data from Nanded district of Maharashtra. Average pesticide used was 3.2 kg active ingredient per hectare of cotton area. Farmers also used number of cultural and physical methods directly or indirectly to limit the crop loss due to pest and diseases. The attitude of farmers towards insect pest risk varied accordingly with the use of pesticides. The findings suggested that improving knowledge on pests and management practices could help in reducing pesticide usage.

Mahantesh and Singh (2009) in their study reported that, farmers had limited knowledge of pest management as well as the consequences of pesticide use in vegetable cultivation. Farmers perceived that, over the years the severity

of pests was increasing and therefore greater quantities of pesticides required for controlling pests.

Sutharsan *et al.* (2014) studied on pesticide usage pattern for vegetable cultivation in Manmunai south and Eruvilpattu divisional secretariat division of Batticaloa district, Srilanka. The findings of the study concluded that, majority of the farmers (90 per cent) in the study area use pesticides higher than the recommended level. Hence, it is essential to educate the farmers on recommended pesticide usage practices, reduced usage of synthetic pesticides and use of organic farming practices to reduce the ill effects of synthetic pesticides.

Deviprasad *et al.* (2015) in their study on pesticide usage pattern in four districts of Karnataka reported that pesticides are readily available and widely used in crop cultivation. The main intention of pesticides was to prevent and control insects, pests and diseases in the field crops. There was lack of knowledge among the farmers about preventive and proper pesticide application, personal hygiene were observed. The disposal of empty pesticide formulation containers was in appropriate and were executed carelessly. They also stated that there is a need for comprehensive intervention and awareness among the farmers on environmental issues including health impacts due to usage of pesticides.

Khan *et al.* (2015) carried out a study on Farmers' knowledge about common pests and pesticide safety in conventional cotton production in Pakistan. A survey of 318 randomly selected farmers from two districts of the cotton belt of Punjab in Pakistan was conducted and data were collected through group discussions with farmers and individual interviews. Relative frequencies of distribution for the tested variables, weighted average scores based on the weight assigned to each answer for the rating scales, and the Borich Needs Assessment Model for the training needs were used for relevant comparisons and found that majority of the farmers relied on the chemical method for pest control, but knowledge on pesticide safety issues was below

average. High needs for training were found on the proper period for pesticide application, the identification of natural enemies for cotton pests and the discrimination of symptoms of various diseases.

Shashi *et al.* (2016) in their study reported that, the majority of the farmers both in poly houses (71.42 per cent) and open fields (90.00 per cent) were not aware of recommended pesticides against different pests, similarly, 96.67 per cent of open field and 85.71 per cent of poly house farmers were not aware of the pesticide classification based on toxicity. The farmers were aware of the ban of endosulfan in agriculture (95 per cent of open field and 92.86 per cent of poly house farmers), while most of the farmers (78.57 per cent in poly house and 88.33 per cent in open field) were not aware about ban of monocrotophos use on vegetables. Majority of the poly house (85.71 per cent) and open field (75 per cent) farmers used pesticide mixtures rather than spraying of single chemical to save money. Most of the farmers had poor knowledge regarding pesticide residues in vegetables and pre-harvest intervals.

Anil *et al.* (2017) in their studies reported that, about 33.33 per cent of the farmers was aware of recommended pesticides against different pests and only 13.33 per cent of the farmers was aware of pesticide classification based on toxicity. It may be due to illiteracy and literate's negligence that had led the farmers for the application of pesticides at improper dosage. Majority of the farmers were also unaware of pesticide classification based on toxicity which might be attributed to low literacy level, insufficient extension activities and negligence of farmers.

Kumar *et al.* (2017) noticed that, 66.6 per cent of farmers were not aware about recommended pesticides against various pests and 86.6 per cent of the farmers were not aware about the pesticide classification based on toxicity and symbols of toxicity on packing. About 33.3 per cent of the farmers have awareness on the recommended pesticides against various pests. In general, 70.0 per cent of the farmers contacted pesticide dealers for recommendations

and only few farmers i.e., 16.0 per cent preferred to contact Agricultural Officers (A.O).

Meenambigai *et al*. (2017) in their study observed a sign of changing trend in awareness among farmers like use of stick for mixing, use of measuring cups and not reusing the pesticide containers for household purpose was observed. However, farmer's knowledge on recommended pesticide, dosage, safe harvest interval, label claim and personnel protection during spray operation were lagging. In order to produce pesticide residue free okra fruit, it becomes imperative to educate the farmers about the significance of following of proper pre harvest interval, color code given in pesticide containers, eco-friendly pest management and health hazardous caused by misuse of pesticides.

Kumar *et al.* (2018) conducted a study to know the awareness of 300 farmer respondents towards pesticide usage with respect to rice-lentil production system in Sheikhpura district of Bihar in India. They reported that the farmers had low to medium knowledge on various aspects of pesticides use, toxicity, target pest, recommended dose, time of application, handling of pesticides and disposal. They also observed that majority of the respondents were not concerned about long term ill effects and consequences of that on human's health and environment and finally, they concluded that preference of farmers towards pesticide selection was primarly based on their efficacy rather than safety.

Kumari and Basavaraja (2018) in their study stated that, majority of the farmers got the information about pesticides from the pesticide dealers. Farmers should be encouraged to obtain information on optimum quantity of pesticide use from agricultural universities and extension workers. Awareness need to be created on the handling of personal protective measures among farmers, while handling pesticides, encouraged to reduce the use of synthetic pesticides and induce them to go for bio pesticides and organic farming, educated about different non-chemical control methods and encouraged to adopt integrated pest management practices.

Sai *et al.* (2019) evaluated on the knowledge and perception of farmers regarding pesticide usage in a rural farming village of Southern India. They found that the knowledge level of farmers is adequate among farmers but this did not reflect in their practice. So, there is a need for continuous pesticide safety education along with training to the farmers regarding use of personal protective devices, personal hygiene and sanitation practices during and after application of pesticides in the study area.

Sai *et al.* (2020) conducted a study on farmers awareness of pesticides in cucurbit growing areas of Guntur district. The study indicated that there is a lack of awareness about ban of monocrotophos, use of personal protection equipment while spraying and disposal of empty containers. Also found that there was no relation between knowledge and education level of farmers. Hence it recommended that there was a requirement of extension activities and intensive training programs on the responsible usage of pesticides.

2.2 STUDIES ON FACTORS INFLUENCING THE PESTICIDES BUYING BEHAVIOUR OF FARMERS

Rohini and Padmanaban (2000) analyzed the factors responsible for brand and dealer loyalty towards pesticides by farmers. The results showed that, the price of the preferred brand, efficiency of the preferred brand and advertisements influenced the brand loyalty with regard to dealer loyalty and factors such as credit availability, quality of product, customer service, discount, advertisement and distance from the farm, played an important role in purchasing.

Bandara *et al.* (2013) concluded that, the majority of respondents had considered only about efficacy of pesticide rather than their outer appearance and ingredients. Some respondents reported that they just go to seller and take chemicals whatever the seller recommended without knowing brand name or company's name.

Dharmraj *et al*. (2013) reported that, farmers were focusing on the price, quality and credit facility while purchasing agri inputs. Majority of the farmers

got the information from television as their source. As per their study farmers purchasing the agri inputs from the co-operative societies of their area, due to fairness in billing and getting credit facility.

Mishra *et al.* (2013) in their study reported that, promotion was influenced by many factors and it affected many other things mostly on the purchasing behaviour of the farmers. Due to advertisement campaigns, farmers were aware of the various brands and the companies. The most desired media by the farmers was found out to be the pamphlets, brochures, newspaper, magazines and hoardings. Sales promotion in agrochemicals was a key ingredient in marketing. Sales promotion such as demonstration, field trails and get together were growing up fast to attract farmers to buy their products.

Shanthini and Kathirvel (2013) in their study on farmers brand preference on the consumption of fertilizer in Tiruppur district, Tamilnadu, identified factors such as quality, price, availability, and advertisement influence the purchase of fertilizers among farmers. One of the products, which was very successful and had found a permanent place for itself in the minds of the farmers, was the SPIC and IPL fertilizer. Each branded SPIC and IPL fertilizer stands out distinctly when grouped with other branded fertilizer.

Kang *et al.* (2015) conducted an empirical research on factors that influence the behaviour decision of repeated seed purchase for farmers- field investigation based on 519 vegetable farmers in Wuhan city. It was found from the research that the factors such as education degree, risk attitude, perceived value, seed quality, seed purchase convenience, relationship trust and obstacle transfer will influence the behaviour or willingness of farmers to repeatedly purchase the seeds. The farmers with higher education degree or risk preference are more willing to try out new varieties. Improving farmer's perceived value for the purchased seeds and the trust in distributors, as well as the relatively high seed quality, will increase farmer's willingness for repeated seed purchase; While the higher costs for information seeking, costs for

technical study and other transfer obstacle factors have a significant prohibitive effect on the farmers to prevent them from purchasing new varieties of seeds and hinders the promotion of new varieties.

Gaikwad and Jirali (2016) studied the farmer's perception of pesticide residue management in brinjal Dharwad, Karnataka. The result revealed that the source of information using the pesticides was found to be predominantly the pesticides dealers compared to agriculture experts and government officials.

Patel *et al.* (2017) made an attempt to identify factors influencing seed purchase decisions in rural areas of Gujarat. The study concluded that, certain socio-demographic characteristics of farmers such as age, landholding pattern, agricultural income, region and education qualification will affect their purchase decision process. In addition to this, brand loyalty, relationship with suppliers, timely supply, proximity of point of purchase, credit facility, cost consideration, quality seed 11 material and provision for technical guidance were the other major purchase decision factors of farmers in rural areas of Gujarat.

Kumar *et al.* (2018) in their study reported that, 100 per cent of the respondent farmers were dependent on the chemical pesticides for the management of pests and diseases. The respondent farmers were using a variety of pesticide formulations of different groups and for different purposes. Most of the respondents remembered the pesticides by their trade names without any awareness of their technical names. Among them, the most frequently mentioned were insecticides followed by fungicides, herbicides and acaricides.

Mohammad *et al.* (2018) in their studies reported that, farmers sought the pesticides that were easily accessible at reasonable prices besides having the benefits of appropriate performance and effectiveness for pest management. Criteria related to performance and effectiveness, as well as the criteria related to financial affordability and accessibility, had the highest ranks among factors. Since the farmers' main objectives for using pesticides as a

quick and easy solution to pest control were crop protection and farm yield enhancement, the factors of performance and effectiveness were the main determinants of farmers' decisions in selecting and using pesticides

Kassem et al. (2021) evaluated on toward fraudulent pesticides in rural areas: do farmers' recognition and purchasing behaviours' matter? Their findings indicated that, farmers perceived high risks to farmer health and crop yield (a score of 4 out of 5) and a moderate risk to the environment (3.5 out of 5) from fraudulent pesticides. Nonetheless, nearly three-fourths of the farmers had purchased fraudulent pesticides anyway. The statistical analysis suggested that farmers who resist purchasing fraudulent pesticides have higher education, longer experience in farming, and better recognition of fraudulent pesticides.

2.3 STUDIES ON CONSTRAINTS FACED BY FARMERS IN PURCHASING PROCESS OF PESTICIDES

Reddy and Raju (1999) studied the behaviour of rural consumers for seeds. The factors influencing brand loyalty of farmers were dealers' suggestion, quality product and co-farmers. The problems with regard to seed were supply of poor quality of seeds, adulteration and irregular supply of seeds.

Sonwa *et al.* (2008) in their study on management of cocoa: constraints during acquisition and application of pesticides in the humid forest zones of Southern Cameroon stated that, high cost and lack of availability of pesticides in rural areas are the major constraints by users of pesticides.

Singh (2010) in his study stated that, problem faced by the farmers in procuring various type of agricultural inputs problem in the supply of fertilizers was reported by the maximum number of farmers. The most important problem with 12 respect to fertilizers was high price, lack of availability and insufficient supplies. Poor quality and adulteration of fertilizers were also reported by many farmers. High cost and poor quality were again mentioned as the main problems associated with manures and pesticides. The major problem reported with respect to agricultural equipment was its high cost.

Dogra *et al.* (2017) in their study observed that, the problems was lack of irrigation facilities in common (75.00 per cent) followed by the lack of quality planning material (67.50 per cent) and lack of technical knowledge (57.50 per cent). The problems like in adequacy of capital, lack of quality planting material and high wages of labour were significantly with farm size categories.

Jatin *et al.* (2017) in their study identified constraints faced by the farmers and dealers in purchasing and selling fertilizers in Banaskantha district of North Gujarat. They found that, major constraints faced by the farmers in purchase of fertilizers were high price and non-availability on required time of the fertilizers. And majority (86.67 per cent) of the dealers faced constraint of less bonus on more sales.

Jehangir *et al*. (2017) reported that, major constraints faced by the farmers in adoption of recommended paddy production practices were lack of skill in treatment of seeds with chemicals (98.8 per cent), lack of technical advice for seed storage (93.3 per cent), irregular visits of Agricultural Officers (94.4 per cent), low rate of paddy in local market (84.4 per cent), high cost of fertilizers (82.2 per cent), high rate of seeds (72.7 per cent), inadequate and untimely supply of loans (80.0 per cent), High rate of interest on loans in block Budgam (81.8 per cent) and in block Chadoora (66.6 per cent). Other economic constraints were high rate of interest loans and high charges of labour.

Sivaraj *et al*. (2017) in their study observed that, inadequate availability of organic inputs in time (68.89 per cent) was identified as the major constraint by the certified organic farmers because the preparation of organic inputs and use of every practice was found to be tedious and risky. The certified organic farmers used various on farm resources and carried out organic farming practices in an eco-friendly way. Scarcity of irrigation water (64.45 per cent) was identified as the second major constraint by certified organic farmers.

Thanganayaki *et al.* (2017) worked on buyer behaviour and satisfaction of agricultural input products with special reference to Palladam taluk. Farmers and Agri-input dealers were experiencing difficulties in accessing and supplying the agricultural inputs. The constraint faced by farmers in accessing the farm inputs is mainly due to poor distribution system in country.

Vijay *et al.* (2017) in their study on problems of KVK beneficiaries in adoption of recommended production of wheat crop reported that, problems faced by the farmers were non-availability of bank credit, marketing, non-availability of DAP and storage etc.

