A STUDY OF INSECTICIDES USE AND APPLICATION PATTERN ON MAJOR VEGETABLE CROPS BY THE FARMERS OF BALODABAZAR - BHATAPARA DISTRICT OF CHHATTISGARH

M.Sc. (Ag.) Thesis

by

Chandrkant Dubey

DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE
FACULTY OF AGRICULTURE
INDIRA GANDHI KRISHI VISHWAVIDYALAYA
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Thesis

Submitted to the

Indira Gandhi Krishi Vishwavidyalaya, Raipur

by

Chandrkant Dubey

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CERTIFICATE - I

This is to certify that the thesis entitled **"A study of insecticides use and application pattern on major vegetable crops by the farmers of Balodabazar-Bhatapara district of Chhattisgarh"** submitted in partial fulfillment of the requirements for the degree of **Master of Science in Agriculture** of the Indira Gandhi Krishi Vishwavidyalaya, Raipur, is a recorded of the bonafide research work carried out by **Chandrkant Dubey** under my guidance and supervision. The subject of the thesis has been approved by the student's advisory committee and the Director of Instructions.

No part of the thesis has been submitted for any other degree or diploma or has been published/published part has been fully acknowledged. All the assistance and help received during the course of the investigations have been duly acknowledged by him.

Chairman

(Dr. Rajesh Kumar Sahu)

Date: 03/08/2016

THESIS APPROVED BY THE STUDENT'S ADVISORY COMMITTEE

Chairman (Dr. Rajesh Kumar Sahu) _____

Member (Dr. M. A. Khan) _____

Member (Dr. Vikas Singh) _____

Member (Dr. (Smt.) S. Shukla) _____

CERTIFICATE – II

This is to certify that the thesis entitled **"A study of insecticides use and application pattern on major vegetable crops by the farmers of Balodabazar-Bhatapara district of Chhattisgarh"** submitted by **Chandrkant Dubey** to the Indira Gandhi Krishi Vishwavidyalaya, Raipur, in partial fulfillment of the requirements for the degree of **Master of Science in Agriculture** in the Department of Agricultural Extension has been approved by the external examiner and student's advisory committee after oral examination.

Signature External Examiner

(Name Dr. N. K. Khare)

Prof. & Head, JNKVV, Jabalpur

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Major Advisor _____

Head of the Department _____ 08/9/16

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Chandrkant Dubey

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LIST OF ABBREVIATIONS

%	Per cent
Agril.	Agricultural
AI	Adoption Index
DBM	Diamond Black Moth
DDT	Dichloro-diphenyl-trichloroethane
Deptt	Department
et al.	Et alii (And Others/co-workers)
EC	Emulsifiable concentrate
F	Frequency
FAO	Food and Agricultural Organization
Fig.	Figure
ha	Hectare
i.e.	That is
IPM	Integrated Pest Management
KCC	Kisaan Call Center
KI	Knowledge Index
KMS	Kisan Mobile Salahkar
KVK	Krishi Vigyan Kendra
MM	Millimeter
MT	Metric Tonnes
NGO	Non Governmental Organisation
NHM	National Horticulture mission
NSKE	Neem Seed Kernal Extract
RAEO	Rural Agriculture Extension Officer
RAWE	Rural Agriculture Work Experience
RHEO	Rural Horticulture Extension Officer
SADO	Senior Agriculture Development Officer
SD	Standard Deviation
TV	Television
Viz.	Namely
WHO	World Health Organisation
WP	Wettable Powder

THESIS ABSTRACT

a) Title of the Thesis:	A Study of insecticides use and application pattern on major vegetable crops by the farmers of Balodabazar - Bhatapara district of Chhattisgarh
b) Full Name of the Student:	Chandrkant Dubey
c) Major Subject:	Agricultural Extension
d) Name and Address of the: Major Advisor	Dr. Rajesh Kumar Sahu Assistant Professor, DKS College of Agriculture & Research Station, IGKV, Bhatapara (C.G.)
e) Degree to be awarded:	M.Sc. (Ag.) Agricultural Extension

Signature of the Student

Signature of Major Advisor

Date:...03/08/2016

04/8/16

Signature of Head of the Department

Abstract

The study was conducted in Balodabazar-Bhatapara district of Chhattisgarh, during the year 2015-16. Total of 120 vegetable growers were selected as respondents from eight villages of Bhatapara and Simga block. The data were collected personally through pre-tested interview schedule and analyzed by using appropriate statistical methods.

The study revealed that majority of 30.83 per cent respondents had primary school education, 73.00 per cent respondents were having joint family and 21.67 per cent of the respondents were having 16 to 20 years of farming experience. Majority of the respondents i.e., 31.67 per cent had marginal size of land holdings, while cent per cent were having irrigation facility and 75.83 per cent had personal tube-well. All the respondents were involved in agriculture, 35.83 per cent respondents received only Medium annual income (Rs. 25001 to Rs. 50000) and 69.17 per cent had not acquired credit. While, 96.67 per cent of them were getting information regarding use of insecticide and application pattern from input dealer and majority had contact with RAEO/ RHEOs, 60.00 per cent had medium level of risk orientation and half of

them had medium cosmopoliteness. All of them were procuring insecticides from the input dealers who were making regular availability of the insecticides to almost all the respondents. Majority of the respondents were having nil to partial knowledge of waiting period of insecticides used for control of fruit borer and white fly of tomato, brinjal and chilli.

Majority of the respondents 91.67 per cent were mixing more than one insecticides. All the respondents were adopting cultural practices and chemical practices of IPM. While adoption level of mechanical and biological practices of IPM was negligible

Correlation analysis revealed that the variables education, farming experience, annual income, and sources of insecticide were positively and significantly correlated at 0.01 level of probability and availability of insecticide was positively and significantly correlated with application pattern of insecticide by vegetable growers at 0.05 level of probability. In the case of adoption of IPM practices education, land holding, annual income, credit acquisition, source of information, contact with extension agents, risk orientation, source of insecticide, availability of insecticide and knowledge of waiting period of insecticide were positively and significantly correlated with adoption of IPM practices at 0.01 level of probability.

Multiple regression analysis revealed that two variables farming experience and annual income had positive and significant contribution towards for application pattern of insecticide by respondents at 0.01 level of probability. In the case of adoption of IPM practices, only land holding had positive and significant contribution at 0.01 level of probability and education, farming experience, source of insecticide had positive and significant contribution at 0.05 level of probability.

The respondents faced lack of technical knowledge of IPM practices and Non-availability of biopesticides & traps as the major constraints and suggested that extension agencies should conduct regular training for IPM practices and Input should be timely available in market (bio-agents and traps etc).

शोध ग्रंथ सारांश

अ) शोध ग्रंथ का शिर्षक	:	छत्तीसगढ़ के बलौदा बाजार–भाटापारा जिले के कृषको द्वारा सब्जी फसलों में कीटनाशी का उपयोग एवं उपयोग करने के तरीकों के अध्ययन।
ब) छात्र का पूरा नाम	:	चन्द्रकान्त दुबे
स) प्रमुख विषय	:	कृषि विस्तार
द) मुख्य परामर्शदाता का नाम एवं पता	:	डॉ. राजेश कुमार साहू सहायक प्रध्यापक, डीकेएस कृषि महाविद्यालय एवं अनुसंधान केंद्र, इ.गां.कृ.वि., भाटापारा
इ) उपाधि जिससे सम्मानित किया जाना है	:	कृषि विस्तार में स्नातकोत्तर (कृषि)

मुख्य परामर्शदाता के हस्ताक्षर

छात्र के हस्ताक्षर

दिनांक....03/08/2016

3/8/16
विभागाध्यक्ष के हस्ताक्षर

सारांश

यह शोधकार्य छत्तीसगढ़ राज्य के बलौदा बाजार–भाटापारा जिले में वर्ष 2015–2016 के दौरान किया गया। भाटापारा व सिंमगा विकासखंड के 8 गांव से 120 सब्जी उत्पादकों को उत्तरदाताओं के रूप में चुना गया। प्राप्त आंकड़ो को साक्षात्कार अनुसूची के माध्यम से व्यक्तिगत रूप से एवं पूर्व परीक्षण कर एकत्र किया गया है और उचित सांख्यिकीय विधियों का उपयोग कर विश्लेषण किया गया।

इस अध्ययन् के परिणामो से ज्ञात होता है कि उत्तरदाताओं में 30.83 प्रतिशत प्रायमरी स्कूल स्तर तक शिक्षित और 73 प्रतिशत उत्तरदाता संयुक्त परिवार में आते हैं। 21.67 प्रतिशत उत्तरदाताओं को सोलह से बीस साल का कृषि अनुभव था। अधिकतम (31.67%) उत्तरदाताओं के पास सीमांत आकार वाली जमीन व सभी के पास सिंचाई की सुविधा थी, जिस में से 75.83 प्रतिशत उत्तरदाताओं के पास सिंचाई के लिये खुद का बोरवेंल थी। सभी कृषि कार्य से जुड़े हुये थे एवं अधिकतम उत्तरदाता, 25001 से 50000 हजार रु. प्रतिवर्ष वार्षिक आय वाले वर्ग में पाये गये। 69.17 प्रतिशत उत्तरदाताओं ने ऋण सुविधा प्राप्त नही किया। सबसे अधिक (96.67%) उत्तरदाताओं द्वारा आदान विक्रेता से कीटनाशकों तथा उनके

उपयोग संबंधी सूचना प्राप्त की एवं ग्रामीण कृषि विस्तार अधिकारी व ग्रामीण उद्यान विस्तार अधिकारी से संपर्क किया। 60.00 प्रतिशत उत्तरदाताओं में मध्यम प्रकार के जोखिम संबंधित विचार पाया गया एवं आधे उत्तरदाताओं ने कहा की वे सप्ताह में कम से कम एक बार गांव एवं शहर से संपर्क रखते है।सभी किटनाशी दवा का आदान विक्रेता से क्रय करते थे जहां से 96.67 प्रतिशत दवा की पूती होती है। उन्हे टमाटर, बैंगन व मिर्च के फल भदक एवं सफेद मक्खी के नियंत्रण हेतु प्रयुक्त कीटनाशीयों के प्रतिक्षा अवधि के बाबत निरंक से आंशिक जानकारी थी।

ज्यादातर 91.67 प्रतिशत उत्तरदाताओं के द्वारा दो से अधिक दवाओं को मिला कर छिडकाव किया गया। उत्तरदाताआ द्वारा समन्वित कीट प्रबंधन के सस्य व रायायनिक विधियों का अधिकतम पाया गया। जबकी यांत्रिक व जैविक विधियों का अंगीकरण न्युनतम था।

सहसबध विश्लेषण (कोरिलशन कॉफिसिऐंट) मे पाया गया को शिक्षा, कृषि अनुभव, वार्षिक आय एवं कोटनाशी दवा के स्त्रोत, ये चारों चर 0.01 प्रतिशत स्तर पर सब्जी फसलो में कोटनाशी दवा का उपयोग करने के तरीकों के साथ साकारात्मक रुप से अत्याधिक सहसंबन्धित पाए गये और कोटनाशी दवा का उपलब्धता 0.05 प्रतिशत स्तर पर साकारात्मक सहसंबधित पाई गयी।

समन्वित कीट प्रबंधन के अंगीकरण के संदभ में शिक्षा, भूमि का रक्बा, वार्षिक आय, ऋण प्राप्ति, जानकारी के स्त्रोत, प्रसार संस्थाओं के साथ संपर्क, जोखिम का दृष्टिकोंण, कीटनाशी दवा का स्त्रोत, कोटनाशी दवा का उपलब्धता एवं समय अन्तराल ये दस चर 0.01 प्रतिशत स्तर पर समन्वित कीट प्रबंधन के अंगीकरण के साथ साकारात्मक रुप से अत्याधिक सहसंबन्धित पाए गये।

इस अध्ययन में सभी 14 चरों के साथ बहुपतिशमत विश्लेषण (मल्टिपल रिग्रेसन) करने पर केवल 2 चर अर्थात् कृषि का अनुभव एवं वार्षिक आय का 0.01 प्रतिशत पर सब्जी फसलो में किटनाशी दवा का उपयोग करने के तरीकों के साथ अत्यंत महत्वपूर्ण और साकारात्मक योगदान का पता चलता है। व समन्वित कीट प्रबंधन के अंगीकरण के संदभ में केवल एक चर भूमि का रक्बा का 0.01 प्रतिशत स्तर पर अत्यंत महत्वपूर्ण और साकारात्मक योगदान का पता चलता है और शिक्षा, कृषि का अनुभव एवं जानकारी का स्त्रोत को 0.05 प्रतिशत स्तर पर महत्वपूर्ण और साकारात्मक योगदान का पता चलता है

सब्जो में समन्वित कीट प्रबंधन के अंगीकरण में आने वाली सामान्य समस्याओं में अधिकतम उत्तरदाताओ ने समन्वित कीट प्रबंधन संबंधी तकनीकी ज्ञान की कमी व आदान की अनुप्लब्धता को बताया व सुझाव दिया की उचित प्रशिक्षण का नियमित आयोजन एवं आदान उपलब्ध कराना चाहीए।

CHAPTER-I
INTRODUCTION

Horticulture crops cover large varieties of fruits, vegetables, flowers, plantation and spice crops. Among these, vegetable cultivation is the major attraction to farmers as it is comparatively more remunerative than field crops. The wider adaptability of vegetables to different kinds of abiotic stresses like water, soil, weather, etc. offers enormous scope for growing vegetables in stress and waste land areas. They are also playing an important role in commerce and economy, particularly through export trade (Anonymous, 2011).

Vegetables are rich and comparatively cheaper source of carbohydrates, proteins, vitamins and minerals and they play an important role in balanced nutrition. Indian subcontinent is endowed with salubrious climate which permits growing of vegetables throughout the year. As per dietician, daily requirement of vegetables is 75 - 125 g of green leafy vegetables, 85 g of other vegetables and 85 g of roots and tubers with other food (Rai, 2014).

Most of the vegetables grown in India are vulnerable to be attacked by insect pests. The role of insecticide use has become critically important with modernization of agriculture in India. Modernization of agriculture implies the increased use of modern inputs such as chemical fertilizers, irrigation, quality modern seeds etc. But these provide a favorable climate for rapid growth of insects.

Globally, the total area under cultivation of vegetable in 2012-13 was 58,971,121 hectares, production of vegetable recorded 1,159,179,443 MT and productivity was recorded as 19.7 MT per ha. The highest production recorded 573,935,000 MT in China during 2012-13 and it ranks first in the world. India ranks second with a record production by 146,554,000 MT (Anonymous, 2014).

India's significant horticulture production is despite its comparatively lower productivity. Both in case of fruits and vegetables productivity of India was 11.6 and 17.6 MT per ha, respectively during 2010-11. In Chhattisgarh, the total area under vegetables is 377,212 hectares with production of 4,965,331 MT and an average

productivity is 13.1 MT per ha. An area of 79,167 hectares comes under tomato and brinjal crops in Chhattisgarh state with the production of 13,07,905 MT and productivity of 16.70 MT ha (Anonymous, 2013).

In Balodabazar-Bhatapara district, the total area under vegetables is 8325 hectares with production of 125853 MT. An area of 2439 ha comes under tomato, brinjal, cauliflower and cabbage with production of 47946 MT. Balodabazar-Bhatapara district has geographical area of 359,386 hectares, net sown area of 237,620 ha., irrigated land in kharif is 64,000 ha. and in rabi is 37,000 ha. Area under kharif crops 237,620 ha, while area under rabi crops is 82,990 ha. Croping intensity of the district is 132.32% with annual rainfall of 1013.21 mm (Anonymous, 2015 a).

According to FAO (Food and Agricultural Organization), "A pesticide is any substance or mixture of substances that are intended for preventing, destroying, controlling and mitigating any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm or otherwise interfering with the production, processing, storage, transport or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies". In general Pesticides are chemical substances used to suppress or kill animals, plants, insects and pests in agricultural, domestic and institutional settings. The main groups of commonly used pesticides include herbicides, insecticides, fungicides, fumigants and rodenticides.

Integrated pest management (IPM) is an ecological approach to managing pests by combining biological, cultural, and chemical tools to minimize economic, health, and environmental risks (Vanderman *et al.*, 1994). Zehnder (1994) reviewed the 150-year history of pesticide use in vegetable crops and summarized constraints and examples of successful adoption of IPM practices. Although IPM tactics have been used to varying degrees during the past 100 years, formal strategies were not well recognized nor crafted into practices until the 1970s. Pest management in vegetable crops had not received the same level of attention as in agronomic crops because of the vast number of vegetable crops, diversity in production systems and arthropod

complexes (Capinera, 2001), and lower investments in research and educational efforts.

Over the period 2007 to 2008, herbicides ranked the first in three major categories of pesticides (insecticides, fungicides, herbicides). Europe is now the largest pesticide consumer in the world, followed by Asia. Most of the pesticides worldwide are used to fruit and vegetable crops. Worldwide, about 3 billion kg of pesticides is applied each year with a purchase price of nearly $40 billion (Pan, 2003). The losses due to Insects are 13%, plant pathogens 12%, and weeds 12%. (Pimentel, 1997).

The estimated demand of pesticide in India was of 55590 MT and in Chhattisgarh was of 800 MT in the year 2012-2013. In India there is a trade-off between agricultural production and increasing soil, air and water pollution and associated health hazards (Gupta, 2004 and Agoramoorthy, 2008)

Currently, India is the largest producer of pesticides in Asia and ranks twelfth in the world for the use of pesticides. Although the average consumption of pesticides is far lower than many other countries, the problem of pesticide pollution is serious in India. Unfortunately, India is one of the few remaining countries still producing and using some of the chlorinated pesticides such as DDT and lindane (Vijgen *et al*., 2011).

Regarding the pesticide share across agricultural crops, cotton account for 45% followed by rice (25%), chillies/vegetables/fruits (13-24%), plantations (7-8%), cereals/millets/oil seeds (6-7%), sugarcane (2-3%) and other (1-2%) (Abhilash and Singh, 2009).

Pesticides are widely used throughout the world, especially in agriculture for crop protection. Pesticides poisoning is a major challenge and an important public health problem worldwide and it is more prevalent in developing countries like India. The use of personal protective’s can reduce a chronic health hazards related to pesticides to the sprayer but due to failure in adopting proper preventive measure during spraying may cause skin disease, respiratory problem and constant long term

exposure results in various health problems like neurotoxicity, neruoendocrinotoxicity, and carcinogenicity, etc.

In commercial cultivation vegetable crops are grown intensively; sometimes even two or more crops are taken in a season. Introduction of high yielding technology creates microclimatic conditions which favours the rapid multiplication of insect pest and diseases. However for controlling these losses excessive and indiscriminate use of pesticides not only increases the cost of production but also results in many human health problems and environmental pollution.

According to (World Health Organization) WHO estimates, one million cases of pesticide poisoning occur every year and consequently there are 20000 deaths globally (Nasir, 1999). The most damaging ecological disturbance of injudicious use of pesticides is the existence of high concentration of pesticide residues in food chain, including cereals, pulses, vegetables, fruit, milk, milk products and water.

Pesticides came in to extensive use in agriculture and public health as early as 1944. They are now used on fruits, vegetable and other crops on a massive scale. Benefits reflected in terms of enhanced farm productivity and control of vector borne diseases were so overwhelming that the real awakening to the problem of toxic residues left by pesticides come into sharp focus only around 1960.

The problem of contamination of our food commodities; especially fruits and vegetable by pesticide residues constitutes one of the most serious challenges to public health. The hazards of toxic residues can be considerably reduced if pesticides are used in accordance with “good agricultural practice”. The information on the levels of pesticide residues occurring in food commodities is essential and can be obtained through regular monitoring procedures.

The extensive and indiscriminate use of these chemicals on vegetables posses serious residue problems, which are hazardous for human and animal health, natural enemies and for environment. Pests, including insects, mites, pathogens (disease causing organisms), weeds, nematodes, rodents and others significantly contribute to high farm production costs and reduce quality and yields (Henneberry *et al*.,1991).

The use of insecticides, however, carries several dangers. Non-optimal and non judicious use of insecticides may result in serious problems related to crop production and certain externalities like pollution and health hazards. Fresh vegetables are an essential part of a healthy diet as it is an important source of vitamins and minerals. However, vegetables can also be a source of poisonous toxic substance-pesticides (Knezevic and Serdar, 2008). Over 1000 compounds may be applied to agricultural crops in order to control objectionable moulds, insects and weeds (Ortelli *et al*., 2006).

Pesticides' striking effort in preventing, crop loss and controlling vectors of diseases have led to their acceptance and expanded use throughout the world (Sharp and Peter, 2005). However, the potent chemicals for killing pests have elevated anxiety that they are agents of human diseases and environmental pollution. It has been observed that their long term, low dose exposure is increasingly linked to human health effects such as immune-suppression, hormone disruption, diminished intelligence, reproductive abnormalities and cancer (Wiles *et al.*, 1998). Pesticide residues in food are global problems (Abhilash and Singh, 2009).

Pesticides classified as being extremely or highly hazardous by FAO and WHO, including barred by some countries, unrelenting used in developing countries (WHO, 2003).

Farmers use chemical insecticides as it is easy to use, easily available and fast in action. No matter, it kills harmful or useful insects. There are few safer pesticides, but their use has been limited as many farmers are unaware about these types of pesticides. Majority of them are unaware about the type of pesticide, safety precautions, level of precautions, level of poisoning, and potential hazards to human health and environment. Low education levels of the rural population, lack of information and training on pesticide safety, poor spraying technology, and inadequate personal protection during pesticide use have been reported to play a major role in causing hazards.

Illness suffered by one or more members of household can result from exposure to pesticides. Ill health may affect the overall performance and the productivity of the family farm since labour input in agriculture is normally supplied

supplied by households especially in small-holder agriculture in developing countries. The level of health costs has been estimated in some studies in other countries and is believed to be closely related to the level of socio-economic development and the context of the prevailing culture (Ajayi, 2000).

Pesticide is so indispensable in agricultural production. About one-third of the agricultural products are produced by using pesticides (Liu *et al*., 2002). Most pesticides are not spontaneously generated. Most of them are high toxic to humans and the environment. Pesticides and their degraded products would flow into the atmosphere, soils and rivers, resulting in the accumulation of toxic substances and thus threatening human health and the environment. The environmental pollution caused by pesticides in Asia, Africa, Latin America and the Middle East and Eastern Europe is now serious.

Even in earlier years the residuals of DDT, lindane and dieldrin in fish, eggs and vegetables have been much beyond the safe range in India (Wu, 1986). In India the DDT content in human body was ever the highest in the world.

Looking to this aim, the present study entitled **"A study of insecticides use and application pattern on major vegetable crops by the farmers Of Balodabazar-Bhatapara district of Chhattisgarh"** was undertaken during the year 2015 – 16 with the following Objectives:

1. To study the Socio-economic profile of vegetable growers,
2. To assess the existing management and application pattern followed by the respondents for important insect-pests of major vegetables,
3. To assess the use and application knowledge of insecticides by the respondents,
4. To study the extend of adoption of IPM practices by the respondents,
5. To identify the constraints faced by the respondents in adopting IPM practices and their suggestions to overcome them.

LIMITATION OF THE STUDY

1. The present study faced the limitations of the time and the resources to be encountered by the researcher as a student scholar.
2. The items included in the study for detailed investigation are also limited because it is not possible to cover all the segments in such a short time.
3. Although every effort was made to make the best use of standardized tools and techniques of data collection, yet their accuracy may not be guaranteed.
4. As present study is based upon the expressed opinions of the respondents and individual attitude, which was perceived by them, hence biasness might have occurred as it happens in most of the cases in such type of field study.
5. Although all possible precaution were taken to make the study precise, objective and reliable and as the present study was restricted to vicinity of Balodabazar-Bhatapara district. Therefore, the trend of finding might not give true picture of those areas, which has not resembled the present setting of locations.