Kenea *et al.* (2019) conducted a study on constraints of agricultural input supply in Ethiopia. The study was intended to identify the farm input constraints existed in the study area. The major constraints faced by farmers while purchasing the agricultural inputs like input price, absence of input supply at the right time, credit constraint, farm size and annual income. Hence, the study recommended that, improving the efficiency of credit system, timely and sufficient amount of delivering credit to farmers who engaged on crop production has to be considered, establishing extension service in the study area is mandatory.

Gupta *et al.* (2020) worked a study on constraints faced by vegetable growers in adoption of IPM in Bundelkhand region of Uttar Pradesh. The major constraint faced by farmers were lack of knowledge on pesticide application, bio-pesticides, high cost of inputs, lack of proper marketing facilities, inadequate demonstration of new technologies about Integrated Pest Management (IPM).

Chapter - III

Material and Methods

Chapter III

MATERIAL AND METHODS

An attempt was made in this chapter to describe the sampling design, nature and mode of data collection and analytical tools employed in achieving the objectives of the present study. Different concepts and methods followed in the study are outlined as:

3.1. Sampling design

3.2. Sampling procedure

3.3. Collection of data

3.4. Tools of analysis

3.5. Concepts and terms used

3.1 SAMPLING DESIGN

Multistage purposive cum random sampling design was employed in the present study.

3.2 SAMPLING PROCEDURE

3.2.1 Selection of district

Guntur district of Andhra Pradesh was purposively selected to study the buying behaviour of farmers towards pesticides, as the district occupies first place in production of cotton in Andhra Pradesh. Out of various crops cultivated in the Guntur district, cotton crop was selected as the pesticide consumption is high for this crop.

3.2.2 Selection of mandals

The second stage of sampling pertained to the selection of the mandals. Among the 58 mandals two mandals were selected randomly viz., Sattenapalli and Veldurthy.

3.2.3 Selection of villages

The selection of villages formed the third stage of sampling. From the selected mandals, a total of ten villages five from each mandal namely Pakalapadu, Pedamakkana, Panidam, Rentapalle, Nandigama from Sattenapalli mandal, Uppalapadu, Srigiripadu, Rachamallipadu, Patlaveedu, Mandadi from Veldurthy mandal were selected randomly in Guntur district.

3.2.4 Selection of farmers

Cotton farmers of selected villages were listed and 10 farmers from each village were randomly selected for the survey thus making the total sample size of 100.

3.3 COLLECTION OF DATA

The data pertaining to the present study were obtained through survey method and enquiries were made with the help of pre-tested schedules. The present study was related to the agricultural year 2021-22.

3.3.1 Primary data

The primary data regarding socio-economic profile of sample farmers, pesticide usage in cotton, awareness towards pesticide usage, source of information regarding pesticides, factors influencing buying behaviour of farmers towards pesticides and constraints faced by them in purchasing process of pesticides were collected using interview schedule.

3.3.2 Secondary data

The secondary data regarding the mandal-wise and village-wise crop acreage details of cotton in Guntur district were collected from the Joint Director of Agriculture (JDA) and Mandal Agriculture Offices (MAO).

3.4 TOOLS OF ANALYSIS

The data collected were subjected to appropriate set of statistical tools to arrive at valid conclusions. Data was statistically analysed using SPSS program.

3.4.1 Frequencies and Percentages

Some of the data were also interpreted in terms of their frequencies and percentages wherever necessary to know the distribution pattern of respondents according to variables.

3.4.2 Chi-square test

To compare the observed frequencies with an expected group of frequencies, we must be able to state what frequencies would be expected. The hypothes is H0 states the proportion of objects falling in each of the categories in the presumed population. The chi-square technique gives the probability that, the observed frequencies could have been sampled from a population with the given expected values.

The null hypothesis H0maybe tested by using the following statistics:

$$\chi^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i} \ (\text{or}) \sum \frac{(O-E)^2}{E}$$

D.F=K-1

Oi = Observed number of cases in the ith category

Ei = Expected number of cases in the ith category when H0is true

K = Number of categories

If this value of $\chi 2$ is greater than the table value of $\chi 2$ at specified level of significance for (k- 1) degrees of freedom, it will be significant and then we shall be justified in suspecting significant divergence between the fact and theory and rejecting the null hypothesis of equality of two sets of observed and expected frequencies.

If the value of $\chi 2$ is non – significant, it justifies the agreement between the observed fact and the theory or hypothesis. If the value of $\chi 2$ is equal to zero the agreement is perfect. In practice, it is very rare to get $\chi 2=0$ and therefore, we start suspecting our sampling technique by declaring that this perfect agreement between the fact and theory is good to be true.

3.4.3 Garrett's Ranking Technique:

Garrett's ranking technique was employed to prioritize or rank the level of information sources available on pest management, basis of application of chemical pesticides, factors influencing in the quantity of pesticides usage and brand selection, problems while purchasing pesticides from private dealers and agriculture department by the farmers.

Garrett's formula for conveying ranks into per cent is given by,

$$\text{Percent position} = 100 \times \frac{\left(R_{ij} - 0.5\right)}{N_j}$$

Where,

Rij = rank given for i^{th} factor by j^{th} individual

Nj = number of factors ranked by j^{th} individual

3.4.4 Likert's scale

Likert's scale is named after its creator, Rensis Likert, who developed it in 1932. Likert scale is a psychometric scale used to scale the responses of the consumers. It was used to give quantitative value on subjective or objective dimensions, with various levels between agreement and disagreement. It is considered symmetric or balanced because there are equal numbers of positive and negative positions. Five point scale was given to the different parameters which are highly satisfied, satisfied, moderate, dissatisfied and highly dissatisfied to measure the pest management techniques adopted, services provided by pesticide private companies, agriculture department and support given by private dealers and peer group.

3.5 TERMS AND CONCEPTS USED

Concepts and definitions used in the study are presented below.

3.5.1 Buying behaviour

Consumer buying behaviour is the study of the ways of buying and disposing of goods, services, ideas or experiences by the individuals, groups and organizations in order to satisfy their needs and wants.

3.5.2 Pesticides

Pesticides are the organic or inorganic substances that are meant to control pests like insects, fungal organisms, bacterial organisms, weeds and other organisms which cause damage to the crop.

3.5.3 Brand

A brand is defined as a name, term, design, symbol or any other feature that identifies one seller's good or service as distinct from those of other sellers. The legal term for brand is trade mark.

3.5.4 Agriculture input companies

Private companies who sell agricultural inputs like pesticides, fertilizers, seeds and agricultural equipment's through a distributer or a dealer

3.5.5 Pesticide dealer

A person who sells pesticides to the farmers on behalf of company.

3.5.6 Pesticide company representative

Professionals who are either agricultural graduates or post graduates who take care of sales, marketing and product development of pesticides.

3.5.7 Kisan call centers

Kisan call centers enable farmers to have direct discussions with the subject matter experts who are able to analyse the problem effectively and provide the solution through phone call.

3.5.8 Product free samples

Free samples of the product are distributed to some of farmers by the private input companies as a part of marketing activity to promote their products.

3.5.9 Professional money lender

Professional money lender is an individual or group that usually lends relatively small amount of money at high rates of interest to farmers

Chapter - IV

Results & Discussion

Chapter IV

RESULTS AND DISCUSSION

This chapter deals with the results obtained from the 100 sample cotton farmers through the pre-tested structured interview schedule. The data was analyzed and presented according to the objectives of the study.

4.1 Socio-economic profile of sample cotton farmers in the study area

4.2 To study the pesticide usage pattern by sample cotton farmers in the study area

4.3 To analyze awareness of sample cotton farmers towards pesticides usage

4.4 To study the factors influencing the buying behavior of cotton farmers towardspesticides

4.5 To identify the constraints faced by the sample cotton farmers in purchasing of pesticides

4.1 TO STUDY THE SOCIO-ECONOMIC PROFILE OF FARMERS

The insights regarding farmers socio-economic profile in terms of age, education level, family size, land holding, annual income, source of credit, farming experience, mass media exposure, primary and secondary occupation, farm size were collected, analyzed and presented in following section

4.1.1 Age Group

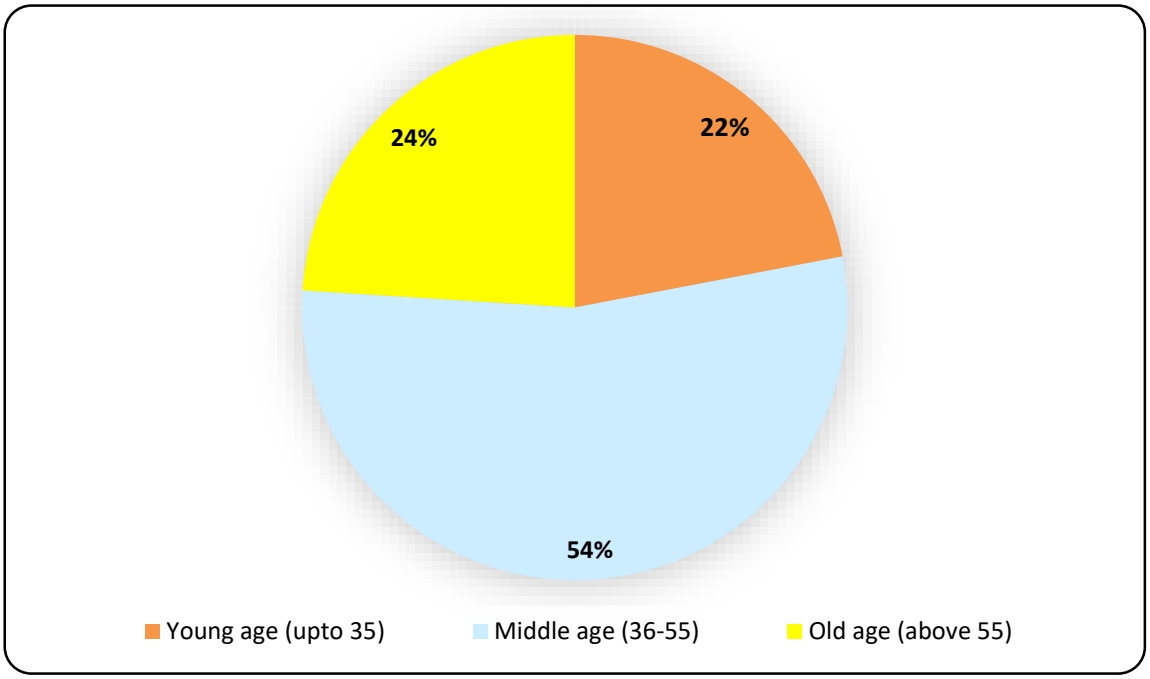
The data regarding age of sample cotton farmers was collected and classified into three groups *viz*., young age group (up to 35), middle age group (36-55), and old age group (above 55 years). The collected data was analyzed and presented in the following table 4.1

Table 4.1. Age categorization of sample cotton farmers

S. No.	Categories	Frequency	Percentage
1	Young age (up to 35)	22	22
2	Middle age (36-55)	**54**	**54**
3	Old age (above 55 years)	24	24
	Total	100	100

A glance at Table 4.1 depicts that, out of 100 sample farmers, 54 per cent of the respondents were middle-aged (36-55 years), followed by 24 per cent of respondents were old aged (above 55 years) and 22 per cent of the respondents were young aged (up to 35 years). It shows that, majority of the sample farmers were in middle age group. The findings of the present study are similar with the studies of Mahantesh *et al.* (2009).

Fig. 4.1. Age categorization of sample cotton farmers



4.1.2 Education level

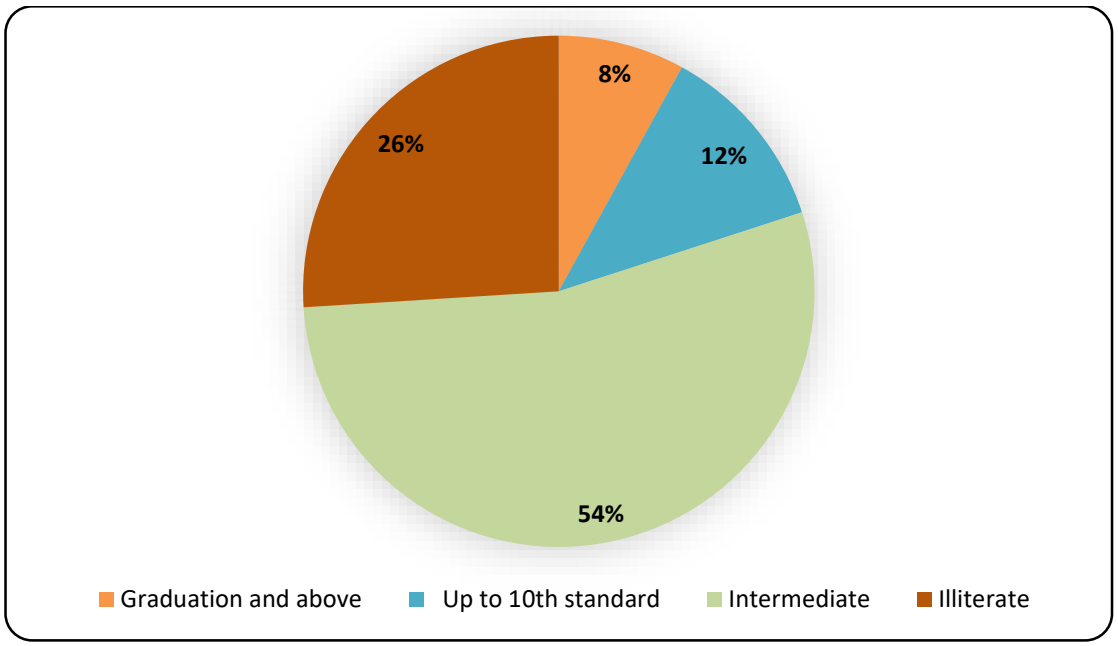
The information education level of cotton farmers was collected and categorized into four groups namely illiterate, 10th standard, intermediate, graduation and above are provided in Table 4.2.

Table 4.2. Education level categorization of sample cotton farmers

S. No.	Particulars	Frequency	Percentage
1	Illiterate	26	26
2	Up to 10th standard	12	12
3	Intermediate	**54**	**54**
4	Graduation and above	8	8
	Total	100	100

Table 4.2 confers that, 54 per cent of the farmers had intermediate education, followed by 26 per cent of the respondents were illiterate, 12 per cent of the respondents had education level up to 10th standard, and 8 per cent of the respondents had education level of graduation and above. The educational status reveals that, majority of respondents were having literacy level of Intermediate. The same results were presented by kumar *et al.* (2018).