LAYOUT OF THE STUDY

The present study has been presented in several chapters. The first chapter is devoted to introduction, which has been presented in brief. In the second chapter a comprehensive reviews of literature has been dealt with. The third chapter deals the research methods and techniques used for the study along with its analysis and interpretation of data. The major findings and suitable discussion pertaining to the result have been incorporated in the fourth chapter. While in the fifth chapter summary conclusions along with implication have been discussed. The relevant literatures consulted and cited in the body of the presentation have been enlisted in references just after the summary and conclusion. At the end of dissertation, the structured interview schedule has been displayed under the “Appendix”.

CHAPTER-II

REVIEW OF LITERATURE

Review of literature is an important component of any research work, without which the research is considered to be incomplete. Reviewing the past literature helps the researcher to put his / her effort in desirable direction and it helps the researcher to know the subject matter. Through review, researcher comes to know about the methods, procedures and techniques as well as results of past studies. It provides clues and guidance throughout the research process. Steady efforts were made to compile research findings of the research studies possessing more or less similar characteristics. The main purpose of this chapter is to present some of the findings of research studies, which are related to the application pattern of insecticide by vegetable growers, adoption of IPM practices and other relevant works carried out in India and abroad.

A brief account of related studies has been furnished under the following heads:

2.1 Socio-personal characteristics

2.2 Socio- economic characteristics

2.3 Communicational characteristics

2.4 Socio-psychological characteristics

2.5 Technological characteristics

2.6 Application pattern of insecticide by vegetable growers

2.7 Adoption of IPM practices

2.8 Constraints

2.9 Suggestions

2.1 Socio-personal characteristics

2.1.1 Age

Patel (2008) observed that the majority of the respondents (72.00%) belonged to middle age group (36 to 55 years), about 18.00 per cent respondents were of young

age group (up to 35 years) and 10.00 per cent respondents were of old age group (more than 55 years). Thus, it may be concluded that the majority of soybean growers belonged to middle age group (36 to 55 years).

Kumar and Rathod (2013) conducted study on adoption behavior of farmers about recommended technology of soybean and observed that they were distributed in middle (36.00%), young (33.33%) and old (30.67%) age category.

2.1.2 Education

Kushwaha (1996) found that majority of the tomato growers (44%) wereeducated formal schooling level.

Ruyosu and Kharub (2003) reported that majority of the farmers belonged to primary level of education group.

Koli (2003) revealed that majority of the onion growers were educated up to primary and secondary school.

Hanumanaikar *et al.* (2006) noted that the majority of the respondents (56.00%) were educated up to primary and middle school, followed by 18.00 per cent of the respondents were educated up to high school and only 4.00 per cent of the respondents had college education. While remaining 22.00 per cent of the respondents were illiterate.

Roy and Chowdhary (2007) revealed that the maximum number of the vegetable growers (33.33%) were educated up to primary school level, followed by 30.00 per cent of the vegetable growers educated up to middle school level, 16.67 per cent vegetable growers were higher secondary passed and 10.00 per cent vegetable growers educated up to graduate and post graduate level, 6.67 per cent of the vegetable growers were educated up to secondary level and 3.33 per cent of the vegetable growers were illiterate.

Nagadev and Venkataramaiah (2007) found that about 16.67 per cent sample respondents were illiterates, while 83.33 per cent of sample respondents were literates in different groups.

Mao *et al.* (2008) concluded that most families heads were able to read and had studied in the primary school, while a few of them had studied in the secondary school and only a family had studied in high school education.

Singh *et al.* (2010) revealed that education level of farmers was found to have positive and significant contribution with adoption of improved vegetable cultivation technology.

Lakra (2011) found that the most (25.62%) of selected hybrid rice cultivators had primary level of education, followed by 20.62 per cent of selected hybrid rice cultivators were high school passed and 16.89 per cent had passed middle school. However, 15 per cent had passed higher secondary, 11.25 per cent respondents were college passed and only 10.62 per cent respondents were illiterate. The findings revealed that most of the respondents in the study area had passed primary level of education.

Pal (2011) revealed that the average literacy rate of lac grower's family head was 73 per cent, 39 per cent family head had education up to primary level, 25 per cent had education up to high school, 6.0 per cent had education up to intermediate level and only 3.0 per cent had education up to degree level.

Hossain *et al.* (2011) stated that 53.33 per cent had education ranged from primary to secondary, far below the national average.

Singh *et al.* (2013) observed that 26.15%, 22.30% and 16.15% of the respondents had primary level, middle level and matric or above level education, respectively. Howbeit, rest of the respondents (35.38%) was illiterate. The educational level of the study area was higher than that of national level and it might be due to the better educational facilities available in the area.

2.1.3 Caste category

Khare *et al*. (2002) noted that majority of vegetable growers had belonged to OBC category.

Lanjewar (2009) revealed that the majority of the respondents (92.86%) belonged to general caste, followed by 7.14 per cent who belonged to other backward

class, and none of the respondents were found in the category of scheduled tribes and scheduled caste.

2.1.4 Family type

Parganiha (2002) reported that majority of migrant (60%) and non-migrant (70%) respondents belonged to joint family system. The remaining respondents lived in nuclear families.

Suryawanshi (2009) found that the maximum (63.33%) number of the finger millets growers had joint family.

Upadhyay & Desai (2011) stated that majority (68.33%) of the respondents were from joint family.

Hai *et al.* (2011) revealed that maximum respondents (53.50%) were having joint type of family.

Rathod *et al*. (2011) revealed that majority of farm women lived in joint family (65%) while 35 per cent lived in nuclear family.

2.1.5 Farming Experience

Saxena (2003) observed that majority of the respondents (51.38%) were having 11 to 20 years of tomato farming experience, whereas 41.66 per cent of the respondents were having up to 10 years of tomato farming experience and only 6.94 per cent of the respondents were having more than 20 years of tomato farming experience as low and high category of experience.

Sahu (2010) reported thatthe selected respondents were enough experienced in farming activities as 65 per cent respondents reported the experience of 11 to 30 years and 32 per cent reported the experience of 31 to 50 years.

Kumar and Rathod (2013) revealed that about 62 per cent respondents found to have medium farm experience (8-13 year) followed by the respondents (25.33%) of high experience.

Bèye (2014) reported as ant the requirement of a transition period of 5 to 10 years to build the fundamentals of sustainable seed systems through the structuring of the seed sector and the creation of appropriate conditions to ensure food security,

enriched biodiversity and sustainable production. With climate change, local traditional seed systems, as well as integrated seed approaches, will likely play a more important role to improve the performance of agricultural systems while ensuring farmer autonomy.

2.2 Socio- economic characteristics

2.2.1 Land holding

Gupta (1999) concluded that 52.66 per cent of the respondents families had a land holding up to 2.5 acres followed by 41.33 per cent with land holding of 2.6 to 7.5 acres (medium farms) and only 9.00 per cent had land holding of more than 7.5 acres.

Mishra (2000) found that majority of migrants families belonged to small andmarginal category.

Dongardive (2002) stated that nearly one- third (30.00%) of the chilli respondents were in the marginal group, followed by 26.67 per cent, 23.33 per cent and 20.00 per cent of them who had large, small, and medium size of land holding, respectively.

Parganiha (2002) reported that 16.25, 7.50 and 3.75 per cent migrants were found as small, medium and big farmers respectively. Whereas, the percentage of non-migrants for land holding were found 12.50, 27.50 and 7.50 per cent as marginal, small and big, respectively.

Vathsala (2005) revealed that 38.9 per cent of the cabbage growers had a land holding of 2.5 to 5.0 acres (small farmers) followed by 43.3 per cent of the respondents who had land holding of more than 5.0 acres (big farmers) and only 17.8 per cent of the respondents had land holding up to 2.5 acres (marginal farmers).

Nagadev and Venkataramaiah (2007) reported that 39.33 per cent of respondents belonged to semi medium category, 20.00 per cent belonged to medium land holding, while 26.67 per cent possessed small land holding, 12.00 per cent possessed marginal land holding and only meager number (2.00%) had large land holding.

Roy and Chowdhary (2007) revealed that the majority of the vegetable growers (96.67%) belonged to the marginal farmer category having up to 1 ha land, followed by 3.33 per cent of the vegetable growers belonged to large farmer category and none of vegetable growers belonged to small and medium farmer category.

Mewara and Pandya (2007) indicated that the majority of the tomato growers (58.00%) possessed small size of land holding, followed by 26.00 per cent and 16.00 per cent of them who had medium and large size of land holding, respectively**.**

Ram *et al*. (2010) revealed that the majority of vegetable growers (95.33%) were having land holding between 0-2.5 ha, followed by 4.67 per cent respondents in more than 2.5-5.0 ha.

2.2.2 Irrigation facility

Sharma (1993) revealed that the majority of the respondents (50.00%) adopted tube well for irrigating their wheat crop and 42.20 per cent were using canals as a source of irrigation.

Mukim (2004) found that the highest coverage of area under irrigation was through tube well (42.19%) followed by Canal + well (32.81%). Canal + tubewell and pond contributed 23.44 and 1.56 per cent area under irrigation, respectively.

Prajapati (2010) revealed that cent per cent of the respondents (100%) had utilized drip irrigation method for banana production. None of the respondents were found to use any other method of irrigation for banana production.

2.2.3 Occupation

Patel (2008) observed that maximum number of the respondents (52.00%) was involved in farming, followed by farming + labour (14.00%), farming + service (12.66%), farming + animal husbandry + service (7.34%) farming + others (8.00%) and farming + occupation + service (6.00%), as their main occupation. Occupations were found to have no significant and negative relationship with technological gap.

Kumar and Munjunath (2008) revealed that the majority of the vegetable growers (88.75%) were dependent only on farming.

2.2.4 Annual income

Balamatti (1993) reported that majority of the respondents were in the medium income category (66.66%) drawing gross income ranging between Rs. 6400 to Rs. 15000 per year.

Sunil (2004) conducted a study on tomato growers in Belgaum district of Karnataka and found that majority of the respondents belonged to medium income category (48.33 per cent).

Patel (2005) revealed that an equal number (34.00%) of the chilli growers belonged to medium and low annual income group, respectively,and 32.00 per cent of them had high annual income of Rs. 2 lakhs and above.

Khan *et al.* (2007) found that the majority of respondents (64%) came into medium income category while, rest were divided into low (20%) and high income group (16%).

Deshmukh *et al.* (2007) found that priority of respondents (81.59%) fall under medium level of income having Rs. 1,001 to 37,000 per annum.

Chobitker (2007) revealed that majority (36.67%) of cole growers were having medium income.

Lokhande (2010) noted that maximum percentages (53.34%) of tomato growers were having medium income.

Meena *et al.* (2012) revealed that majority of farmers belonged to middle income group i.e. between Rs. 1.50 to Rs. 5.75 lakh per annum. This income group alone constituted 72.50 per cent of the total sample. Further, 11.50 and 16.00 per cent farmers were from low and high income groups, respectively.

Deshmukh and Deshmukh (2013) reported that majority of respondents were found in medium category in annual income (64%) and annual incomes were significantly associated with constraint level.

Pradhan (2014) observed that majority of respondents (52.08%) were having annual income in the range of Rs. 50001 to 100000 (medium level of annual income), followed by 27.08 per cent of the respondents under the income range of Rs. 100001 to 200000 (moderate level of annual income),

2.2.5 Credit acquisition

Pandey *et al.* (2004) revealed that majority of the respondents (66.25%) had not acquired the credit, whereas, only 33.75 per cent respondents had acquired the credit.

Kushwaha (2005) found that majority of the respondents (62.50%) had not acquired the credit, whereas, only 37.50 per cent respondents had acquired credit. Out of total credit acquired, the majority (82.22%) had taken short-term credit followed by mid-term credit (11.11%) and long-term credit (6.67%).