Fig. 4.2. Education level categorization of sample cotton farmers



4.1.3 Family Size

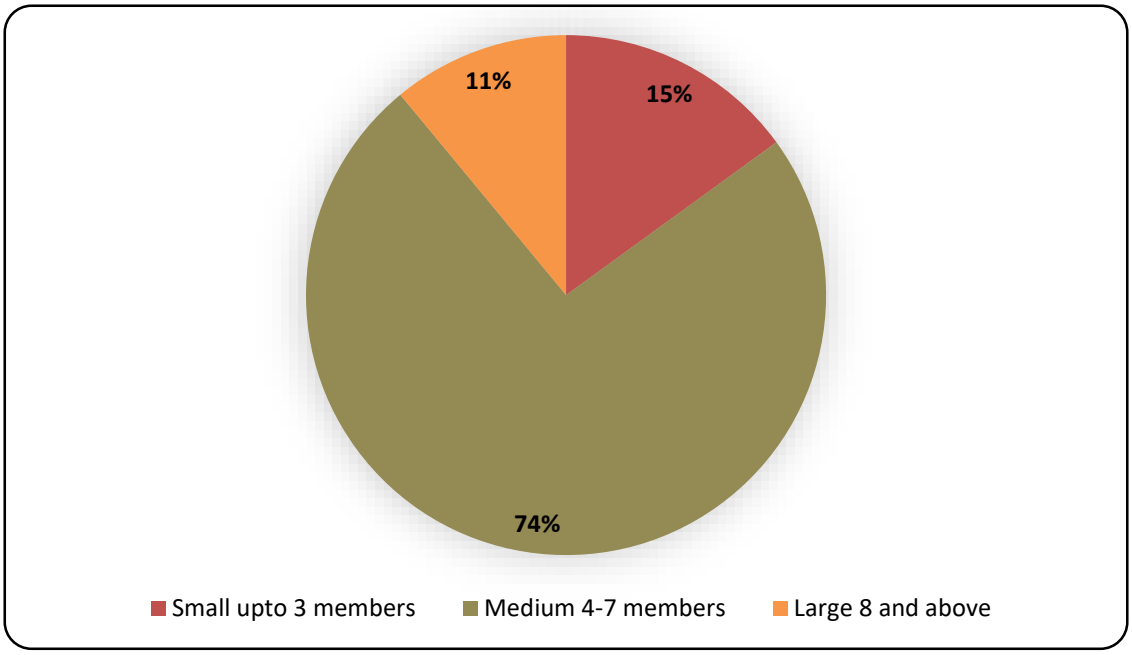
The data pertaining to Family size of sample cotton farmers was collected and classified into three groups *viz*., small (up to 3), medium (4-7), and large (8 and above), and the same was shown in Table 4.3.

Table 4.3. Family size categorization of sample cotton farmers

S. No.	Categories	Frequency	Percentage
1	Small (Up to 3 members)	15	15
2	Medium (4-7 members)	**74**	**74**
3	Large (8 and above)	11	11
	Total	100	100

The table 4.3, shows that, among the 100 respondents, 74 per cent of respondents belonged to middle sized family, 15 per cent of respondents were having small size family, and 11 per cent of respondents belonged to large sized family group. It shows that majority of the respondents had medium (4-7 members) sized family.

Fig. 4.3. Family size categorization of sample cotton farmers



4.1.4 Annual Income of Sample Farmers

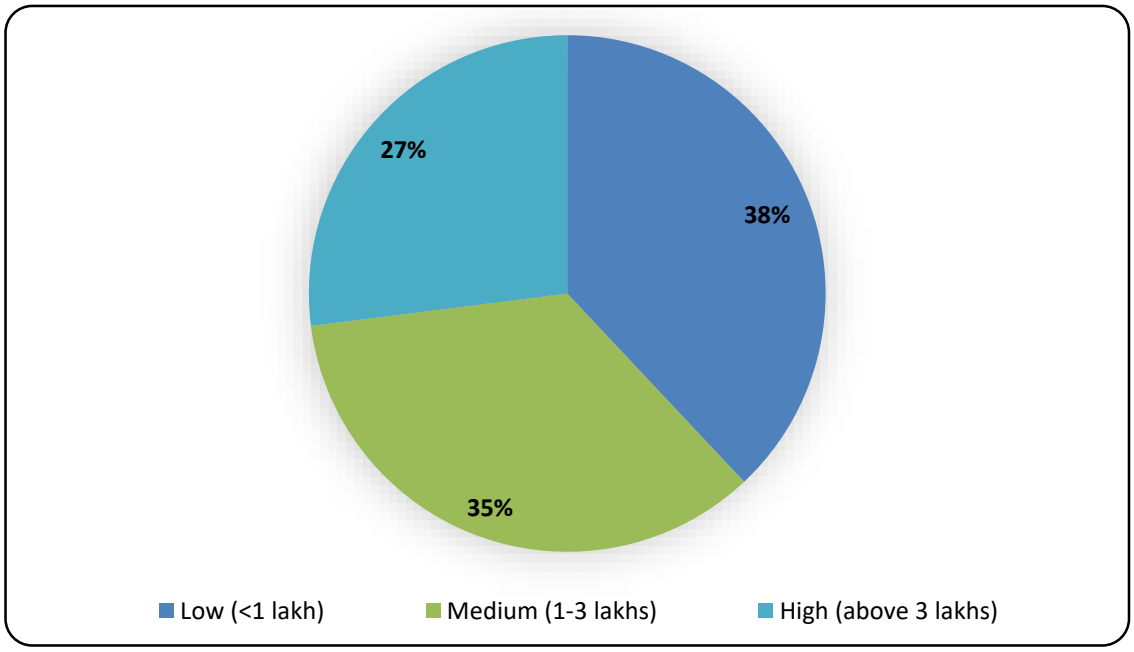
The information regarding Annual income of sample cotton farmers was collected and divided into three groups *viz*., low (<1 lakh), medium (1-3 lakh) and high (above 3 lakhs) and the data is presented in Table 4.4.

Table 4.4. Annual income categorization of sample cotton farmers

S. No	Categories	Frequency	Percentage
1	Low (<1 lakh)	**38**	**38**
2	Medium (1-3 lakhs)	35	35
3	High (above 3 lakhs)	27	27
	Total	100	100

The above table 4.4, shows that, 38 per cent of sample farmers were of low income group with less than 1 lakh per annum followed by 35 per cent were having medium income group with 1-3 lakhs per annum, while 27 per cent were in high annual income group with above 3 lakhs. It can be inferred that most of the sample cotton farmers belonged to low income group. The findings of the present study are similar with the studies of Mahantesh *et al.* (2009).

Fig. 4.4. Annual income categorization of sample cotton farmers



4.1.5 Operational Land Holding of Sample Farmers

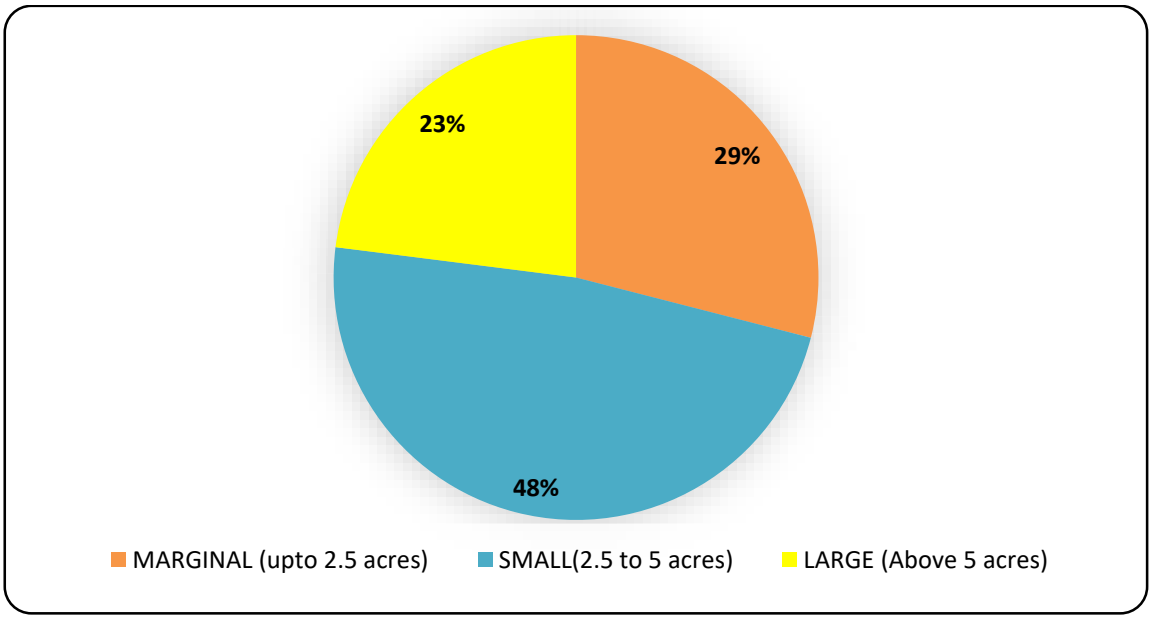
The data regarding operational land holding of the sample cotton farmers was collected and categorized into three categories namely marginal (up to 2.5 acres), small (2.5-5 acres), large (above 5 acres) and the results were presented in table 4.5

Table 4.5. Operational land holding size categorization of sample cotton farmers

S. No.	Categories	Frequency	Percentage
1	Marginal (up to 2.5 acres)	29	29
2	Small (2.5- 5 acres)	**48**	**48**
3	Large(above 5 acres)	23	23
	Total	100	100

The table 4.5, shows that, among sample cotton farmers, small farmers were of 48 per cent having operational land area of 2.5-5 acres, 29 per cent of the respondents were marginal farmers having operational land area of up to 2.5 acres, while the remaining 23 per cent were large farmers having operational land area of above 5 acres. It can be inferred that majority of the sample cotton farmers were having small operational land holding.

Fig. 4.5. Operational land holding categorization of sample cotton farmers



4.1.6 Farming Experience

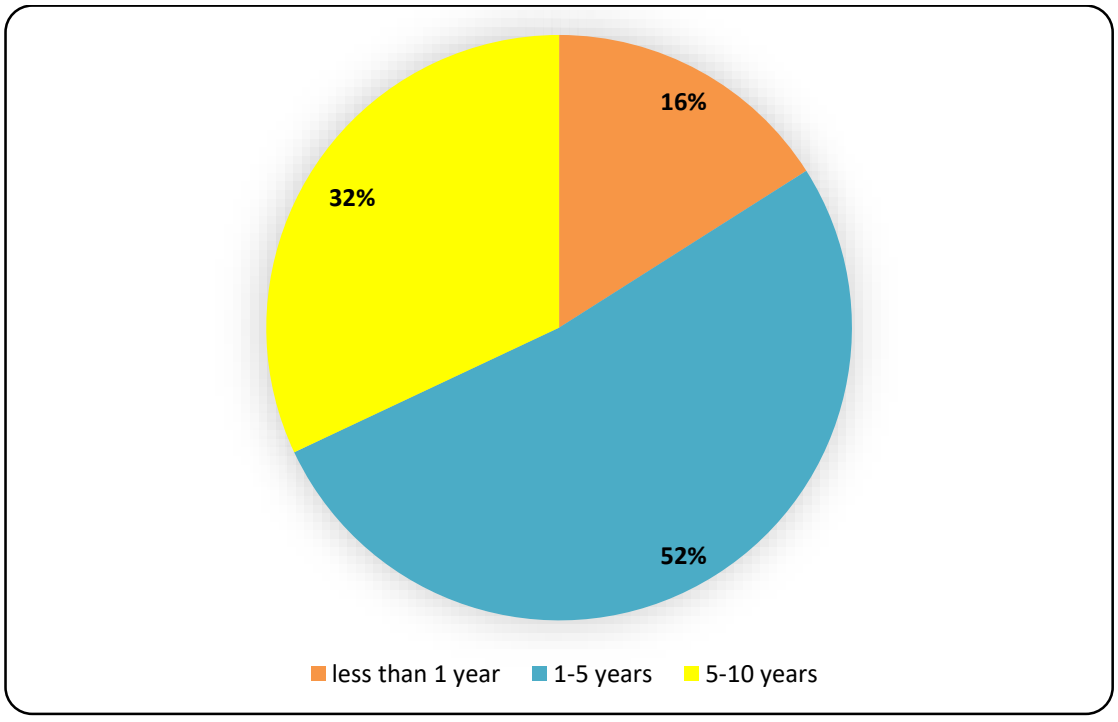
The information regarding Faming experience of sample cotton farmers was collected and grouped into three categories *viz.*, less than 1 year, 1-5 years, 5-10 years. The data collected was analyzed and presented in table 4.6.

Table 4.6. Farming experience categorization of sample cotton farmers

S. No.	Categories	Frequency	Percentage
1	less than 1 year	16	16
2	1-5 years	**52**	**52**
3	5-10 years	32	32
	Total	100	100

The Table 4.6, indicates that, 52 per cent of the respondents are having 1-5 years of farming experience, followed by 32 per cent of respondents are having 5-10 years of farming experience while 16 per cent of the respondents are having less than 1 year of farming experience. It was inferred that, majority of sample cotton farmers had 1-5 years of farming experience.

Fig. 4.6. Farming experience categorization of sample cotton farmers



4.1.7 Sources of Credit

The data pertaining to the source of credit was collected and categorized into five categories namely money lenders, neighbors/friends/relatives, government departments, input dealers, and commercial banks. The data was collected and presented in table 4.7.

Table 4.7. Sources of credit categorization of sample cotton farmers

S. No	Categories	Frequency	Percentage
1	Money Lenders	**34**	**34**
2	Neighbors/Friends/Relatives	8	8
3	Government Departments	6	6
4	Input Dealers	22	22
5	Commercial Banks	30	30
	Total	100	100

The above Table 4.7, shows that among sample cotton farmers, 34 per cent of respondents were depended credit on money lenders, 30 per cent were depended on commercial banks, 22 per cent were depended on input dealers, 8 per cent were depended credit on friends/neighbors, and 6 per cent were depended on government departments. It shows that the majority of sample cotton farmers depended credit on money lenders as the process for availing credit was easy. The above results are similar with the findings of Sreekanth, 2018.