Dubey (2008) revealed that majority (63.07%) of the respondents had not acquired credit, whereas, only 36.93 per cent of respondents had acquired credit. Out of total credit acquired respondents (39.58%) had taken the medium term credit, followed by short-term credit (37.51%) and long-term credit (22.91%). The majority of the respondents had acquired medium term credit while, minimum percentage of respondents had acquired long-term credit.

Dhruw (2008) indicated that the majority of the respondents (50%) had taken loan from nationalized bank.

Lanjewar (2009) revealed that the majority of the respondents (57.14%) had not acquired the credit, whereas only 42.86 per cent respondents had acquired the credit. Out of the credit acquiring respondents (total 60) the majority of the respondents (55.00%) had taken the short term credit, followed by medium term credit (23.33%) and long term credit (21.67%).

Lakra *et al*. (2012) found that majority of the respondents (65.63%) had acquired credit for agriculture. Out of total credit acquired farmers (105), it was further noted that 61.90 per cent respondent had preferred to take the short term loan credit (6 months), followed by 24.77 per cent of respondents had taken medium term loan credit (6 – 18 months) and only 13.33 per cent of the respondents had taken long term credit (6 months – 5 years). The credit facilities were available to 84.77 per cent respondents very easily and quickly, followed by 15.23 per cent respondent faced some difficulty to obtain credit. As regards to source of credit, the majority of the respondents (67.61%) had obtained credit from co-operative society, followed by

18.10 per cent had taken credit from regional rural bank, 12.76 per cent obtained it from nationalized bank, 1.91 per cent had obtained credit from money lender and 0.96 per cent had obtained credit from friends/ neighbours/ relatives and others.

2.3 Communicational characteristics

2.3.1 Sources of information

Narbaria (2013) revealed that in the study area, majority of the respondents (75.39%) had found information regarding rice cultivation from Rural Agriculture Extension Officer (RAEO). He also revealed that 60.31 per cent of the respondents had obtained the information from friends, followed by 48.41 per cent of respondents had obtained the information from T.V., 34.12 per cent had obtained the information from progressive farmer, 31.74 per cent of respondents obtained the information from neighbour, while 28.57 per cent of the respondents had obtained the information regarding rice cultivation from relatives and farmer fair, 27.77 per cent of the respondents had obtained the information from agriculture store, followed by about 10.31 per cent of the respondents used ADO, news paper and Kisan mitra as source of information, 9.52 per cent exhibition, 8.73 per cent Agriculture scientist, 7.14 per cent Sarpanch, 5.55 per cent Radio and 4.76 per cent Agriculture Magazines.

Painkra (2014) revealed that majority (98.33%) of respondents got information regarding black gram cultivation from friends & neighbors, followed by 97.50 per cent using Rural Agriculture Extension Officer (RAEO). About 97 per cent respondents collected information from relatives, 75 per cent from Senior Agriculture Development Officer (SADO) and 74.16 per cent from Agriculture retailers. In addition to aforesaid sources, about 47 per cent respondents received information from kisan mitra, 35.85 per cent from farmers' fare, 20 per cent from training programme, 19.16 per cent from sarpanch/panch and progressive farmers, 15 per cent from television and 12.50 per cent from radio.

Dhruw (2014) revealed that in the study area, majority of the respondents (82.63%) had found information regarding summer rice cultivation from R.A.E.O. The study also revealed that, 79.16 per cent of the respondents had obtained the

information from progressive farmer, followed by 59.72 per cent of respondents had obtained the information from friends.

2.3.2 Contact with extension agents

Narbaria (2013) found regarding contact with Agriculture college/university, majority of respondents (90.48%) had never contact, while only 9.52 per cent of them had sometimes contact. Regarding contact with NGO, the majority of respondents (90.41%) had never contacted, while only 1.59 per cent of them had sometime contact.

Painkra (2014) observed that 63.33 per cent respondents were often contacts with Rural Agriculture Extension Officer (RAEOs).

Dhruw (2014) reported that 56.25 per cent of the respondents often contact with R.A.E.Os, followed by 31.94 per cent of the respondents regular contact and 11.18 per cent of the respondents rarely contact with RAEOs.

2.4 Socio-psychological characteristics

2.4.1 Risk orientation

Vasava (2005) revealed that nearly two-third (63.33%) of the respondents had medium risk orientation, followed by 30 per cent and 6.67 per cent of them who had high and low level of risk orientation, respectively.

Veeraiah (2005) observed that nearly three-fifth (57.34%) of the respondents had medium level of risk orientation, while 37 per cent and 4.66 per cent had low and high level of risk orientation.

Pradhan (2014) concluded that majority of the respondents (73.61%) had medium level of risk orientation, followed by 15.28 per cent of them had low level of risk orientation and 11.11 per cent of the respondent had high level of risk orientation.

Painkra (2014) reported that majority (86.66%) of respondents had medium level (19 to 23 score) of risk orientation followed by 10.884 per cent of had low level (less than 19 score) of risk orientation, while only 2.50 per cent of respondents were having high level (more than 23 score)

2.4.2 Cosmopoliteness

Sahu (2006) revealed that maximum number of respondents (farmers and women) belonged to medium level of cosmopoliteness category.

Rajni (2006) found that the maximum member of respondents (44.45%) had medium level of cosmopoliteness, whereas 34.12 per cent respondents has low level and 21.43 per cent respondents were having high level of cosmopoliteness.

Yadav (2007) revealed that majority of trained (57.56%) and untrained farmers (68.89%) were having medium level of cosmopoliteness. It was noted that 15.56, 22.22 per cent of trained farmers had low and very high level of cosmopoliteness, respectively. Similarly, 22.44 and 0.00 per cent of untrained farmers had low, high and very high cosmopoliteness, respectively.

Dwivedia (2013) revealed that the majority of the respondents (78.13%) had medium level of cosmopoliteness, followed by 15.00 per cent of the respondents had low level of cosmopoliteness, remaining 6.87 per cent of the respondents were found in high level of cosmopoliteness category

2.5 Technological characteristics

2.5.1 Source of insecticide

Jing (2015) reported that majority of the farmers (90.8%) obtain their pesticides from local agrochemical input dealers. This is not surprising as the majority of the respondent base is unable to distinguish between different pest and disease pathogens and control measures such as insecticides and fungicides and rely on information and advice provided by local agro-input dealers for the decision making.

2.5.2 Knowledge of waiting period of insecticide

Jeyanthi and Kombairaju (2005) noticed that more than 89% of the farmers in the selected GN division harvest the produce before the recommended pre-harvest interval. Among the selected respondents, 100% of farmers from Thettativu-south, Kaluthavalai-4 and Shanthipuram GN divisions harvest the produce before the period of pre-harvest interval. In the study area, it was a regular practice to spray pesticides

immediately before or after the harvest. When the pesticide spray was done immediately before harvesting, the danger of pesticide residue on produce was more.

Mohiuddin *et al.* (2009) opined that insecticide application depended upon the season. During rainy season farmers' sprayed insecticides every day in brinjal and country bean at Chittagong region while in the winter season, interval was more than 5 days. On the other hand for both the region, maximum farmers (82% & 87%) spray interval was more than 3 days in brinjal and yard long bean.

Miah *et al.* (2014) reported that pesticide application in the study area as well as whole country depends upon seasons, crop types, infestation rates and vegetables for instance, in the rainy season pesticides are usually used each day or in every alternative day. In addition, fast growing vegetables (e. g., brinjal, cabbage, cauliflower, cucumber, lady's finger, yard long bean, tomato etc.) that are to be harvested in alternative days or two-three days in a week receive indiscriminate use of pesticides. The current study found that on an average 4%, 19%, 18% and 58% respondents spray pesticides over their vegetable fields in each day, alternative day, two and one times in a week respectively

Jing (2015) revealed that most vegetable farmers harvest their produce within 7 days after spraying pesticides, with some harvesting their produce on the same day after spraying, thereby endangering the lives of consumers.

2.6. Application pattern of insecticide by vegetable growers

Jipanin *et al.*(2001) found in the survey that farmers applied pesticides by both single and mixed method. Few farmers (about 9%) apply one chemical at a time. However, majority of (91%) the farmers applied the pesticides in mixtures. Farmers believe that a "cocktail" application is always more effective and reduce labour cost.

Jing (2015) reported that most farmers mix two or more pesticides together without considering their compatibility or active ingredients but rather rely on the perceived efficacy based on their trade names. Mixing of pesticides was encouraged by the farmers' desire to have rapid knockdown of pests or the economics of managing both pests and diseases at a single spraying operation. This idea is however,

questionable, at least as practiced, because the combinations used could be indiscriminate and incompatible resulting in ineffectiveness of the pesticides to manage the pests and diseases.

2.7. Adoption of IPM practices

Vathsala (2005) revealed that majority of the respondents (60.00%) were high adopters, 28.9 per cent of the respondents were medium adopters and 11.1 per cent of the respondents were low adopters of integrated pest management practices in cabbage.

Shrivastava (2005) found that majority of the respondents (63.75%) had medium level of adoption regarding control measure practices of various rice diseases, whereas 18.13 per cent and 18.12 per cent of the respondents had low and high level of adoptions, respectively.

Raghuwanshi (2005) observed that the highest numbers of respondents (63.75%) were having medium level of adoption regarding control measures of various insect pests in rice crop, followed by low level of adoption category which comprised of 20.00 per cent respondents, while only 16.25 per cent of the respondents were found in high level of adoption category.

Patel (2006) revealed that more than half (56.00%) of the pigeon pea growers had medium level of adoption, followed by low and high level of adoption with 24.00 and 20.00 per cent of the pigeon pea growers, respectively.

Reddy (2006) indicated that 59.17 per cent of farmers were noticed in medium adopter group of IPM practices of cabbage crop. whereas 15.00 per cent of them were noticed in high adoption category only.

Gandhi *et al.* (2008) observed that 34.67 percent of farmers were under low adopter group of IPM practices of tomato crop with mean score of 17.3 whereas 42 per cent of farmers were under medium adopters group with mean score of 19.2. However, only 23.33 per cent of the respondents were of high adopter category with mean score of 21.04.

Shori (2011) found that the majority of respondents (71.25%) had medium level of adoption about control measure practices of various weeds of rice crop, whereas 16.25 and 12.50 per cent of them had low and high level of adoption, respectively.

Dayaram *et al.* (2012) indicated that 60 per cent respondents had medium level of adoption of IPM practices while equal per cent of respondents (20%) had high and low level of adoption, respectively.

Rai (2014) concluded that maximum number of the respondents (66.67 %) showed medium level of adoption regarding management practices of key insect-pests of brinjal and tomato crops, whereas 10.00 per cent of the respondents reported high level of adoption. Medium to high adoption may be due to the fact that the respondents were educated, belonged to higher income group and better utilization of information sources and better orientation towards scientific technologies etc.

2.8 Constraints

Vathsala (2005) revealed that non-availability of IPM materials, lack of technical guidance, non-availability of bio-pesticides, non-availability of pheromone traps, non-availability of NPV, lack of knowledge about trap crop system, price fluctuation, high cost of labour, lack of subsidy, lack of labour and lack of interest by the farmers about IPM were the constraints faced by the farmers.

Kumari (2012) revealed that the respondents were facing number of constraints that restricted their action towards adoption of IPM practices. Lack of knowledge, lack of skill, the laborious and complex nature of IPM practices and non-availability of inputs and tools of IPM were the major constraints reported by the respondents. Small farm size and lack of information about recent pest management strategies, extension services, involvement of IPM experts, community participation were also reported by respondents as the major constraints.

Sarthi (2013) revealed that the highest percentage of respondents (85%) were of the opinion that lack of technical knowledge regarding IPM practices were the major constraints ranked 1st, followed by lack of co-operation among farmers for

adopting IPM (81.66) IInd, lack of proper training conducted for adopting improved IPM practices (60.00%) IIIrd in ranked, scarcity of labour in peek period of operation (60%) IVth in ranked, higher cost of pheromone traps ranked Vth.

Kumar *et al.* (2013) reported that twenty per cent considered non availability of bio-pesticides and fungicides as another constraint in adoption of IPM technologies.

Satya gopal *et al.* (2014) indicated that lack of knowledge was perceived as the major constraint in adoption of IPM technologies in rice and was ranked first by the rice farmers. Trichogramma, Pheromone traps, Light traps, Clipping of leaf tips, dipping of nursery bundles in insecticidal solution were the major technologies being not adopted or discontinued by the rice farmers because of Lack of proper knowledge in those technologies. This might be due to fact that the above technologies require more comprehension for its adoption by the farmers.

2.9 Suggestions

Raghuwanshi (2005) reported that majority of the respondents (78.75%) suggested that the facility of training should be given regarding different control measure of various insect pests in rice crop, followed by 78.12 per cent suggested that the proper precaution should be taken during the use of insecticides, subsidy facilities should be increased on plant protection aspects.

Shrivastava (2005) reported that the main suggestions given by the respondents were training should be given regarding different control measure practices of various rice diseases, fungicides should be available at subsidized rate locally, spurious agro-chemicals selling should be strictly banned, proper precaution should be taken during the spraying of fungicides.

Shori (2011) observed that weedicides should be made available at low cost at village level which emerged as the main suggestion as reported by 75.00 per cent of the respondents.

Singh (2013) observed that herbicides should be available at low cost at village level which emerged as the main suggestion as reported by 75.34 per cent of the respondents. The other suggestions were free distribution of herbicides for *Parthenium*

weed control (67.96%), labour problems should be managed timely (53.12), increase knowledge in village level about harmful effects of *Parthenium* weed (50.78), training should be given to farmers regarding different control measure practices of *Parthenium* weed (35.15), RAEO's and other agricultural officers should frequently visit the villages for giving appropriate guidance to the farmers (32.03), modern agriculture equipments should be provided for weed control and other agricultural operations (28.12), certified seeds and fertilizer should be made available on time at village level (23.43), good quality herbicides should be provided on time (21.09), selling of expired herbicides *etc*. should be banned by admistration (15.62) and biological weed control method should be increased for controlling the *Parthenium* weed (6.25).

Sarthi (2013) revealed that the majority of the FFS trained farmers (83.33%) suggested that extension agent or agency should convey right information at right time and technical knowledge regarding use of IPM materials like Neem Seed Kernal Extract (NSKE) and pheromone traps etc.

CHAPTER-III

MATERIALS AND METHODS

This chapter covers precise method and procedure followed during the course of research work as well as preparation of manuscript. The blueprint used in carrying out investigation has been outlined in this chapter. The bifurcation of research methodology adopted is given under following heads:

3.1 Location of the study area

3.2 Sample and sampling procedure

3.3 Variables of the study

3.3.1 Independent variables

3.3.2 Dependent variables

3.4 Operationalization of independent variables and their measurement

3.5 Operationalization of dependent variables and their measurement

3.6 Constraints

3.7 Suggestions

3.8 Type of data

3.9 Developing the interview schedule

3.9.1 Validity

3.9.2 Reliability

3.10 Method of data collection

3.11 Statistical analysis

3.1 Location of the study area

Chhattisgarh State consists of three Agro-Climatic Zones i.e., Chhattisgarh Plains, Bastar Plateau and Northern Hills. Balodabazar-Bhatapara district comes under Chhattisgarh Plains Zone.

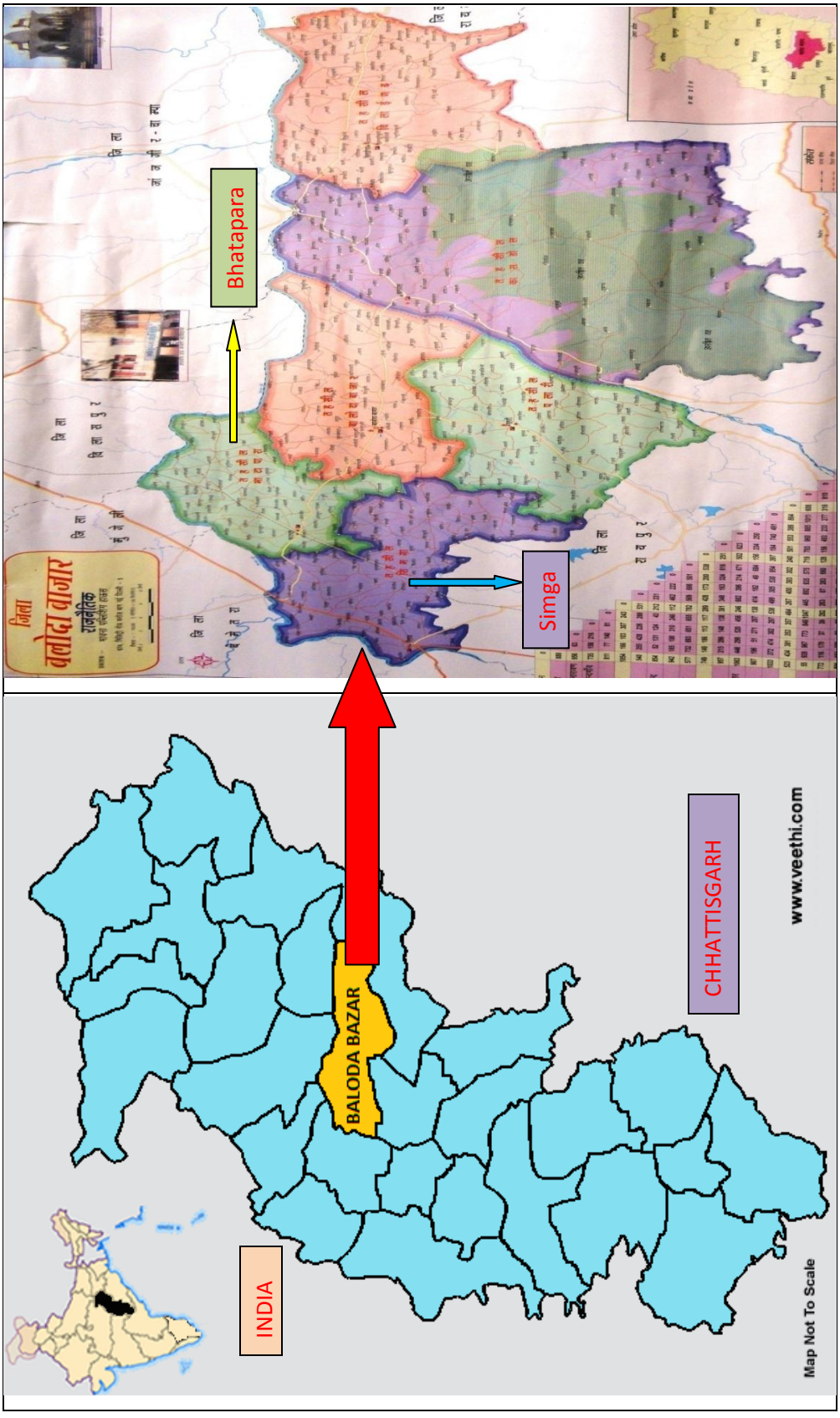

Fig.: 3.1 - Map of the study area

3.2 Sample and sampling procedure

3.2.1 Selection of district

The Chhattisgarh state consists of 27 districts, out of which Balodabazar-Bhatapara district was purposively selected because the district is having a promising prospective for vegetable cultivation.

3.2.2 Selection of blocks

Balodabazar-Bhatapara district consists of six blocks namely; Balodabazar, Bhatapara, Simga, Palari, Bilaigarh, and Kasdol. Out of the six blocks, Bhatapara and Simga blocks were purposively selected for the study, as the maximum area under vegetable cultivation is under these two blocks only (Anonymous, 2015b).

3.2.3 Selection of villages

For the study, a list of those villages was prepared, where vegetable cultivation was more prevalent and were having maximum area under vegetable cultivation in both the blocks, with the help of Departments of Horticulture and Agriculture, Government of Chhattisgarh. Thereafter, a total of eight villages, four villages from each block, were randomly selected for the study. The villages selected from the Bhatapara block were Tikuliya, Dhurrabandha, Tarenga and Karhi Bazar whereas Simga, Kachlon, Jaroud, and Marrakona were selected from the Simga block. In this way, a total of eight villages were selected for the study.

3.2.4 Selection of respondents

A list of the farmers involved in vegetable cultivation from each villages were prepared with the help of RHEOs / RAEOs of the Department of Horticulture and Agriculture, in consultation with the prominent progressive farmers of the area. Fifteen vegetable growers from each selected village were selected randomly, out of the prepared list of total vegetable growers of the selected villages. Thus, a total of 120 farmers (15x 8=120) were selected for the study.

3.2.5 Collection of data

The data were collected through personally interviewing the vegetables growers with the help of pre-tested structured interview schedule, in local dialect.

3.2.6 Statistical methods

Collected data was tabulated and processed by using appropriate statistical tools and methods.

3.3 Variables of the study

3.3.1 Independent variables

Socio-personal

- Education
- Family type
- Farming experience

Socio-economic

- Land holding
- Irrigation facility
- Annual income
- Credit acquisition

Communicational

- Source of information
- Contact with extension agencies

Socio-psychological

- Risk orientation
- Cosmopoliteness

Technological

- Source of insecticide
- Availability of insecticide
- knowledge of waiting period of insecticide

3.3.2 Dependent variables

- Application pattern of insecticide by vegetable growers.
- Adoption of IPM practices

3.4 Operationalization of independent variables and their measurement

3.4.1 Socio-personal characteristics

3.4.1.1 Age

The age of the vegetable growers as informed by them during personal interview was recorded. The chronological age was used for analysis and it was categorized as follows:

Categories	Score
➢ Young(<35years)	1
➢ Middle (36-55 years)	2
➢ Old (>55 years)	3

3.4.1.2 Education

Level of formal education obtained by the respondent farmers may influence their social status, attitude and adoption. Education is the individual's ability to read and write, and the amount of formal education, he/she possesses will affect the manner in which the individual gathers data and relates himself / herself to his/her environment. The formal education level of respondents was recorded and they were categorised and scored as follows:

Categories	Score
➢ Illiterate	0
➢ Primary (up to 5^{th} class)	1
➢ Middle (6^{th} to 8^{th} class)	2
➢ High School (9^{th} to 10^{th} class)	3
➢ Higher Secondary (11^{th} to 12^{th} class)	4
➢ Graduate	5
➢ Post Graduate	6

3.4.1.3 Caste category

Caste is an endogamous and hereditary subdivision of an ethnic unit occupying a position of superior rank or social esteem in comparison to other such divisions (Kroebar, 1948), in this study the caste of the respondents were categorized in following manner:

Categories	Score
➢ General	1
➢ Other Backward Classes	2
➢ Scheduled Castes	3
➢ Scheduled Tribes	4

3.4.1.4 Family type

A family may be nuclear or joint. Nuclear family is the social group consisting of married man and woman with their children living together under the same roof and sharing a common hearth. Joint family is the social group consisting of several related individual families, especially those of a man and his children; along with their spouse, residing in a single dwelling.