4.1.8. Mobile phone usage

The data regarding mobile phone usage of sample cotton farmers was collected and classified into two groups namely smart phone and basic mobile. The data collected was analyzed and presented in table 4.8**.**

Table 4.8. Mobile phone usage categorization of sample cotton farmers

S. No	Categories	Frequency	Percentage
1	Smart phone	**78**	**78**
2	Basic mobile	22	22
	Total	100	100

A study of table 4.8 shows that among sample cotton farmers, 78 per cent of sample cotton farmers had smart phones while 22 per cent of the sample cotton farmers had basic mobile for their daily communication. This shows that majority of farmers were having smart phones for getting the information about production, marketing, post-harvest.

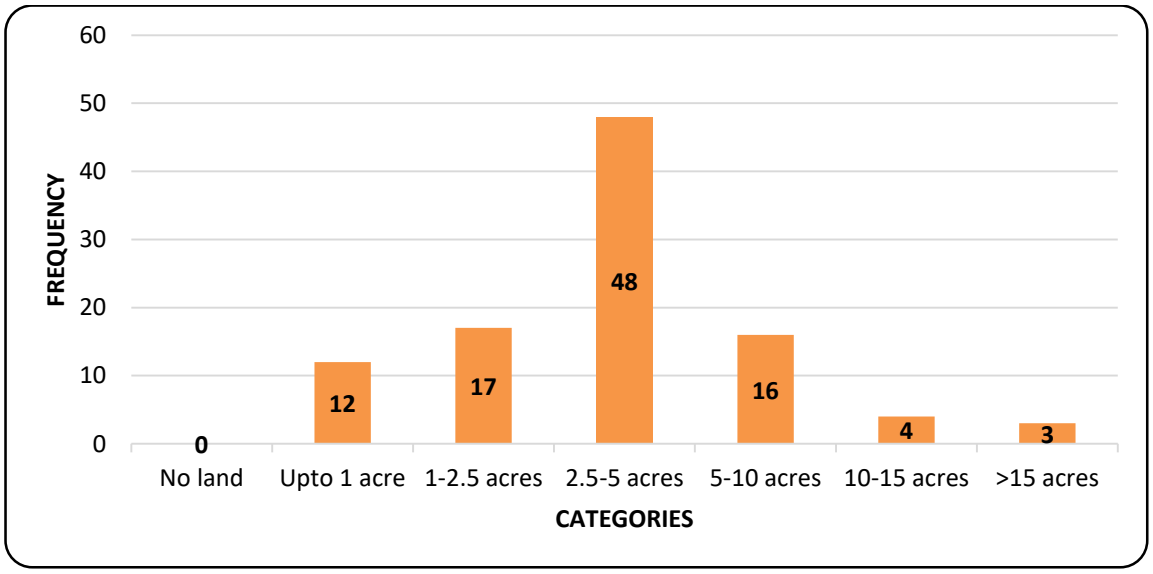
4.1.9 Farm size

The data regarding the Farm size of the sample cotton farmers was collected and categorized into seven groups namely no land, less than 1 acre, 1-2.5 acres, 2.5-5 acres, 5-10 acres, 10-15 acres, and >15 acres. The data was collected and presented in table 4.9.

Table 4.9. Farm size categorization of sample cotton farmers.

S. No	Categories	Frequency	Percentage
1	No land	0	0
2	Less than 1 acre	12	12
3	1-2.5 acres	17	17
4	2.5-5 acres	**48**	**48**
5	5-10 acres	16	16
6	10-15 acres	4	4
7	>15 acres	3	3
	Total	**100**	**100**

Fig 4.7. Farm size categorization of sample cotton farmers.



From the above table 4.9, it reveals that, 48 per cent of respondents were having land holdings between 2.5-5 acres, 17 per cent growers were having land holding between 1-2.5 acres, likewise 16 per cent of farmers were having land holdings between 5-10 acres, 12 per cent respondents were having less than 1 acre of land, 4 per cent of respondents were having land holding between 10-15 acres of land and 3 per cent of respondents were having more than 15 acres of land. Thus, it may be concluded that, the maximum percentage of cotton growers i.e. (48 per cent) have landholding between 2.5-5 acres. The same results were presented by kumar *et al.* (2018).

4.1.10 Mass media exposure

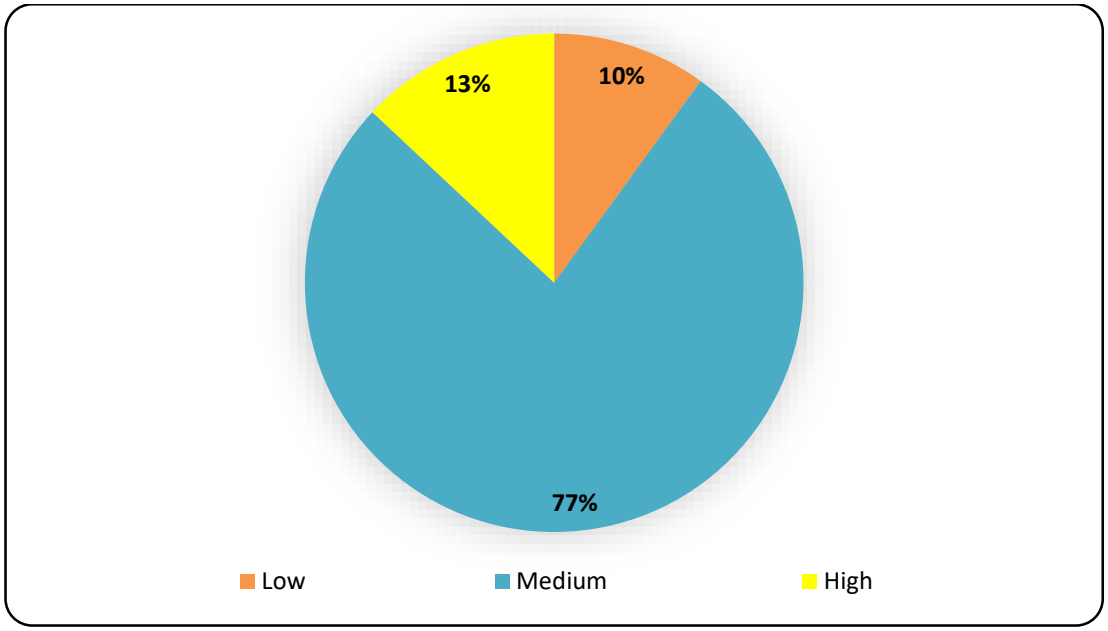
The data regarding mass media exposure of the sample cotton farmers were collected and grouped into three categories *viz.*, low, medium, high. The collected data was analyzed and shown in table 4.10.

Table 4.10: Mass media exposure categorization of sample cotton farmers.

S. No	Categories	Frequency	Percentage
1	Low exposure	10	10
2	Medium exposure	**77**	**77**
3	High exposure	13	13
	Total	100	100

From the table 4.10, it shows that, 77 per cent of respondents were having medium level of mass media exposure and 13 per cent of respondents were having high level of mass media exposure, 10 per cent of the respondents were having low level of mass media exposure. Thus, it can be concluded that majority (77 per cent) of the cotton growers were having medium level of mass media exposure.

Fig. 4.8. Mass media exposure categorization of sample cotton farmers.



4.1.11 Major Occupation of Sample Farmer

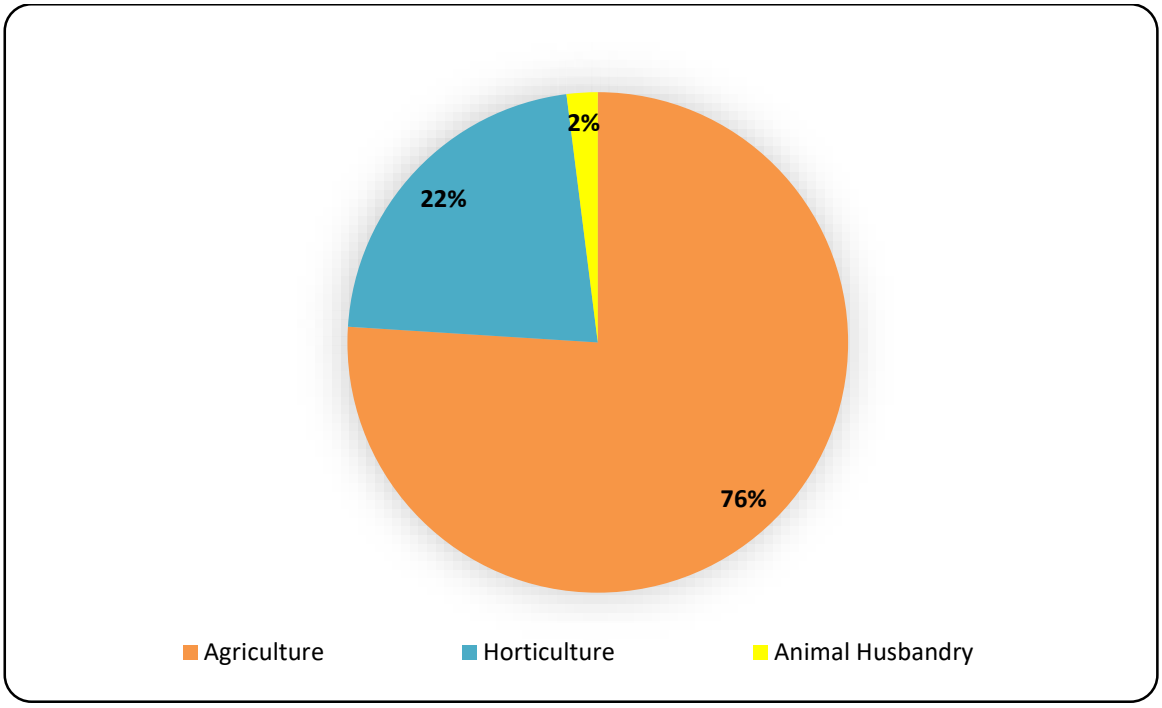
The data regarding the major occupations of sample farmers were collected and divided into three groups *viz*., Agriculture and Horticulture and Animal husbandry. The data collected was analyzed and presented in table 4.11.

Table 4.11 Major occupation categorization of sample cotton farmers.

S. No	Categories	Frequency	Percentage
1	Agriculture	**76**	**76**
2	Horticulture	22	22
3	Animal Husbandry	2	2
	Total	100	100

From the above Table 4.11, Agriculture was the major occupation for 76 per cent of the sample cotton farmers, followed by horticulture was the major occupation for 22 per cent of the sample cotton farmers and only 2 per cent of the farmers were having animal husbandry as their major occupation. This infers that agriculture was the major occupation for most of the farmers. The same results were presented by Mishra et al. (2013).

Fig. 4.9. Major occupation categorization of sample cotton farmers.



4.1.12 Secondary Occupation of sample farmer

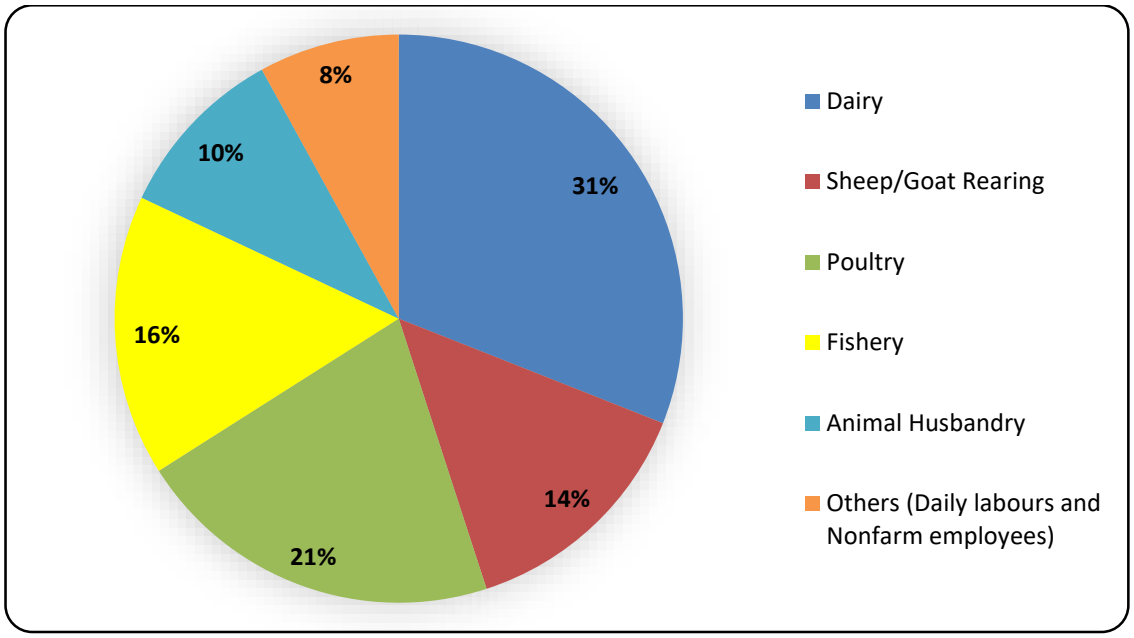
The data regarding secondary occupation of the sample cotton farmers was collected and categorized into following categories namely dairy, sheep/goat rearing, poultry, fishery, animal husbandry, others. The data collected was analyzed and presented in table 4.12.

Table 4.12 Secondary occupation categorization of sample cotton farmers.

S. No	Categories	Frequency	Percentage
1	Dairy	**31**	**31**
2	Sheep/Goat Rearing	14	14
3	Poultry	21	21
4	Fishery	16	16
5	Animal Husbandry	10	10
6	Others (Daily labours and Non-farm employees)	8	8
	Total	100	100

From the above table 4.12, it shows that the majority (31 per cent) of the respondents had dairy as the secondary occupation, followed by poultry (21 per cent). The fishery, sheep/goat rearing, animal husbandry and others (daily labours and non-farm employees) were having 16, 14, 10, 8 percentages respectively. This shows that majority of the farmers were having dairy as their secondary occupation.

Fig 4.10. Secondary occupation categorization of sample cotton farmers.