Operationally for the purpose of the present study the term nuclear was applied to family unit consisting primarily of husband, wife and their children and the term joint family was applied to family unit consisting of at least two married couples living in common residence and where the men were related as father, son or a brother and earnings from all sources are pooled together and / or expended for all and generally managed by one family head. The scoring was done as:

Categories	Score
➢ Nuclear family	1
➢ Joint family	2

3.4.1.5 Size of family

Operationally the family size refers to the total members in the family including dependents. This may also influence the decision-making and ultimately the adoption behaviour of respondents. Categorisation and scoring were done as:

Categories	Score
➢ Very Small (Up to 3 members)	1
➢ Small (4 to 5 members)	2
➢ Medium (6-10 members)	3
➢ Large (Above 10 members)	4

3.4.1.6 Working members

Working members refers to the number of adult members of the family who are engaged in earnings. The number of working members may influence their adoption behaviour, since they may manage the agriculture more efficiently. The scores were assigned as:

Categories	Score
➢ Small (up to 3 members)	1
➢ Medium (4-5 members)	2
➢ Large (Above 5 members)	3

3.4.1.7 Farming experience

Farming experience refers to the number of years of experience of cultivation by the individual farmer. Experience leads to maturity and learning. Eventually a person develops his thinking and attitude as per his past experience and builds it's own frame of reference of comparing with the new ideas and thoughts. It was recorded in complete years as reported by the respondents. Categorisation and scoring were done as:

Categories	Score
➢ Up to 5 years	1
➢ 6-10years	2
➢ 11-15years	3
➢ 16-20years	4
➢ 21-25years	5
➢ Above – 25years	6

3.4.1.8 Social participation

The social participation of vegetable growers may influence their adoption behaviour. Through social participation, farmer may get an opportunity for more learning/exposure towards new ideas and may be motivated for adoption. The term social participation in this study refers to the degree of involvement of the respondents in formal/informal organizations as member or executive/office bearer or both. A social participation score was computed for each respondent on the basis of their membership(s) and position in various formal/informal organizations. The major formal / informal organisations found in the rural areas were village panchayat, cooperative society, youth club, kisan club and caste panchayat. The participation in each of the organisation was recorded. The scoring was done in following manner:

Categories	Score
➢ No participation	0
➢ Only member	1
➢ Executive / Office Bearer	2

3.4.2 Socio-economic characteristics

3.4.2.1 Land holding

Land holding of respondents' family is considered as an important factor influencing their various components of adoption. It may be related to cropping pattern, annual income, social status and contacts with extension agents. In this study the actual land holding of the family was considered. The respondents were placed in the following four categories:

Categories	Score
➢ Marginal (up to 2.5 acre)	1
➢ Small (2.51 to 5 acre)	2
➢ Medium (5.01 to 10 acre)	3
➢ Large (more than 10 acre)	4

3.4.2.2 Irrigation facility

Information regarding the type of the source used by the respondents for providing irrigation to the crops was collected. Different sources of irrigation such as Personal tube well, River, Pond, Small pond (*Dabari)*, Well and *Nala* were identified and scores were given as under:

Categories	Score
➢ No Source	0
➢ Personal tube well	1
➢ River	2
➢ pond	3
➢ Small pond (*Dabari)*	4
➢ Well	5
➢ *Nala*	6

3.4.2.3 Occupation

Number of occupations may also influence the adoption level of the respondents because as occupations increases, farmer may not give his full attention for a single occupation i.e. agriculture. In present study, other occupations practised by each respondent was also recorded and categorised in the following manner:

Categories	Score
➢ Agriculture	1
➢ Service	2
➢ Animal husbandry	3
➢ Business	4
➢ Agriculture labour	5

The respondents were practicing the occupation as their main occupation or as a sub-occupation, for extra income. The information regarding a particular occupation as main occupation or sub-occupation was also collected and the scoring was done as under:

Categories	Score
➢ Main occupation	1
➢ Sub-occupation	2

3.4.2.4 Annual income

Annual income of a farm family is one of the most important factor for their Socio-economic status, investment in agriculture, adoption of crops and their improved package of practices and credit acquisition behaviour. In this study, the annual family income was operationally defined as the annual monetary income received by all the members of family from different sources and was estimated in terms of actual income in rupees. It was calculated from the daily / monthly income as per the convenience of respondents. The annual income of the respondents from each occupation was collected and thereafter the total income from all the occupations practiced by the respondents was clubbed together to get the final figure of the total annual income of the respondents from all the occupations. The respondents' family were categorised in the following manner:

Categories	Score
➢ Low (Up to Rs. 25000)	1
➢ Medium (Rs. 25001 to Rs. 50000)	2
➢ Moderate (Rs. 50001 to Rs. 100000)	3
➢ High (Rs. 100001 to Rs. 500000)	4
➢ Very high (More than Rs. 500000)	5

3.4.2.5 Credit acquisition

The availability of credit needed to purchase the required inputs may influence the extent of adoption of improved practices by the farmers. The adoption of improved vegetable cultivation technology requires more investment of capital to purchase the inputs like fertilizers, pesticides, improved seed, implements etc. The information regarding whether the respondent have acquired the credit or not was collected and was then measured by the following scores:

Particulars	Score
➢ Not acquired	0
➢ Acquired	1

The sources of credit were identified including national banks, cooperative society, moneylenders, shop, non-governmental organisations (NGOs), etc. and each source was given equal weightage and the availability of credit identified by farmers were then measured by the following scores:

Source of credit	Score
➢ Nationalized bank	1
➢ Cooperative society	2
➢ Money lender	3
➢ Shop	4
➢ NGO	5

The duration of repayment of the credit acquired by the respondents was also collected and was then measured by the following scores:

Duration of credit	Score
➢ Up to 6 month	1
➢ 6 – 12 month	2
➢ > 12 month	3

The farmers have the facility to select the mode of the credit sanctioned for them, whether they can get it in cash or they can get goods equating to the value of the credit limit, i.e., in terms of kind. The mode of disbursement of the credit acquired by the respondents was also collected and was then measured by the following scores:

Credit disbursement	Score
➢ Direct (Cash)	1
➢ Indirect (Kind)	2

The amount of the credit acquired by the respondents was also collected and was then measured by the following scores:

Amount of credit	Score
➢ Up to Rs. 25,000	1
➢ Rs. 25,001 – 50,000	2
➢ Rs. 50,001 – 1,00,000	3
➢ More than Rs. 1,00,000	4

3.4.3 Communicational characteristics

3.4.3.1 Sources of information

Source of information are supposed to directly associate with the adoption of technology. These information sources provide different information to the respondents regarding recommended use and application pattern of insecticide. For assessing this variable, different nineteen sources of information were identified. To determine the extent of utilization of each information source, the responses of the farmers were recorded and presented in frequency and percentage. Afterwards the respondents were categorized for analysis on the basis of using information sources as follows:

Categories	Score
➢ Not seeking information	0
➢ Seeking information	1

The credibility of the particular information source as perceived by the respondents was also collected and was categorized on the basis as follows:

Credibility of source	Score
➢ Nil	0
➢ Medium	1
➢ High	2
➢ Complete	3

The credibility index for all the sources of information was computed by the credibility of that particular source as perceived by the respondents. A procedure was also followed to assess the credibility index with the help of following equation:

$$C.I. = \frac{O}{S} \times 100$$

Where,

CI = Credibility index of source

O = Total obtained score by source

S = Total obtainable score

3.4.3.2 Contact with extension agents

This is operationally defined as the "frequency with which a respondent comes in contact with extension agents i.e. RAEOs / RHEOs, KVK, University scientists, NGOs". The extent of contact was measured by four point continuum scale *viz*., never, sometimes, always and regularly with a score 0, 1, 2 and 3, respectively. On the basis of extent of contact, the respondents were grouped in to four categories as following manners:

Categories	Score
➢ Never	0
➢ Sometimes	1
➢ Often	2
➢ Regularly	3

The credibility of the particular extension personnel as perceived by the respondents was also collected and categorized on the basis as follows:

Credibility of extension agents	Score
➢ Nil	0
➢ Medium	1
➢ High	2
➢ Complete	3

The credibility index for all the extension agents was computed by the credibility of that particular extension personnel as perceived by the respondents. A procedure was also followed to assess the credibility index with the help of following equation:

$$C.I. = \frac{O}{S} \times 100$$

Where,

CI = Credibility index of extension agents

O = Total obtained score by extension agents

S = Total obtainable score

3.4.4 Socio-psychological characteristics

3.4.4.1 Risk orientation

Risk orientation was operationalised as the degree to which a farmer is oriented towards risk and uncertainty and has courage to face the problem in cultivation of vegetable. The risk orientation scale developed by Supe (1969) was used with slight modifications in this study. The risk orientation score for each of the respondents were differentiated in to three categories according to following manner:

Categories	Scores
➢ Low level (less than 64 score)	1
➢ Medium level (64 to 74 score)	2
➢ High level (more than 74 score)	3

3.4.4.2 Cosmopoliteness

Cosmopoliteness is the tendency of an individual to be in contact with outside of his own community based on the belief that all the needs of an individual cannot be satisfied within his own community.

To measure Cosmopoliteness of respondents, they were asked to indicate their extent of contact with outside to their social system by their own efforts. The procedure followed by Ravishankar (1979) was used in quantification of this variable

with slight modification. The respondents were grouped in to four categories as following manners:

Categories	Scores
➢ Nil (Never)	0
➢ Low (Once in a month)	1
➢ Medium (Once in a week)	2
➢ High (Twice or more in a week)	3

3.4.5 Technological variables

3.4.5.1 Source of insecticide

There are various sources from which the farmers could get the insecticides which he requires viz., agriculture department, cooperative society, Representatives of manufacturing companies, input dealers, etc. The sources of insecticide may affect the quality and also the price of the insecticide which is paid by the farmer. The different sources from which the farmers procure insecticide were categorized depending upon the following scores:

Categories	Scores
➢ Agriculture Department	1
➢ Co-operative Society	2
➢ Representatives of manufacturing companies	3
➢ Input dealers	4

3.4.5.2 Availability of insecticide

Although there may be various sources from which the farmers could procure insecticides, but the amount and availability of the insecticide may differ when the farmers actually requires the insecticide. Depending upon these the different sources of insecticides were categorized as per following scores:

Categories	Scores
➢ Fully	2
➢ Partially	1
➢ Nil	0

3.4.5.3 Storage place of insecticides

The farmers usually procure the insecticides a little before the use, depending upon the reason for decision of spray in his field or he may also bring the insecticide just before the day of spray. So, there is a need for the temporary storage of the insecticides for usually few days before use. Depending upon the place and location of the storage of insecticide the respondents were categorised as per following scores:

Categories	Scores
➢ Anywhere at home	1
➢ Carefully at secured place	2
➢ At outer area of house	3
➢ Keep in farm	4
➢ Buy at time of use (No storage)	5

3.4.5.4 Knowledge of toxicity symbol of different insecticide label

Each insecticide container bears a specific symbol on its label representing the level of toxicity of the chemical. They are red (higher poison), yellow (high poison), blue (medium poison) and green (some poison). It is to aware the farmers regarding the severity of toxicity of the insecticide and henceforth to have precautions in its handling. The respondents were categorized depending upon their awareness of the different toxicity symbols in the insecticide label, as per following scores:

Categories	Scores
➢ Fully	1
➢ Partially	2
➢ Nil	3

3.4.5.5 Frequency of insecticide spray

Usually it is the tendency of the vegetable growers to regularly spray insecticides as a precautionary measure to prevent the insect damage occurrence. The data regarding their frequency of insecticide sprays at the different growth stages of the crop viz., nursery, planting, flowering, fruiting, harvesting, was collected and categorized as per following scores:

Frequency of spray	Scores
➢ One spray	1
➢ Two spray	2
➢ Three spray	3
➢ Four spray	4
➢ Five spray	5
➢ Seven spray	7

3.4.5.6 Application time of insecticide

The time of application of insecticide on the crop may affect its efficacy. Therefore, the time of application of insecticide in the fields by the respondents was recorded and categorized according to following scores:

Categories	Scores
➢ Morning	1
➢ Afternoon	2
➢ Evening	3

3.4.5.7 Precautions during insecticide application

As everybody knows that insecticides are poisons and are hazardous for human life too. The applicator should follow certain precautions while insecticide application. The knowledge and adoption by the respondents, of major precautions while insecticide application viz., use of mask, use of gloves, use of shoe, use of goggles, use of cap, use of hand wash after application, changing cloth after application, wind direction, No consumption of eatables, sprayer nozzle care, etc. was recorded and categorized as per following scores:

Knowledge	Scores
➢ Nil	0
➢ Partial	1
➢ Full	2

Adoption	Scores
➢ Never	0
➢ Sometimes	1
➢ Often	2
➢ Regular	3

3.4.5.8 Use of empty insecticide container

Since the insecticides are poisonous and hazardous chemicals, the container in which they are supplied are also poisonous and hazardous for human health. The insecticide containers should be carefully destroyed to prevent it from mixing with the different natural resources and prove detrimental to human life. The disposal of the insecticide containers by the respondents was recorded and categorized according to following scores:

Categories	Scores
➢ Reuse after washing	1
➢ Just throw at farm any where	2
➢ Bury in soil	3
➢ Burn	4
➢ Sell to *kabaadi*	5

3.4.5.9 Knowledge of waiting period of insecticide

Knowledge about innovation may be an important factor affecting the adoption behavior of farmers. Bloom (1979) defined knowledge as "those behavior and best situation which emphasized the remembering either by recognition or recall of ideas, materials on phenomenon." Operationally knowledge was used in this study as actual

knowledge of farmers regarding waiting periods of different insecticides used for different insects of major vegetable crops. Waiting period is the specific period for each insecticide on particular crop which is necessary to be practiced for the elimination of the residual toxicity of the insecticide and making the vegetable safe for human consumption. The responses of respondents regarding knowledge were obtained into three point continuum scale as under:

Categories	Scores
➢ Nil	0
➢ Partial	1
➢ Complete	2

A procedure was also followed to assess the knowledge index with the help of following equation:

$$K.I. = \frac{O}{S} \times 100$$

Where,

KI = Knowledge index of respondent

O = Total obtained score by respondent

S = Total obtainable score

Adoption is the decision by the farmer for completely utilization of any technology on his fields. The adoption of the waiting period of the insecticides on different crops by the respondents was studied. If a person doesn't have knowledge of any detrimental effects of his actions, then it may be his ignorance, but when he is having knowledge and even then he is not adopting it then the situation is alarming. Now it may not be his ignorance but is his negligence and greed. The adoption of waiting period of different insecticides over the vegetable crops was studied and was categorized according to following score:

Categories	Scores
➢ Nil	0
➢ Partial	1
➢ Complete	2

A procedure was also followed to assess the Adoption index with the help of following equation:

$$A.I. = \frac{O}{S} \times 100$$

Where,

AI = Adoption index of respondent

O = Total obtained score by respondent

S = Total obtainable score

3.4.5.10 Extent of crop damage by different insects

Extent of any insect-pest is determined by the degree of damage caused by it on the crop. The higher the damage, the greater is the possibility and usage of insecticides on the crop. The farmers perception of the level of damage by the different important insects in the vegetable crops was recorded and categorized as per following scores:

Categories	Scores
➢ < 25%	1
➢ 26-50%	2
➢ 51-75%	3
➢ >75%	4

3.5 Operationalization of dependent variables and their measurement

3.5.1: Application Pattern of insecticide by vegetable growers

The vegetable growers may use the insecticides by applying a single insecticide or they may mix two or more insecticides. As per their application pattern, the respondents were categorized as per following scores:

Categories	Scores
➢ By mixing of insecticide	1
➢ One insecticide	2

If the respondent is mixing two or more insecticides before application, he might be doing this on the basis of compatibility of the different insecticides, on the suggestions of other farmers, on the input dealer's suggestion or they might be mixing the different insecticides by just their approximation. Based on the basis of their decision for mixing of different insecticides the farmers were categorized as per following scores:

Decision taken	Scores
➢ Based on compatibility	1
➢ Based on suggestions of other farmers	2
➢ Based on suggestions of input dealer	3
➢ Based on approximation	4

3.5.2 Adoption of integrated pest management practices

Adoption refers to a mental process through which an individual passes from hearing about an innovation to final adoption (Rogers, 1995).

Categories	Scores
➢ Nil	0
➢ Partial	1
➢ Complete	2

It was operationalized as the degree of the use of recommended practices of integrated pest management. Extent of adoption of IPM practices in vegetable cultivation by the respondents was assessed on the basis of responses given by the vegetable growers during personal interview by introducing a set of 14 questions covering cultural, mechanical, biological, and chemical practices of IPM on three point continuum scale *viz* "nil", "partially adopted" and "complete adopted" with the score of 0, 1 and 2 respectively. The responses of the respondents for adoption of each practice were recorded and further adoption index was also obtained by using following formula:

$$A.I. = \frac{\text{Sum of adoption score actually obtained by the respondents}}{\text{Maximum possible adoption score obtainable by the respondents}} X10$$

A.I= adoption index

3.6 Constraints faced by application pattern of insecticides and adoption of IPM practices

Reading (1977) defined constraints as use of forces to influence or prevent an action on state or quantity of being compelled to do or not to do something.

Thakre (1980) defined constraint as the quality of sense of being restricted to a given course of action or inaction. For the present study constraints refers to the difficulties encountered by vegetable growers in use of IPM practices for crop cultivation.

Efforts were made to identify the constraints faced by the respondents pertaining to use of IPM practices. The respondents were asked to indicate the difficulties they have faced regarding the various aspects connected with the use of IPM practices such as cultural, mechanical, biological, and chemical practices. The difficulties reported by the respondents were listed out and frequencies and percentage to each were worked out and ranked.

3.7. Suggestions given by vegetable growers to overcome the constraints faced by them during application pattern of insecticide and adoption of IPM practices

Considering the constraints faced by the vegetable growers in adoption of IPM practices, and to overcome the same, the respondents were asked to give their valuable suggestions. The suggestions offered were summed and converted into percentage and then ranked on the basis of number and percentage of respondents who reported for the respective suggestions

3.8 Type of data

The following types of the data were obtained from the respondent in view of the objectives of the study:

1. Data pertaining to the regarding their socio-personal characteristics
2. Data regarding socio-economic characteristics
3. Data regarding socio-psychological characteristics
4. Data regarding communicational characteristics
5. Data regarding constraints/problems and suggestion as perceived by respondents on relating to adoption of IPM practices.

3.9 Developing the interview schedule

The interview schedule was designed on the basis of objectives and independent and dependent variables in the present investigation. To facilitate the respondents, the interview schedule was framed in ―Hindi. Each question was thoroughly examined and discussed with the experts before finalizing the interview schedule. Adequate precautions and care were taken into consideration to formulate the questions in a manner that they were well understood by the respondents and would find it easier to respond.

The prepared interview schedule was used in the study area for collecting the data. On the basis of experience gained in pre-testing, the necessary modifications and suggestions were incorporated before giving a final touch to interview schedule.

3.9.1 Validity

Validity refers to the degree to which the data collection instruments measures what it is supposed to measure rather than something else. The validity of interview schedule used for this study was maximized by taking following steps:

1. The interview schedule was thoroughly discussed with the concerned scientists and member of advisory committee and their suggestions were incorporated.
2. Pre-testing of interview schedule provided an additional check for improving the instrument.

3 The relevancy of each question in terms of objectives of study, their logical order and wordings of each question was checked carefully.

3.9.2 Reliability

Reliability of an interview schedule refers to ―its consistency or stability in obtaining information from respondents.

The test-retest method of estimating reliability of an interview schedule was followed in this study. Thirty respondents of the study area were randomly selected and interviewed and they were re-interviewed after 2 to 3 weeks by using the same interview schedule followed at the time of first interview. Since same responses were observed, the reliability of the interview schedule was ensured.

3.10 Method of data collection

Respondents were interviewed through personal interview. Prior to interview, respondents were taken into confidence by revealing the actual purpose of the study and also full care was taken to develop good rapport with them. They were assured that the information given by them would be kept confidential. The interview was conducted in the most formal and friendly atmosphere without any complications.

3.11 Statistical analysis

The data collected during the course of investigation was tabulated into the coding sheet and then appropriate analysis of data was made according to objectives as suggested by Cochran and Cox (1957). The statistics techniques were applied in the form of frequency, percentage, mean, standard deviation, coefficient of correlation, etc. the analysis was carried out with help of Computer Section of IGKV, Raipur.

CHAPTER-IV

RESULTS AND DISCUSSION

This chapter deals with the results obtained on various aspects of the study and supported with suitable discussion on findings. The data was collected through the pre-tested interview schedule prepared in Hindi on the basis of objectives of the study. The data collected were classified, tabulated, analyzed, presented, interpreted and discussed systematically.

The findings of the study are presented and discussed under the following heads:

4.1. Independent variables

- 4.1.1 Socio-personal characteristics of the vegetable growers
- 4.1.2 Socio-economic characteristics of the respondents
- 4.1.3 Communicational characteristics of the respondents
- 4.1.4 Socio-psychological characteristics of the respondents
- 4.1.5Technological characteristics of the respondents

4.2 Dependent variables

- 4.2.1 Application pattern of insecticide by respondents
- 4.2.2 Adoption of IPM practices

4.3 Correlation coefficient analysis of independent variables with application pattern of insecticide by respondents and adoption of IPM practices

4.4 Multiple regression analysis of independent variables with application pattern of insecticide by respondents and adoption of IPM practices

4.5 Constraints faced by the respondents in application pattern of insecticide and adoption of IPM practices

4.6 Suggestions given by the respondents to overcome the constraints faced by them during application pattern of insecticide and adoption of IPM practices

4.1. Independent variables

4.1.1. Socio-personal characteristics of the vegetable growers

Socio-personal characteristics of the vegetable growers like age, education, caste, family type, family size, working members, social participation, farming experience in vegetable cultivation were considered as socio-personal characteristics of the respondents. These characteristics were analyzed and are presented as given below:

4.1.1.1 Age

The findings on age of the respondents are presented in Table 4.1. The data reveals that more than half of the respondents (55.00%) belonged to the middle age group (between 36 to 55 years). However, nearly one third of the respondents (31.67%) were of young age group (up to the age of 35 years). Whereas, in the old age group, i.e., above 55 years, the percentage of respondents was only 13.33 per cent. The findings indicated that the majority of the respondents in the study area belonged to the middle age group, followed by young age group and older age group. This reflected that involvement of young and old people was comparatively not much in the vegetable cultivation. Since vegetable cultivation is considered as a risky occupation, demanding young and experienced, both characteristics in person, hence involvement of middle age ones incorporated both.

Table 4.1: Distribution of respondents according to their age

(n=120)

Sl. No.	Age category	Frequency	Percentage
1	Young (up to 35 years)	38	31.67
2	Middle (36-55 Years)	66	55.00
3	Old (Above 55 years)	16	13.33

These findings are similar to findings of Patel (2008), who observed that the majority of the respondents (72.00%) belonged to middle age group (36 to 55 years), about 18.00 per cent respondents were of young age group (up to 35 years) and 10.00

per cent respondents were of old age group (more than 55 years). Kumar and Rathod (2013), conducted study on adoption behavior of farmers about recommended technology of soybean and observed that the respondents were distributed in middle (36.00%), young (33.33%) and old (30.67%) age category.

4.1.1.2 Education

Information regarding formal educational status of the respondents was collected, tabulated, analysed and presented in Table 4.2. The data reveal that a little less than one third of the respondent (30.83%) had education up to primary level. About 20.00 per cent respondent were illiterate, while 18.33 per cent of the respondent were having education up to middle school, 17.50 per cent of the respondent were high school passed and 8.33 per cent of them were higher secondary school passed.

Table 4.2: Distribution of respondents according to their education level

(n=120)

Sl. No.	Education level	Frequency	Percentage
1	Illiterate	24	20.00
2	Primary (up to 5^{th} class)	37	30.83
3	Middle (6^{th} to 8^{th} class)	22	18.33
4	High School (9^{th} to 10^{th} class)	21	17.50
5	Higher secondary (11^{th} to 12^{th} class)	10	08.33
6	Graduate	05	04.17
7	Post Graduate	01	00.83

While only five percent of the respondent had gone to college and 4.17 per cent of them had done graduation and only one respondent (0.83%) was post graduate. The findings revealed that more than half of the respondents (50.8%) in the study area were having low education status, were either illiterate or educated up to primary level.

Similar findings were reported by Roy and Chowdhary (2007), they noted that maximum number of the vegetable growers (33.33%) were educated up to primary school level, followed by 30.00 per cent of the vegetable growers educated up to middle school level. 16.67 per cent vegetable growers were higher secondary passed

and 10.00 per cent vegetable growers were educated up to graduate and post graduate level, 6.67 per cent of the vegetable growers were educated up to secondary level and 3.33 per cent of the vegetable growers were illiterate. Ruyosu and Kharub (2003), reported that majority of the farmers belonged to primary level of education group.