4.2 PESTICIDES USAGE PATTERN IN COTTONCROP BY THE SAMPLE FARMERS

To understand the pesticide usage pattern of cotton farmers, broadly divided into three categories namely herbicides, insecticides, fungicides. The data collected was analyzed and presented with following sub heads.

4.2.1 Pesticides Usage Pattern in Cotton by the Sample Farmers

The information regarding pesticides to effectively control various weeds, pests, and diseases in the field was collected, analyzed and presented in Table 4.13.

From Table 4.13, it shows that the top two chemicals used by sample cotton farmers were Pendimethalin 30% EC, Glyphosite 40% SL which was used by 82 per cent, 56 per cent of the sample farmers respectively and the least two herbicides used by sample farmers were Propaquizafop 10% EC, Quizalofop ethyl 5% EC were used by 35 per cent and 28 per cent respectively. The top three insecticides were Monocrotophos 36% SL, Acephate 75% SP, Chlorantraniliprole 18.5 % SC SP were used by 100 per cent, 100 per cent, 77 per cent of the sample cotton farmers respectively. The least three insecticides used by the farmers were Imidacloprid 70% WG, Dicofol 18.5% EC, Emamectin benzoate 5 % SG were used by 14 per cent, 21 per cent, 28 per cent of sample cotton farmers respectively. The top three fungicides were Carbendazim 12% + Mancozeb 63% WP, Streptomycin sulphate 90%w/w, Copper oxychloride 50% WP used by 58 per cent, 45 per cent, 34 per cent of sample cotton farmers respectively. The least three fungicides used by the farmer were Carbendazim 50% WP, Mancozeb 75% WP, Pyraclostrobin 20% WG used by 29 per cent, 16 per cent, 11 per cent respectively by the sample cotton farmers. Among herbicides the deviation was highest for pendimethalin 30% EC with 71.43 per cent and least for quizalofop ethyl 5% EC with deviation of 28 percent of sample cotton farmers. Among insecticides the deviation was highest for 81.82 per cent Imidacloprid 17.8% SL, least deviation (negative) was Diafenthiuron 50% WP with -42.86 per cent. The findings of the study were in accordance with Sutharsan *et al*. (2014).

The deviation of the pesticide dosage used by farmers from recommended dosage indicated that deviation in dosage was ranging from 16 percentage to 81.82 percentage. Among herbicides the highest (71.13) deviation was for pendimethalin 30% EC and least (27.42) deviation was for propaquizafop 10% EC. Among insecticides the highest (81.82) deviation was for Imidacloprid 17.8%EC and the least (-42.86) deviation was for Diafenthuron 50% WP. Among fungicides the highest deviation was for carbendazim 50% WP and the least (0.00) deviation was for pyraclostrobin 20% WG. The same results were presented by Sutharsan *et al*. (2014).

Table 4.13. Usage of pesticides in sample cotton farmers

a. Herbicides usage pattern in sample cotton farmers

S.No	Type of pesticide	Name of pesticide	Recommended dosage per hectare	Average quantityused per hectare	Variation in pesticide usage	Deviation (%)	Target for	Number of sample farmers used	Percent
1	Herbicide	Pendimethalin 30% EC	800ml	2800 ml	2000	71.43	Broad leaved weeds and grassy weeds	82	82
2	Herbicide	Quizalofop ethyl 5% EC	400 ml	1200 ml	800	66.67	Broad leaved weeds and grass weeds	28	28
3	Herbicide	Propaquizafop 10% EC	450 ml	620 ml	170	27.42	Broad leaved weeds and grass weeds	35	35
4	Herbicide	Glyphosate 41% SL	1200 ml	2500 ml	1300	52.00	Non selective herbicide	56	56

b. Insecticides usage pattern in sample cotton farmers

S.No	Type of pesticide	Name of pesticide	Recommended dosage per hectare	Average quantity used per hectare	Variation in pesticide usage	Deviation (%)	Target for	Number of sample farmers used	Percent
1	Insecticide	Monocrotophos 36% SL	400 ml	1250 ml	850	68.00	Sucking pests	**100**	**100**
2	Insecticide	Acephate 75% SP	500 gms	1625 gms	1125	69.23	Sucking pests	**100**	**100**
3	Insecticide	Imidacloprid 17.8% SL	100 ml	550 ml	450	81.82	Sucking pests	53	53
4	Insecticide	Imidacloprid 30.5% SC	210 ml	250 ml	40	16.00	Sucking pests	38	38
5	Insecticide	Imidacloprid 70% WG	150 gms	187.5 gms	37.5	20.00	Sucking pests	14	14
6	Insecticide	Acetamiprid 20% SP	200 gms	500 gms	300	60.00	Sucking pests	72	72

7	Insecticide	Thiamethoxam 25% WG	180 gms	375 gms	195	52.00	Sucking pests	62	62
8	Insecticide	Fipronil 5% SC	1500 ml	1500 ml	0	0.00	Sucking pests	85	85
9	Insecticide	Diafenthiuron 50% WP	1250 gms	875 gms	-375	-42.86	Sucking pests	73	73
10	Insecticide	Flonicamid 50 % WG	75 gms	200 gms	125	62.50	Sucking pests	71	71
11	Insecticide	Profenofos 50% EC	320 ml	1250 ml	930	74.40	Lepidopteran insects	33	33
12	Insecticide	Spinosad 45% SC	75 ml	150ml	75	50.00	Sucking, lepidopteran and coleoptera	48	48
13	Insecticide	Spinetoram 11.7% SC	188 ml	500ml	312	62.40	Thrips and lepidopteran insects	46	46
14	Insecticide	Quinalphos 25% EC	625 ml	1875 ml	1250	66.67	Lepidopteran insects	34	34
15	Insecticide	Chlorpyrifos 20% EC	750 ml	1875 ml	1125	60.00	Lepidopteran insects	48	48
16	Insecticide	Indoxacarb 15.8 % EC	250 ml	500 ml	250	50.00	Lepidopteran insects	30	30
17	Insecticide	Emamectin benzoate 5 % SG	125 gms	375 gms	250	66.67	Lepidopteran insects	28	28
18	Insecticide	Flubendiamide 20 % WG	120 gms	200 gms	80	40.00	Lepidopteran insects	28	28
19	Insecticide	Chlorantraniliprole 18.5 % SC	75 ml	225 ml	150	66.67	Lepidopteran insects	77	77
20	Insecticide	Novaluron 10% EC	250 ml	925 ml	675	72.97	Lepidopteran insects	28	28
21	Insecticide	Lamda-cyhalothrin 25% EC	250 ml	875 ml	625	71.43	Lepidopteran insects	75	75
22	Acaricide	Dicofol 18.5% EC	220 ml	625 ml	405	64.80	Mites	21	21

c. Fungicides usage pattern in sample cotton farmers

S.No	Type of pesticide	Name of pesticide	Recommended dosage per hectare	Average quantity used per hectare	Variation in pesticide usage	Deviation (%)	Target for	Number of sample farmers used	Percent
1	Fungicide	Carbendazim 12% + Mancozeb 63% WP	300 gms	625gms	325	52.00	Leaf spot	58	58
2	Fungicide	Metalaxyl 35% WS	350 gms for 100 kg seed	500 gms for 100kg seed	150	30.00	Seed borne diseases	33	33
3	Fungicide	Copper oxychloride 50% WP	750 gms	1875 gms	1125	60.00	Root rot and wilt	34	34
4	Fungicide	Carbendazim 50% WP	250 gms	1250 gms	1000	80.00	Leaf spot and wilt	29	29
5	Fungicide	Mancozeb 75% WP	625 ml	1250 gms	625	50.00	Leaf spot	16	16
6	Fungicide	Pyraclostrobin 20% WG	500 gms	500 gms	0	0.00	Leaf spot	11	11
7	Bactericide	Streptomycin sulphate 90%w/w	120 gms	250 gms	130	52.00	Broad spectrum antibiotic	45	45

4.2.2 Usage of pesticides according to the form of pesticide

The data regarding the usage of pesticides according to the form was classified as soluble powders, soluble liquids, soluble concentrates, emulsifying concentrates, wettable powders, water granules, soluble granules. The data was collected and presented in the below table.

Table 4.14 Usage of pesticides according to the form

S. No	Formulations of Pesticides	Name of the pesticide	Number of sample farmers used
1	Soluble powders	Acephate 75%	100
2	Soluble liquids	Monocrotophos 36% Imidacloprid 17.8%	100
3	Soluble concentrates	Imidacloprid 30.5% Spinosad 45% Spinetoram 11.7% Chlorantraniliprole 18.5 %	85
4	Emulsifying concentrates	Pendimethalin 30% Quizalofop ethyl 5% Propaquizafop 10% Profenofos 50% Quinalphos 25% Chlorpyrifos 20% Indoxacarb 15.8 % Novaluron 10% Lamda-cyhalothrin 2.5% Dicofol 18.5%	82
5	Wettable powders	Diafenthiuron 50% Carbendazim 12% + Mancozeb 63% Copper oxychloride 50% Carbendazim 50% Mancozeb 75%	73
6	Water granules	Imidacloprid 70% Thiamethoxam 25% Flonicamid 50 % Flubendiamide 20 % Pyraclostrobin 20%	71
7	Soluble Granules	Emamectin benzoate 5 %	28

The table 4.14 it showed that, 100 per cent of the sample were using soluble powders, soluble liquids as the form of pesticide, followed by 85 per cent of the sample farmers use emulsifying concentrates, 73 percent of the sample farmers used wettable powders, 71 per cent of the sample farmers used water granules and 28 per cent of the sample farmers used soluble granules. This showed that majority of the farmers used soluble powders and soluble liquids form of pesticides as majority of farmers were using Acephate 75% followed by Monocrotophos 36% and Imidacloprid 17.8%.

4.3 AWARENESS OF COTTON FARMERS TOWARDS PESTICIDES USAGE

To understand the awareness of cotton farmers towards pesticides usage was broadly divided into two categories, Awareness on pesticides selection and awareness on pesticide application. The data regarding various aspects different kinds of brands, Use of contact pesticides, use of systematic pesticides, duration of pesticide effectiveness, pesticide knowledge, pest enemies identification, bio-pesticides, pesticide dosage, spraying techniques, non-conventional methods, time of spray, pesticide solution preparation were calculated, analyzed and presented as below.

4.3.1 Awareness of cotton Farmers towards Pesticide selection

Categories were considered like different kinds of brands, Use of contact pesticides, use of systematic pesticides, duration of pesticide effectiveness, were grouped under awareness on pesticide selection

For the analysis, a four-point scale was taken. 4, 3, 2, 1 were taken as scores against completely aware, moderately aware, aware but depends, unaware respectively. The calculation was done for mean scores and ranking was given accordingly in descending order.

The Table 4.15, showed that, the awareness level towards pesticide selection was highest for different kinds of brands which recorded a mean score of 3.17 followed by use of contact pesticides with a mean score of 3.14. Use of

systemic pesticides, time of spray, use of systematic pesticides, pesticide usage knowledge, pest enemies identification, bio-pesticides, with mean scores of 2.96, 2.92, 2.80, 2.32, respectively. The last rank was given for duration of pesticide effectiveness with mean score of 2.13. This shows that the sample farmers were having highest awareness on different kinds of brands of pesticide selection and least awareness on duration of pesticide effectiveness.

4.3.2. Awareness of cotton Farmers towards Pesticide application

Categories were considered like dosage, spraying techniques, non-conventional methods, time of spray, pesticide solution preparation were grouped under awareness on pesticide application.

For the analysis, a four-point scale was taken. 4, 3, 2, 1 were taken as scores against completely aware, moderately aware, aware but depends, unaware respectively. The calculation was done for mean scores and ranking was given accordingly in descending order.

The Table 4.15,b it shows that the awareness level towards pesticide application was high for spraying techniques which recorded a mean score of 3.21 followed by use of time of spray with a mean score of 3.07. Pesticide dosage, non-conventional methods, pesticide solution preparation, pesticide combination with mean scores of 2.15, 1.94, 1.93, 1.68 respectively. This shows that the sample farmers were having highest awareness on spraying techniques of pesticide application and least awareness on pesticide combinations.

Table 4.15. Awareness of cotton farmers towards the use of pesticides

a. Awareness on pesticides selection of cotton farmers towards the use of pesticides

S. No.	Categories	Completely aware		Moderately aware		Aware but depends		Unaware		Total score	Mean score	Rank
		NR	S	NR	S	NR	S	NR	S			
1	Different kinds of brands	34	136	51	153	13	26	2	2	317	3.17	1
2	Use of contact pesticides	37	148	46	138	11	22	6	6	314	3.14	2
3	Use of systematic pesticides	29	116	48	144	13	26	10	10	296	2.96	3
4	Pesticide usage knowledge	34	136	34	102	22	44	10	10	292	2.92	4
5	Pest enemies identification	28	112	32	96	32	64	8	8	280	2.8	5
6	Bio-pesticides	15	60	28	84	31	62	26	26	232	2.32	6
7	Duration of pesticide effectiveness	11	44	16	48	48	96	25	25	213	2.13	7

NR: Number of respondents; S: Score

b. Awareness on pesticide application by the cotton farmers towards the use of pesticides.

S. No	Categories	Completely aware		Moderately aware		Aware but depends		Unaware		Total score	Mean score	Rank
		NR	S	NR	S	NR	S	NR	S			
1	**Spraying techniques**	42	168	42	126	11	22	5	5	321	3.21	1
2	**Time of spray**	26	104	60	180	9	18	5	5	307	3.07	2
3	**Pesticide dosage**	15	60	12	36	46	92	27	27	215	2.15	3
4	**Non-conventional methods**	10	40	12	36	40	80	38	38	194	1.94	4
5	**Pesticide solution preparation**	9	36	10	30	46	92	35	35	193	1.93	5
6	**Pesticide combinations**	8	32	4	12	36	72	52	52	168	1.68	6

NR: Number of respondents; S: Score

4.3.3 Test for the significance of Socio-Economic characters with level of awareness (chi-square test)

In order to assess the significant association between socio-economic characteristics of respondents with level of awareness chi-square test was used namely for education, annual income, farming experience, operational land holding. The data regarding this is presented below with following sub heads.

4.3.4 Education Vs level of awareness towards pesticide

The scores were given for the different factors based on the respondents ranking and addition of these ranks was done. The obtained result was divided into three quartiles as low, medium, high. Chi-square test was done to test the significance relation between education and awareness on pesticide selection and pesticide application. The obtained results were presented below.

Table 4.16 Education Vs level of awareness towards pesticide

a. Education Vs awareness on pesticide selection

Categories		Awareness on pesticide selection							
		Low		Medium		High		Total	
		F	%	F	%	F	%	F	%
Education	Illiterate	2	7.77	22	84.66	2	7.77	26	100
	10^{th} standard	6	11.11	32	59.33	16	29.62	54	100
	Intermediate	0	0.00	12	100	0	0.00	12	100
	Degree and above	2	25.00	6	75.00	0	0.00	8	100
Total		**10**	**10**	**72**	**72**	**18**	**18**	**100**	**100**
Chi-square value = 17.08								**P- value = 0.009(<0.05)**	

*(“P” value > 0.05 - not significant: “P” value < 0.05 - significant),

F=frequency

%= percentage

b. Education Vs awareness on pesticide application

Categories		Awareness on pesticide selection							
		Low		Medium		High		Total	
		F	%	F	%	F	%	F	%
Education	Illiterate	7	26.98	12	46.12	7	26.90	26	100
	10^{th} standard	4	7.45	37	64.51	13	24.07	54	100
	Intermediate	0	0.00	9	75.00	3	25.00	12	100
	Degree and above	2	28.00	5	62.50	1	12.5	8	100
Total		**13**	**13**	**63**	**63**	**24**	**24**	**100**	**100**
Chi-square value = 9.86						**P- value = 0.130(>0.05)**			

*("P" value > 0.05 - not significant: "P" value < 0.05 - significant),
F=frequency, %= percentage

From the above table, it showed that there was significant difference between the education and Awareness on pesticide selection as the 'p' value was 0.009 (<0.05), there was no significant difference between the education and awareness on pesticide application as the 'p' value was 0.130 (>0.05). It can be inferred that, awareness on pesticide selection depends on education while awareness on pesticide application was not depended on education. The same findings were observed in Mohammad et al (2018) and Sreekanth (2018).

4.3.5. Annual income Vs awareness on pesticide usage.

The scores were given for the different factors based on the respondents ranking and addition of these ranks was done. The obtained result was divided into three quartiles as low, medium, high. Chi-square test was done to test the significance relation between Annual income and awareness on pesticide selection and pesticide application. The obtained results were presented below.

Table 4.17 Annual income Vs awareness on pesticide usage.

a. Annual income Vs Awareness on pesticide selection.

Categories		Awareness on pesticide selection							
		Low		Medium		High		Total	
		F	%	F	%	F	%	F	%
Annual Income	Low (<1 lakh)	2	5.26	28	73.66	8	21.0	38	100
	Medium (1-3 lakhs)	8	22.85	25	71.42	2	5.77	35	100
	High (above 3 lakhs)	0	0.00	19	70.33	8	29.66	27	100
Total		**10**	**10**	**72**	**72**	**18**	**18**	**100**	**100**
Chi-square value = 14.52								**P- value = 0.006 (<0.05)**	

*("P" value > 0.05 - not significant: "P" value < 0.05 - significant),

F=frequency, %= percentage

b. Annual income Vs Awareness on pesticide application

Categories		Awareness on pesticide selection							
		Low		Medium		High		Total	
		F	%	F	%	F	%	F	%
Annual Income	Low (<1 lakh)	1	2.63	27	71.05	10	26.31	38	100
	Medium (1-3 lakhs)	5	14.28	19	54.28	11	31.42	35	100
	High (above 3 lakhs)	7	25.92	17	62.96	3	11.11	27	100
Total		**13**	**13**	**63**	**63**	**24**	**24**	**100**	**100**
Chi-square value = 10.22								**P- value = 0.037 (<0.05)**	

*("P" value > 0.05 - not significant: "P" value < 0.05 - significant)

F=frequency, %= percentage

From the table 4.17, it could be inferered that there was significant difference between the annual income and Awareness on pesticide selection as the 'p' value was 0.006 (<0.05), there was significant difference between the annual income and awareness on pesticide application as the 'p' value was 0.037 (<0.05). It can be concluded that both awareness on pesticide selection pesticide application depended on the annual income. The same findings were observed in Sreekanth (2018).

4.3.6 Farming experience Vs awareness on pesticide usage.

The scores were given for the different factors based on the respondents ranking and addition of these ranks was done. The obtained result was divided into three quartiles as low, medium, high. Chi-square test was done to test the significance relation between Farming income and awareness on pesticide selection and pesticide application. The obtained results were presented below.

Table 4.18. Farming experience Vs awareness on pesticide usage.

a. Farming experience Vs Awareness on pesticide selection.

Categories		Awareness on pesticide selection							
		Low		Medium		High		Total	
		F	%	F	%	F	%	F	%
Annual Income	Less than 1 year	4	13.33	24	80.08	2	6.66	30	100
	1-5 Years	4	11.11	20	55.55	12	33.33	36	100
	5-10 years	2	5.80	28	82.40	4	11.77	34	100
Total		**10**	**10**	**72**	**72**	**18**	**18**	**100**	**100**
Chi-square value = 10.65							**P- value = 0.031 (<0.05)**		

*(“P” value > 0.05 - not significant: “P” value < 0.05 - significant)

F=frequency, %= percentage

b. Farming experience Vs Awareness on pesticide application

Categories		Awareness on pesticide selection							
		Low		Medium		High		Total	
		F	%	F	%	F	%	F	%
Annual Income	Less than 1 year	3	10.00	19	63.33	8	26.66	30	100
	1-5 Years	3	8.33	24	66.66	9	25.00	36	100
	5-10 years	7	20.28	20	58.82	7	20.58	34	100
Total		**13**	**13**	**63**	**63**	**24**	**24**	**100**	**100**
Chi-square value = 2.75							**P- value = 0.59 (>0.05)**		

*(“P” value > 0.05 - not significant: “P” value < 0.05 - significant)

F=frequency, %= percentage

From the table 4.18, it could be stated that there was significant difference between the farming experience and Awareness on pesticide selection as the 'p' value was 0.031 (<0.05), there was no significant difference between the farming experience and awareness on pesticide application as the 'p' value was 0.59 (>0.05). It can be inferred that awareness on pesticide selection was depended on the farming experience while awareness on pesticide application was not depended on farming experience. The same findings were observed in Mohammad et al (2018) and Sreekanth (2018).

4.3.7. Operational land holding Vs Awareness on pesticide usage.

The scores were given for the different factors based on the respondents ranking and addition of these ranks was done. The obtained result was divided into three quartiles as low, medium, high. Chi-square test was done to test the significance relation between operational land holding and awareness on pesticide selection and pesticide application. The obtained results were presented below.

Table 4.19. Operational land holding Vs Awareness on pesticide usage.

a. Operational land holding Vs Awareness on pesticide selection.

Categories		**Awareness on pesticide selection**							
		Low		**Medium**		**High**		**Total**	
		F	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Operational land holding	Marginal (upto 2.5 acres)	2	12.54	12	75.00	2	12.50	16	100
	Small (2.5-5 acres)	8	16.65	30	62.55	10	20.86	48	100
	Large (above 5 acres)	0	0.00	30	83.33	6	16.60	36	100
Total		**10**	**10**	**72**	**72**	**18**	**18**	**100**	**100**
Chi-square value = 7.616							**P- value = 0.107 (>0.05)**		

*("P" value > 0.05 - not significant: "P" value < 0.05 - significant)

F=frequency, %= percentage

b. Operational Land holding Vs Awareness on pesticide technique

Categories		Awareness on pesticide selection							
		Low		Medium		High		Total	
		F	%	F	%	F	%	F	%
Operational land holding	Marginal (upto 2.5 acres)	3	18.75	4	25.00	9	56.25	16	100
	Small (2.5-5 acres)	6	12.50	37	77.08	5	10.41	48	100
	Large (above 5 acres)	4	11.11	22	61.11	10	27.77	36	100
Total		**13**	**13**	**63**	**63**	**24**	**24**	**100**	**100**
Chi-square value = 16.5						**P- value = 0.002 (<0.05)**			

*("P" value > 0.05 - not significant: "P" value < 0.05 - significant)

F=frequency, %= percentage

The above table, showed that there was no significant difference between the operational land holding and Awareness on pesticide selection as the 'p' value was 0.107 (>0.05), there was significant difference between the operational land holding and awareness on pesticide application as the 'p' value was 0.002 (<0.05). It can be concluded that, awareness on pesticide selection was not dependent on the operational land holding while awareness on pesticide application was dependent on operational land holding. The same findings were observed in Sreekanth (2018) and Yaswanth (2020).

4.3.8 Source of Information towards pesticides

The information pertaining towards pesticides was collected by different methods like the Agriculture department, Pesticides dealers, Progressive farmers, Pesticide company representatives, Radio and TV commercials, Newspapers, Kisan call centers, Agriculture magazines, Internet, Mobiles, and Whatsapp. These were analyzed by using Garrett's ranking technique and ranks were given below (table 4.20).

Table 4.20. Source of Information towards pesticides

S. No	Categories	Total score	Garrett's mean score	Rank
1	Pesticides dealers	7416	74.16	1
2	Progressive farmers	6728	67.28	2
3	Pesticide company representatives	6656	66.56	3
4	TV/ Radio Commercials	4916	49.16	4
5	Newspapers / Agriculture magazines	4532	45.32	5
6	Internet/ Mobile/ WhatsApp	3323	33.23	6
7	Agriculture department	3281	32.81	7
8	Kisan call centers	3248	32.48	8

From the table 4.20, the first rank regarding pesticide management was awarded to pesticide dealers (rank 1) followed by progressive farmers (rank 2). Pesticide company representatives, tv/radio commercials, newspapers/ agriculture magazines, internet/ mobile/ WhatsApp, agriculture department were given ranks of three, four, five, six, seven respectively. Kisan call centers were given the last rank by the farmer. This indicates that cotton farmers rely majorly on pesticide dealers for sourcing the information regarding pesticides to eradicate pests as they have trust towards pesticide dealers. The same findings were observed in Sreekanth (2018).

4.3.9 Basis for Pesticides Application

The data regarding Application of pesticides was done on the basis of previous usage experience, neighbor farmer suggestion, trial and error method, progressive farmers' recommendations, pesticides company representative, agricultural department's recommendations, internet, mobile, WhatsApp, besides advertisements. They were analyzed by using Garrett's ranking technique and ranking was done accordingly (table 4.21)

Table 4.21. The basis for pesticides application

S. No.	Categories	Total score	Garett's mean score	Rank
1	Previous usage experience	7396	73.96	1
2	Pesticide dealer recommendation	6738	67.38	2
3	Neighbor farmer recommendation	6632	66.32	3
4	Progressive farmers' recommendations	6206	62.06	4
5	Internet/ Mobile/ WhatsApp	5672	56.72	5
6	Pesticide company representatives	5586	55.86	6
7	Articles in Newspapers/ Magazines	4472	44.72	7
8	Agriculture department recommendation	3756	37.56	8
9	Trial and error method	3738	37.38	9

The Table 4.21, showed that the application of pesticides was done based on previous usage experience and it is ranked first with mean score of 73.96 and followed by pesticide dealer recommendation with mean score of 67.38. Neighbor farmer recommendations, progressive farmer recommendations, articles in Newspapers/ Magazines, Agriculture department recommendation were given the ranks of three, four, five, six, seven, eight respectively. The last rank was given to the trial and error method. This indicated that, the major basis for application of pesticides is previous usage experience.

Previous usage experience, Pesticide dealer recommendation, Neighbor farmer recommendation were the primary factors for the basis of pesticide application. Progressive farmers' recommendations, Internet/ Mobile/ WhatsApp, Pesticide company representatives, Articles in Newspapers/ Magazines, Agriculture department recommendation were also important but not as primary. The least preference was given to Trial and error method. The same findings were observed in Yaswanth (2020).

4.4 FACTORS THAT INFLUENCE BUYING BEHAVIOUR OF FARMERS TOWARDS PESTICIDES

To understand the factors that influenced the buying behaviour of farmers, different factors were considered as source of pesticide purchase, payment method, choice if price increases, alternate in absence of required pesticide, loyalty of farmers towards dealer and brand etc., The data was collected, analyzed and presented with following sub heads.

4.4.1 Source of Pesticides Purchase by Sample Farmers

Cotton farmers purchased pesticides from a Department of agriculture, private dealer, co-operative society or from online stores. The analysis was shown in (Table 4.22)

Table 4.22. Source of pesticides purchase by sample farmers

S. No	Categories	Frequency	Percentage
1	Private dealer	**82**	**82**
2	Agricultural department	14	14
3	Co-operative society	0	0
4	Online stores	4	4
	Total	100	100

The Table 4.22 it showed that, among 100 sample farmers 82 per cent of cotton farmers were purchasing pesticides from private dealers, 14 per cent of cotton farmers were purchasing from agriculture department, 4 per cent of cotton farmers are purchasing pesticides from online stores and no sample farmers was purchasing pesticides from co-operative society as they had no co-operative society. This indicated that the majority source of pesticides purchase was from private dealers as the accessibility and availability of required pesticides was easy.

4.4.2 Payment method for purchasing of Pesticides

The payment method for purchasing pesticides was either by using cash, credit or by both cash and credit. The analysis is presented below, in Table 4.23.

Table 4.23. Payment method for purchasing of Pesticides

S. No	Categories	Frequency	Percentage
1	Credit	32	32
2	Cash	31	31
3	Credit and cash	**37**	**37**
	Total	100	100

The table 4.23 it showed that, among 100 sample farmers, 37 percentage of the farmers were purchasing pesticides by using credit and cash, 32 percentage of the farmers were purchasing pesticides by taking credit and 31 per cent of sample farmers were purchasing pesticides by using cash. It showed majority of farmers purchased pesticides by using both credit and cash.

4.4.3 The Alternative choice by the farmers in situation of non-offering of credit by the dealer.

The alternative choice in situation of non-offering of credit for the sample farmers, was made into different categories namely switch to dealer who provides credit, taking credit from other people, reduce the pesticide quantity, go for the cheaper alternative. The collected details are shown in Table 4.24.

Table 4.24. The Alternative choice by the farmers in situation of non-offering of credit by the dealer.

S. No	Categories	Frequency	Percentage
1	Switch to other dealer who provides credit	**53**	**53**
2	Taking credit from other people	36	36
3	Reduce the pesticide quantity	6	6
4	Go for the cheaper alternative	5	5
	Total	100	100

The table 4.24 it showed that 53 percentage of the farmers preferred to switch to dealer who provided credit, 36 percentage sources credit from other people, 6 per cent of farmers reduces the pesticide quantity application and 5

per cent of farmers go for cheaper alternative. It showed that majority of the farmers switch to other dealer who provides credit when there was non-offering of credit by the dealer.

4.4.4 Response to Change of price in Pesticide Brands

The data regarding response to change of price in pesticides were categorized as same brand and same quantity, same brand and reduced quantity, move to low cost alternative brand. The collected data was analyzed and presented in the Table 4.25.

Table 4.25. Response to change of price in Pesticide brands

S. No.	Categories	Frequency	Percentage
1	Same brand and same quantity	**48**	**48**
2	Same brand and reduced quantity	6	6
3	Move to low cost alternative brand	46	46
	Total	100	100

From the above table, it could be seen that, among 100 cotton farmers, 48 respondents voted to use the same brand and same quantity, 46 respondents were in seek of low priced brand and 6 respondents opted to use same brand and reduced quantity. Majority of the respondents used the same brand in same quantity even though there was change of price in pesticides brands due to their previous experience regarding the pesticide brand.

4.4.5 Farmers' Response during the Unavailability of necessary Pesticides

Farmers' response when there was unavailability of necessary pesticides was categorized into four categories viz., shift to alternate brand, shift to alternative chemical, acquire from long distance markets, wait for the same chemical. The collected data was analyzed and shown in (Table 4.26).

Table 4.26. Farmers' Response during the Unavailability of necessary Pesticides

S. No.	Categories	Frequency	Percentage
1	Shift to alternate brand	**54**	**54**
2	Shift to alternative chemical	14	14
3	Acquire from long-distance markets	8	8
4	Wait for the same chemical	24	24
	Total	100	100

When there was unavailability of necessary pesticide, 54 percentage of the respondents shifted to alternate brand, 24 percentage of respondents wants to wait, 14 percentage of respondents shifted to alternative chemical, 8 percentage of respondents acquire from the long-distance markets. This shows that majority of respondents wait until there was availability of necessary chemical in the market. The same findings were observed in Sreekanth (2018).

4.4.6 Loyalty of Farmers' towards Dealer and Brand

Loyalty of farmers towards dealer and brand was classified into four categories namely, always purchase from same dealer, always purchase from same brand, purchase same brand from other dealer, changes brand from same dealer. The collected data was analyzed and shown in the Table 4.27.

Table 4.27. Loyalty of farmers' towards dealer and brand

S. No	Categories	Frequency	Percentage
1	Always purchase from same dealer	33	33
2	Always purchase from same brand	7	7
3	Purchase same brand from other dealer	6	6
4	Change brand from the same dealer	54	54
	Total	**100**	**100**

The table 4.27, it showed that out of 100 sample farmers, 54 percentage of famers changes brand from same dealer, 33 percentage of the farmers always

purchases from the same dealer, 7 percentage of sample farmers purchase from the same brand, 6 percentage of farmers purchases the same brand from other dealer. It showed that, majority of the respondents changed brand from same dealer.

4.4.7 Factors Influencing the Quantity in Application of Pesticides and selection of Brands.

Factors regarding quantity of pesticides application and selection of brands were taken and grouped into seven categories namely damage symptoms observed, intensity of pest and diseases, damage level in the field, number of pests per plant, crop stage, peer group advising, prophylactic action. Farmers were asked to rank the factors. The data obtained was analyzed and presented in Table 4.28.

Table 4.28. Factors influencing quantity in Application of Pesticides and selection of Brands.

S. No	Categories	Total score	Garrett's mean score	Rank
1	Damage symptoms observed	6542	65.42	1
2	The intensity of pest and disease	6020	60.20	2
3	Damage level in the field	5486	54.86	3
4	Crop stage	5398	53.98	4
5	Number of pests per plant	4604	46.04	5
6	Peer group advising	3708	37.08	6
7	Prophylactic action	3042	30.42	7

Among the factors damage symptoms observed was given rank one with mean score of 65.42, followed by intensity of pests and disease, damage level in the field, stage of crop, number of pests per plant, peer group advising with mean scores of 60.20, 54.86, 53.98, 46.04, 37.08, 30.42 respectively. Prophylactic action was given last rank among the factors. It showed that the major factor influencing quantity in application of pesticides and selection of brands was damage symptoms observed by the sample farmers. The same findings were observed in Yaswanth (2020).

4.4.8 Level of Satisfaction by cotton Farmers towards Pesticides and Support Services

The appropriate parameters for measuring farmers' levels of satisfaction with pesticide use and support services were taken into account, and a five-point rating scale was used to measure farmers' opinions. (Table 4.28).

For the analysis, a five point scale was taken. 5, 4, 3, 2, 1 were taken as scores against highly satisfied, satisfied, moderately satisfied, dissatisfied, highly dissatisfied respectively. Calculation of mean scores was done and ranking was given accordingly in descending order.

Table 4.29, showed that the satisfaction levels of respondents towards pesticides. The Availability of the choice product was ranked first with mean score of 3.73, followed by the accessibility for input stores with mean score of 3.68. The availability of range of products, dealer awareness of pesticides, value added services provided by Agri input companies, package size available in the market, promotional activities by the Agri input companies, effectiveness of pesticides available in the market are having mean scores of 3.44, 3.34, 3.31, 3.26, 3.10, 2.95, 2.51 respectively. The last rank was given to the cost of pesticides with mean score of 2.51. This can be inferred that majority of satisfaction level of cotton farmers was availability of the choice product and the least was given for cost of pesticides. The same findings were observed in Shanthini *et al.* (2013) and Sreekanth (2018).

Table 4.29. Level of Satisfaction by cotton Farmers towards Pesticides and Support Services

S. No	Categories	Highly satisfied		Satisfied		Moderate		Dissatisfied		Highly dissatisfied		Total score	Mean score	Rank
		NR	S	NR	S	NR	S	NR	S	NR	S			
1	Availability of the choice product	23	115	39	156	28	84	8	16	2	2	373	3.73	1
2	Accessibility for input stores	33	165	25	100	26	78	9	18	7	7	368	3.68	2
3	Availability of a range of products	29	145	25	100	19	57	15	30	12	12	344	3.44	3
4	Dealer awareness of pesticides	12	60	32	128	38	114	14	28	4	4	334	3.34	4
5	Value added services Agri input company	16	80	36	144	22	66	15	30	11	11	331	3.31	5
6	Package size available in the market	7	35	38	152	35	105	14	28	6	6	326	3.26	6
7	Promotional activities of Agri input companies	11	55	26	104	30	90	28	56	5	5	310	3.10	7
8	Effectiveness of the pesticides available in the market	2	10	32	128	29	87	33	66	4	4	295	2.95	8
9	Cost of pesticides	4	20	15	60	29	87	32	64	20	20	251	2.51	9

NR: Number of respondents; S: Scores.

4.5 CONSTRAINTS OCCURRED WHILE PURCHASING OF PESTICIDES BY COTTON FARMERS

4.5.1 Constraints faced by the cotton Farmers while Purchasing Pesticides from the Private Dealers

The details regarding the constraints faced by the farmers while purchasing pesticides was collected and summed up to get the total scores. Garrett's mean score was calculated from the total score and rankings were given according to it. The data was presented in table 4.30.

Table 4.30. Constraints occurred to the respondents during purchasing of pesticides from the private dealers

S. No	Categories	Total score	Garrett's mean score	Rank
1	High price of pesticides	7228	72.28	1
2	High interest on credit	6910	69.10	2
3	Lack of credit availability	6444	64.44	3
4	Preferred brands are not available	4800	48.00	4
5	Spurious products	4652	46.52	5
6	Offering only credit to specific products	3440	34.40	6
7	Forced sales of other products with highly demanded pesticides	3434	34.34	7
8	Poor dealer knowledge about products	3212	32.12	8

It can be inferred from the table 4.30, that the high price of the pesticides was ranked first by the cotton farmers with a mean score of 72.28, as they were finding it difficult in purchasing the pesticides followed by high interest on the credit given to the farmers by the input dealers, with mean score of 69.10. Lack of credit availability in purchasing was given the third position with mean score of 64.44 as farmers were more dependent on the credit for purchasing the pesticides. Preferred products not available in the market, spurious products,

offering only credit to specific products, forced sales of other products with highly demanded pesticides, Poor dealer knowledge about products, were given the are having mean scores of 48.00, 46.52, 34.40, 34.34 respectively. The last rank was given to the poor dealer knowledge about products available in the market with mean score of 32.12. This showed that, high price of pesticide, High interest on credit, Lack of credit availability were considered as the primary constraints faced by the farmers. Preferred brands were not available, Spurious products, Offering only credit to specific products, Forced sales of other products with highly demanded pesticides were also important but not as primary. The least importance was given to Poor dealer knowledge about products. The same findings were observed in Yaswanth (2020).

4.5.2 Overall constrains/concerns of farmers towards pesticide usage

The data pertaining to overall constrains/concerns of farmers towards pesticide usage was collected from the farmers and Garrett's mean score was calculated. The obtained results were shown in table 4.31

Table 4.31. Overall constrains/concerns of farmers towards pesticide usage

S. No	Categories	Total score	Garrett's mean score	Rank
1	Lack of usage information regarding pesticide	6842	68.42	1
2	Unavailability of the product during peak pest incidence	6172	61.72	2
3	Lack of information regarding new products	6092	60.92	3
4	High dependency on pesticides makes farming unviable	3909	39.09	4
5	Use of pesticides in over dosages making	3680	36.80	5
6	Increasing resistance of pests towards pesticides available	3251	32.51	6

From the above table it showed that, Lack of usage information regarding pesticides was given rank one by the cotton farmers with Garrett's mean score of 68.42, followed by Unavailability of product during peak pest incidence having Garrett's mean score of 61.72. Lack of information regarding new products, High dependency on pesticides made farming unviable, Use of pesticides in over dosages were having Garrett's mean score of 60.92, 39.09, 36.80 respectively. The last rank was given to increasing resistance of pests towards pesticide by the sample farmers as with Garrett's mean score of 32.51. This infered that, lack of usage information regarding pesticide, Unavailability of the product during peak pest incidence, Lack of information regarding new products were the primary problem faced by the cotton farmers. High dependency on pesticides makes farming unviable, Use of pesticides in over dosages were secondary constraints faced by farmers. The least importance was given to Increasing resistance of pests towards pesticides available. The same findings were observed in Jatin *et al*. (2017).

Chapter - V

Summary & Conclusions

Chapter – V

SUMMARY AND CONCLUSIONS

The present study entitled “buying behaviour of cotton farmers towards pesticides in Guntur district of Andhra Pradesh” was done to study the Awareness of pesticide application, pesticide consumption pattern, buying behavior toward pesticides, and constraints occurred while purchasing pesticides by the cotton farmers in Guntur district ofAndhra Pradesh.

5.1 OBJECTIVES OF THE STUDY

1. to know the pesticide usage pattern of farmers and awareness towards pesticides usage
2. to examine the factors influencing the buying behaviour of farmers towards pesticides, and
3. to identify the constraints faced by the farmers in purchasing process of pesticides.

5.2 METHODOLOGY

Guntur district was intentionally chosen for the study, as the district occupied a pride place in consumption of pesticides, area and production of cotton in the state of Andhra Pradesh. Two mandals were selected randomly among the 58 mandals for the study. Five villages were selected from each mandal randomly thus making a total of 10 villages. From each village 10 farmers were selected randomly, thus making a sample size of 100. The required data relating to the study was be collected from the farmers through a pretested schedule through repeated personal visits.

The collected data was analyzed by using descriptive statistics, Chi-square test, Likert’s scale, and Garrett’s ranking technique to achieve the set objectives of the study.

5.3 MAJOR OUTCOMES OF THE STUDY

From the analysis of data the major outcomes of the study were given below.

5.3.1. Socio-economic profile of farmers in the study area

A sample of 100 farmers were taken for the study. Their socio-economic profiles were studied in terms of.

Among the 100 farmers 54 per cent of the respondents were middle-aged (36-55 years), followed by 24 per cent of respondents were old aged (above 55 years) and 22 per cent of the respondents were young aged (upto 30 years).

Out of 100 farmers 54 per cent of the farmers had intermediate education, 26 per cent of the respondents were illiterate, 12 per cent of the respondents had education of 10th standard, and 8 per cent of the respondents had degree and above education.

With respect to 74 per cent of respondents were of middle sized family, 15 per cent of respondents were of small size family, and 11 per cent of respondents were of big sized family group.

The annual income revealed that 38 per cent of sample farmers were of low income group, followed by 35 per cent were having medium income group while 27 per cent were in high annual income group.

Among 100 sample farmers small farmers were 48 per cent, 29 per cent of the respondents were marginal farmers, while the remaining 23 per cent were large farmers.

Out of 100 respondents 52 per cent of the respondents have 1-5 years of farming experience, 32 per cent of respondents have 5-10 years of farming experience while 16 per cent of the respondents have less than 1 year of farming experience.

About 34 per cent of respondents depended for credit on money lenders, 8 per cent depended credit from friends/neighbors, 6 per cent availed from government departments, 22 per cent from input dealers, and 30 per cent depended on commercial banks.

The mobile phone usage showed that 78 percentage of farmers uses smart phones and the remaining 22 per cent uses basic mobile for their daily communication.

Out of 100 respondents 48 per cent of respondents have land holdings between 2.5-5 acres, 17 per cent growers had land holding between 1-2.5 acres, likewise 16 per cent of farmers with land holdings between 5-10 acres, 12 per cent respondents has less than 1 acre of land, while and 4 per cent of respondents between 10-15 acres of land and 3 per cent growers have more than 15 acres of land.

Among the 100 sample farmers, 77 per cent of respondents were with medium level and 13 per cent of respondents are with high level of mass media exposure, 10 per cent of the respondents were with low level of mass media exposure.

The major occupation of the respondents showed that agriculture was the primary occupation for 76 per cent of the sample farmers and horticulture was the major occupation for 22 per cent of the sample farmers and only 2 per cent of the farmers had animal husbandry as their major occupation.

The secondary occupation of the farmers showed that, 31 per cent of the respondents had dairy as the secondary occupation, followed by poultry (21 per cent). The fishery, sheep/goat rearing, animal husbandry and others (daily labors and non-farm employees) were having 16, 14, 10, 8 percentages respectively.

5.3.2 Pesticides Usage Pattern in Cotton by the Sample Farmers

The top two chemicals used by sample cotton farmers were Pendimethalin 30% EC, Glyphosite 40% SL which was used by 82 per cent, 56 per cent of the sample farmers respectively and the least two herbicides used by sample farmers were Propaquizafop 10% EC, Quizalofop ethyl 5% EC were used by 35 per cent and 28 per cent respectively.

The top three insecticides were Monocrotophos 36% SL, Acephate 75% SP, Chlorantraniliprole 18.5 % SC SP were used by 100 per cent, 100 per cent, 77 per cent of the sample cotton farmers respectively. The least three insecticides used by the farmers were Imidacloprid 70% WG, Dicofol 18.5% EC, Emamectin benzoate 5 % SG were used by 14 per cent, 21 per cent, 28 per cent of sample cotton farmers respectively.

The top three fungicides were Carbendazim 12% + Mancozeb 63% WP, Streptomycin sulphate 90%w/w, Copper oxychloride 50% WP used by 58 per cent, 45 per cent, 34 per cent of sample cotton farmers respectively. The least three fungicides used by the farmer were Carbendazim 50% WP, Mancozeb 75% WP, Pyraclostrobin 20% WG used by 29 per cent, 16 per cent, 11 per cent respectively by the sample cotton farmers

Almost 100 per cent of the sample used soluble powders, soluble liquids as the form of pesticide, followed by 85 per cent of the sample farmers use emulsifying concentrates, 73 percent of the sample farmers used wettable powders, 71 per cent of the sample farmers used water granules and 28 per cent of the sample farmers used soluble granules.

5.3.3 Awareness of cotton Farmers on Pesticide Usage

About 100 per cent of cotton farmers awareness level towards pesticide selection was highest for different kinds of brands which recorded a mean score of 3.17 followed by use of contact pesticides with a mean score of 3.14. Use of systemic pesticides, time of spray, use of systematic pesticides, pesticide usage knowledge, pest enemies identification, bio-pesticides, with

mean scores of 2.96, 2.92, 2.80, 2.32, respectively. The last rank was given for duration of pesticide effectiveness with mean score of 2.13.

About 100 per cent of cotton farmers the awareness level towards pesticide application was high for spraying techniques which recorded a mean score of 3.21 followed by use of time of spray with a mean score of 3.07. Pesticide dosage, non-conventional methods, pesticide solution preparation, pesticide combination with mean scores of 2.15, 1.94, 1.93, 1.68 respectively.

5.3.4 Test for the significance of Socio-Economic characters with level of awareness (chi-square test)

In order to assess the significant association between socio-economic characteristics of respondents with level of awareness chi-square test was conducted.

There was significant difference between the education and Awareness on pesticide selection as the ‘p’ value was 0.009 (<0.05), there was no significant difference between the education and awareness on pesticide application as the ‘p’ value was 0.130 (>0.05).

There was significant difference between the annual income and Awareness on pesticide selection as the ‘p’ value was 0.006 (<0.05), there was significant difference between the annual income and awareness on pesticide application as the ‘p’ value was 0.037 (<0.05).

There was significant difference between the farming experience and Awareness on pesticide selection as the ‘p’ value was 0.031 (<0.05), there was no significant difference between the farming experience and awareness on pesticide application as the ‘p’ value was 0.59 (>0.05).

There was no significant difference between the operational land holding and Awareness on pesticide selection as the ‘p’ value was 0.107 (>0.05), there was significant difference between the operational land holding and awareness on pesticide application as the ‘p’ value was 0.002 (<0.05).

5.3.5 Source of Information on eradication of Pests

All 100 cotton farmers the first rank regarding pesticide management was awarded to pesticide dealers (rank 1) followed by progressive farmers (rank 2). Pesticide company representatives, tv/radio commercials, newspapers/agriculture magazines, internet/ mobile/ WhatsApp, agriculture department were given ranks of three, four, five, six, seven respectively. Kisan call centers were given the last rank by the farmer.

5.3.6 Basis for Pesticides Application

Basis for Pesticides Application showed that, the application of pesticides was done based on previous usage experience and it is ranked first with mean score of 73.96 and followed by pesticide dealer recommendation with mean score of 67.38. Neighbor farmer recommendations, progressive farmer recommendations, articles in Newspapers/ Magazines, Agriculture department recommendation were given the ranks of three, four, five, six, seven, eight respectively. The last rank was given to the trial and error method.

5.4 FACTORS THAT INFLUENCE BUYING BEHAVIOUR OF FARMERS TOWARDS PESTICIDES

The source of pesticides showed that, 82 per cent of cotton farmers were purchasing pesticides from private dealers, 14 per cent of cotton farmers were purchasing from agriculture department, 4 per cent of cotton farmers are purchasing pesticides from online stores and no sample farmers was purchasing pesticides from co-operative society as they had no co-operative society.

The major payment source for 100 sample farmers, 37 percentage of the farmers were purchasing pesticides by using credit and cash, 32 percentage of the farmers were purchasing pesticides by taking credit and 31 per cent of sample farmers were purchasing pesticides by using cash.

The alternative choice if credit was not available for the sample farmers was, 53 percentage of the farmers preferred to switch to other dealer who provided credit, 36 percentage sources credit from other people, 6 per cent of farmers reduces the pesticide quantity application and 5 per cent of farmers go for cheaper alternative.

Among the 100 cotton farmers, 48 respondents voted to use the same brand and same quantity, 46 respondents were in seek of low priced brand and 6 respondents opted to use same brand and reduced quantity.

When there was unavailability of necessary pesticide, 54 percentage of the respondents shifted to alternate brand, 24 percentage of respondents waited, 14 percentage of respondents shifted to alternative chemical, 8 percentage of respondents acquired from the long-distance markets.

Out of 100 sample farmers, 54 percentage of famers changes brand from the same dealer, 33 percentage of the farmers always purchased from the same dealer, 7 percentage of sample farmers purchased from the same brand, 6 percentage of farmers purchased the same brand from other dealer.

Among the factors that influenced the quantity in application of pesticides, damage symptoms observed was given rank one with mean score of 65.42, followed by intensity of pests and disease, damage level in the field, stage of crop, number of pests per plant, peer group advising with mean scores of 60.20, 54.86, 53.98, 46.04, 37.08, 30.42 respectively. Prophylactic action was given last rank among the factors.

The satisfaction levels of respondents towards pesticides showed that the Availability of the choice product was ranked first with mean score of 3.73, followed by the accessibility for input stores with mean score of 3.68. The availability of range of products, dealer awareness of pesticides, value added services provided by agri input companies, package size available in the market, promotional activities by the agri input companies, effectiveness of pesticides available in the market are having mean scores of 3.44, 3.34,

3.31, 3.26, 3.10, 2.95, 2.51 respectively. The last rank was given to the cost of pesticides with mean score of 2.51.

5.5 CONSTRAINTS OCCURRED TO THE COTTON FARMERS WHILE PURCHASING PESTICIDES FROM THE PRIVATE DEALERS

Among the constraints faced by the framers, the high price of the pesticides was ranked first by the cotton farmers with a mean score of 72.28, as they were finding it difficult in purchasing the pesticides followed by high interest on the credit given to the farmers by the input dealers, with mean score of 69.10. Lack of credit availability in purchasing was given the third position with mean score of 64.44 as farmers were more dependent on the credit for purchasing the pesticides. Preffered products not available in the market, spurious products, offering only credit to specific products, forced sales of other products with highly demanded pesticides, Poor dealer knowledge about products, were given the are having mean scores of 48.00, 46.52, 34.40, 34.34 respectively. The last rank was given to the poor dealer knowledge about products available in the market with mean score of 32.12.

Among the overall problems, Lack of usage information regarding pesticides was given rank one by the cotton farmers with Garrett's mean score of 68.42, followed by Unavailability of product during peak pest incidence having Garrett's mean score of 61.72. Lack of information regarding new products, High dependency on pesticides makes farming unviable, Use of pesticides in over dosages making were having Garrett's mean score of 60.92, 39.09, 36.80 respectively. The last rank was given to increasing resistance of pests towards pesticide by the sample farmers as with Garrett's mean score of 32.51.

5.6 CONCLUSIONS

- The age categorization of the sample cotton farmers concluded that, majority of the farmers belonged to middle age (36-55) group.

- Greater percentage (54%) of farmers were having intermediate as there highest education qualification.
- Size of family revealed that, most of the sample farmers had medium sized family i.e. 4-7 members.
- Majority (38%) of sample farmers belonged to low annual income (<1 lakh) group.
- Operational land holding of sample farmers showed that, majority of cotton farmers having small (2.5-5 acres) land holding.
- Farming experience of the sample showed that, a greater percentage (52%) of farmers had 1-5 years of farming experience.
- Majority (34%)of the farmers availed credit from the money lenders as the process for availing credit was easy
- Most (78%) of the cotton farmers used smart phone for communication.
- The farm size of the respondents revealed that, most of the farmers (48%) had 2.5-5acres of land.
- Greater percentage (77 per cent) of the cotton growers were with medium level of mass media exposure.
- Agriculture was the main occupation for most of the farmers (76 per cent)
- About 31 per cent of the farmers had dairy as their secondary occupation.
- Among herbicides, the deviation was highest for pendimethalin 30% EC with 71.43 per cent and least for quizalofop ethyl 5% EC with deviation of 28 percent of sample cotton farmers. Among insecticides, the deviation was highest for 81.82 per cent Imidacloprid 17.8% SL, least deviation (negative) was Diafenthiuron 50% WP with -42.86 per cent.

- Majority of the farmers used soluble powders and soluble liquids form of pesticides.
- The sample farmers were having highest awareness on different kinds of brands of pesticide selection and least awareness on duration of pesticide effectiveness.
- The sample farmers were having highest awareness on spraying techniques of pesticide application and least awareness on pesticide combinations.
- A Chi-square test showed that, both awareness on pesticide selection pesticide application depended on the annual income.
- A Chi-square test showed that, awareness on pesticide selection was depended on the farming experience while awareness on pesticide application was not depended on farming experience.
- A Chi-square test showed that, awareness on pesticide selection was not dependent on the operational land holding while awareness on pesticide application was dependent on operational land holding.
- Greater percentage of farmers gets the information regarding pesticides from pesticide dealers followed by progressive farmers.
- Previous usage experience was the main criteria for pesticide application in cotton.
- Previous usage experience, Pesticide dealer recommendation, Neighbor farmer recommendation were the primary factors for the basis of pesticide application. Progressive farmers' recommendations, Internet/ Mobile/ WhatsApp, Pesticide company representatives, Articles in Newspapers/ Magazines, Agriculture department recommendation were also important but not as primary. The least preference was given to Trial and error method.

- Source of pesticide usage showed that majority (82%) source of pesticides purchase was from private dealers.
- Majority (37%) of sample cotton farmers purchased pesticides by using both credit and cash.
- Greater percentage (53%) of sample farmers switched to other dealer who gave credit when there was no availability of credit.
- Majority (48%) of sample farmers opted for the same brand same quantity of pesticides during change in price of pesticides.
- Majority (54%) of sample framers chose to shift to an alternate brand when there was non-availability of required pesticides.
- Loyalty towards dealer and brand showed that higher percentage (54%) of sample farmers changes brand from same dealer.
- It showed that the major factor influencing quantity in application of pesticides and selection of brands is damage symptoms observed.
- High price is the major constraint while purchasing of pesticides by the sample cotton farmers.
- Lack of usage information regarding pesticide was the overall constrain faced by the sample cotton farmers towards pesticide.

5.7 RECOMMENDATIONS

RECOMMENDATIONS FOR THE PESTICIDE COMPANIES

- The study results on awareness of cotton farmers on pesticide selection indicated that, the cotton farmers had low awareness on systemic pesticides, time of spray, use of systematic pesticides, pesticide usage knowledge, pest enemies identification, bio-pesticides, duration of pesticide effect and pesticide combinations. Pesticide companies while conducting development activities and demonstrations as part of their marketing need to focus on these aspects for best usage results and

effect. Addressing on these aspects could enhance awareness of farmers leading to overall satisfaction and retention on pesticide products.

- Further the study on awareness of pesticide usage suggested that, cotton farmers had low awareness on pesticide dosage, non-conventional methods of pest control, pesticide solution preparation, pesticide combination. Hence, the pesticides companies need to focus on enhancing farmers awareness through field demonstrations on these aspects for efficient usage of pesticides.

- The critical deviation of the pesticide dosage used by farmers from recommended dosage indicated that, there were deviations in all the pesticides used by the farmers and the deviation was as high as 81.82 percentage. This was matter of concern and responsibility of pesticide manufactures and marketers to educate the farmers to use recommended dosage of pesticides as the many of the previous studies have indicated the ill effects of non judicious use of pesticides.

- The smart mobile usage was about 78 per cent and hence, the pesticide companies can develop mobile based field diagnosis applications to disseminate the information regarding the damage symptoms and pesticide application to facilitate the farmers in taking in time and right decisions regarding pesticide selection and usage.

- The study indicated that, the credit was playing a major role in dealer and product loyalty, shifting was observed in situations of non availability credit. This can be used to develop loyalty based credit card schemes to farmers through collaboration of banks and NBFC's.

RECOMMENDATIONS FOR THE AGRICULTURAL DEPARTMENT

- The critical deviation of the pesticide dosage used by farmers from recommended dosage indicated that, there were deviations in all the pesticides used by the farmers and the deviation was as high as 81.82 percentage. Hence, this high alarming, measure need to be taken to

educate the farmers regarding consequences of using over dosage of pesticides.

- Awareness of cotton farmers on pesticide selection indicated that, the cotton farmers had low awareness on systemic pesticides, time of spray, use of systematic pesticides, pesticide usage knowledge, pest enemies identification, bio-pesticides, duration of pesticide effect and pesticide combinations. Hence, these areas need to be considered while planning for training and demonstrations conducted to cotton farmers to increase the awareness on pesticide selection.

- The awareness of pesticide usage suggested that the cotton farmers had low awareness on pesticide dosage, non-conventional methods of pest control, pesticide solution preparation, pesticide combination. be considered while designing for training and demonstrations conducted to cotton farmers to increase the awareness on pesticide selection.

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