4.1.1.3 Caste category

Information regarding caste category of the respondents was collected, tabulated, analysed and presented in Table 4.3. The data on caste category of the respondents indicates that the majority of the respondents (94.17%) belonged to Other Backward Classes, followed by 3.33 per cent of the respondents belonging to Scheduled Tribes and only 2.50 per cent of the respondents belonged to General category, while none of the respondents belonged to Scheduled Castes. This reveals that Other Backward Classes dominated vegetable cultivation, while Scheduled Tribes and General category had very small share and none of the Scheduled Castes was involved in vegetable cultivation.

Table 4.3: Distribution of respondents according to their caste category

(n=120)

Sl. No.	Caste category	Frequency	Percentage
1.	General	03	02.50
2.	Other Backward Classes	113	94.17
3.	Scheduled Castes	00	00.00
4.	Scheduled Tribes	04	03.33

Similar findings were reported by Khare *et al*. (2002), who revealed that majority of vegetable growers, belonged to OBC category. Lanjewar (2009), also reported that the majority of the respondents (92.86%) belonged to general caste, followed by 7.14 per cent who belonged to other backward class, and none of the respondents were found in the category of scheduled tribes and scheduled caste.

4.1.1.4 Family type

The information regarding family type of the respondents was collected, tabulated, analysed and is presented in Fig. 4.1 The data reveal that nearly three fourth (73.33%) of the respondents were living in the joint family and only a little more than one fourth (26.67%) of them were having nucleus family.

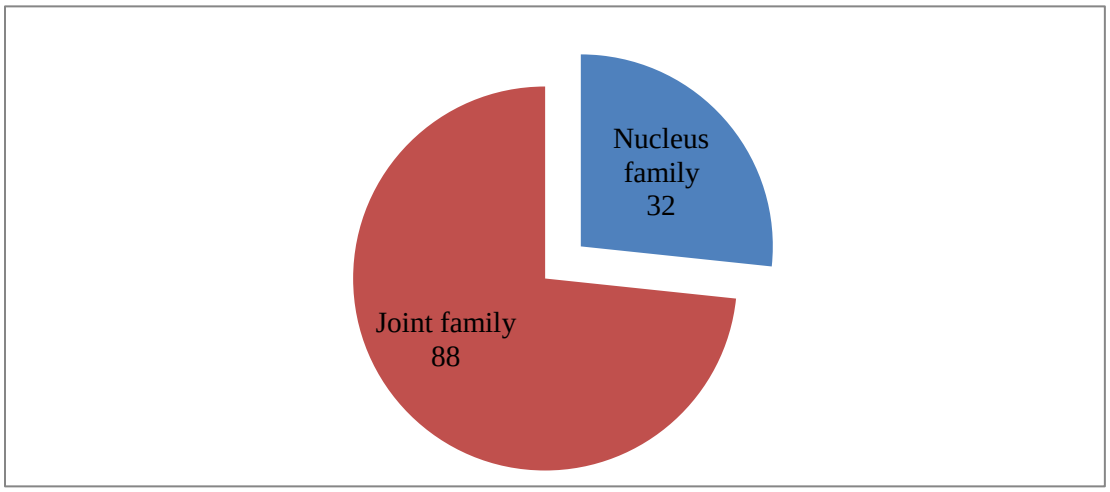

Fig 4.1: Distribution of respondents according to their family type

This reveals that the dominance of the joint family system is still prevalent in the cultivator's social system. Probably due to labour intensive nature of the vegetable cultivation, this needs more hands to work on the fields.

Similar findings were reported by Parganiha (2002), who noted that majority of migrant (60%) and non-migrant (70%) respondents belonged to joint family system and the remaining respondents lived in nuclear families. Upadhyay and Desai (2011) revealed that majority (68.33%) of the respondents were from joint family.

4.1.1.5 Size of family

The distribution of the respondents according to total members of the family is depicted in the Figure 4.2.

The data regarding size of family of the respondents, indicated that nearly half (49.17%) of the respondents were having medium size of family (6 to 10 members), followed by nearly one fourth of the respondents (24.17%) having small size of family

(4 to 5 members). While 22.50 per cent of the respondents were having large size of family (above 10 members) and only 4.17 per cent of the respondents were belonging to very small size of family (Up to 3 members).

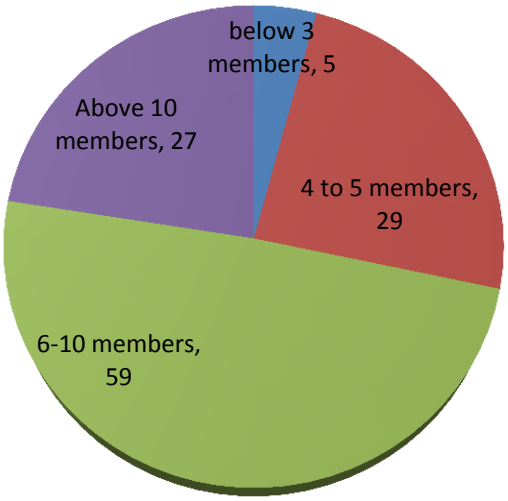

Fig. 4.2: Distribution of respondents according to size of family

The distribution of the respondents according to members of the family is presented in Table 4.4. The data reveals that most of the respondents' families were having three or less male (83.33%), female (89.17%) and children (59.17%) members in the family. It was followed by the families with four to five male (15.83%), female (9.17%) and children (25.83%) members in the family. At the last were the families with six to ten male (0.83%), female (1.67%) and children (15.00%) members in the family. None of the respondents were having more than ten male, female or children members in the family.

Table 4.4: Distribution of respondents according to their size of family

(n=120)

Sl. No.	Size of family	Male		Female		Children	
		F	%	F	%	F	%
1	Very Small (Up to 3 members)	100	83.33	107	89.17	71	59.17
1	Small (4 to 5 members)	19	15.83	11	09.17	31	25.83
2	Medium (6-10 members)	01	0.83	02	01.67	18	15.00
3	Large (Above 10 members)	00	0.00	00	0.00	00	0.00

Similar findings were reported by Mewara and Pandya (2007) who revealed that 48.00 per cent of tomato growers had medium and 46.00 per cent had small size of family, while only 6.00 per cent of tomato growers had large family of size. Lanjewar (2009) revealed that the majority of the respondents (66.43%) had medium size of family (7 to 12 members), followed by 22.14 per cent with small size of family (upto 6 members). Rest of the respondents (11.43%) belonged to large size of family (more than 12 members).

4.1.1.6 Working members

Information regarding working members in the family of the respondents were collected, tabulated, analysed and presented in Fig. – 4.3 and Table 4.5.

The data regarding total working members in the family is depicted in Fig. 4.3, which reveals that nearly all the respondents were having less than three male (90%) and female (94.17%) as working members in the family, followed by respondents having four to five male (10.0%) and female (5.83%) working members in the family. While none of the respondents were having more than five male or female working members in the family.

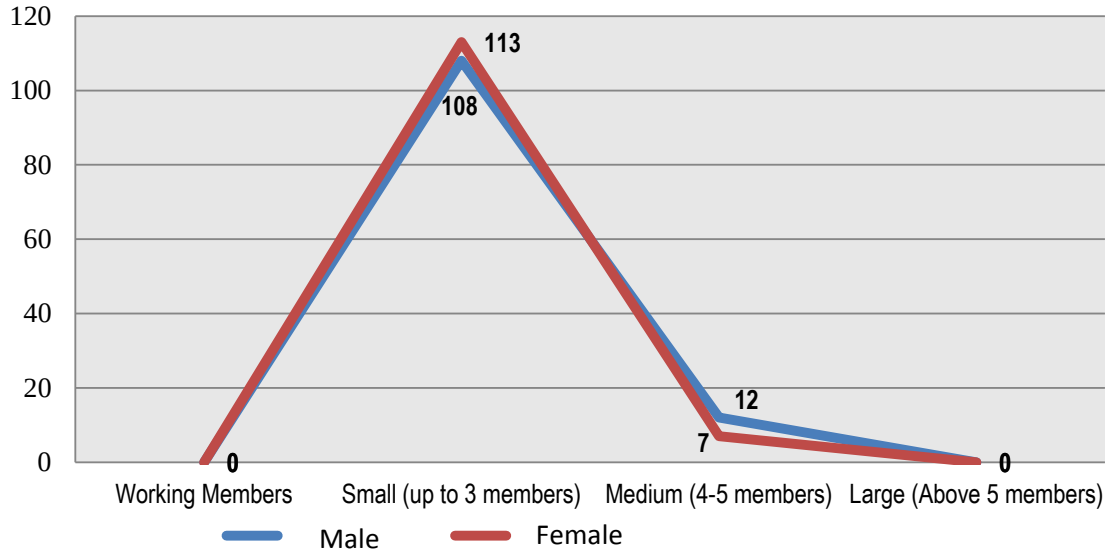

Fig- 4.3: Distribution of respondents according to working members

The data regarding total working members in the family is given in the Table 4.5 which indicated that a little less than half (48.33%) of the respondents were having small size of working members (up to 3 members), followed by a little less than one third of respondents (31.67%) having medium size of working members (4 to 5 members) and only 20.00 per cent of the respondents had large size of working members (Above 5 members).

Table 4.5: Distribution of respondents according to their total working members

(n=120)

Sl. No.	Total working members	Frequency	Percentage
1	Small (up to 3 members)	58	48.33
2	Medium (4-5 members)	38	31.67
3	Large (Above 5 members)	24	20.00

Similar findings were reported by Parganiha (2002) who observed that in case of working members of the family majority of migrants (53.75%) and non-migrants (55%) had more than 3 members. The remaining migrant and non-migrant had 2-3 working members in their families.

4.1.1.7 Farming experience

Information regarding farming experience of the respondents were collected, tabulated, analysed and presented in Table 4.6. The data reveal that majority (21.7%) of the respondents were having 16 to 20 years of farming experience, followed by 20.00 per cent of them were having up to 5 year and 6 to 10 years of farming experience, each.

Table 4.6: Distribution of respondents according to their farming experience

(n=120)

Sl. No.	Farming experience (in years)	Frequency	Percentage
1	Up to 5	24	20.00
2	6-10	24	20.00
3	11-15	13	10.83
4	16-20	26	21.67
5	21-25	21	17.50
6	Above 25	12	10.00

While 17.5 per cent of the respondents were having 21 to 25 years of farming experience, 10.83 per cent of them were having 11 to 15 years of farming experience and 10.00 per cent were having above 25 years of farming experience. This reveals that nearly half of the respondents (50.8%) were having up to fifteen years of farming experience.

Similar findings were reported by Saxena (2003) who observed that majority of the respondents (51.38%) were having 11 to 20 years of tomato farming experience, whereas 41.66 per cent of the respondents were having up to 10 years of tomato farming experience and only 6.94 per cent of the respondents were having more than 20 years of tomato farming experience. Bèye and Marko (2014) reported that it will likely require a transition period of 5 to 10 years to build the fundamentals of sustainable seed systems through the structuring of the seed sector and the creation of appropriate conditions to ensure food security, enriched biodiversity and sustainable production.

4.1.1.8 Social participation

Social participation is an opportunity to communicate with fellow farmers and getting knowledge regarding farming. Information regarding social participation of the respondents were collected, tabulated, analysed and presented in Fig. 4.4 and Table 4.7.

Table 4.7: Distribution of respondents according to their Social participation

(n=120)

Sl. No.	Organisation	Frequency*	Percentage
1	Gram Panchayat	119	99.17
2	Co-operative society	118	98.33
3	Youth club	03	02.50
4	Kisan club	11	09.17
5	Caste panchayat	107	89.17

*Data are based on multiple responses

The data reveal that 99.17 per cent of the respondents were participating in Gram Panchayat, of which 93.28 per cent participated as member and remaining 6.72 per cent participated as office bearer in the Gram Panchayat. Participation in co-

operative society shows that 98.33 per cent were participating, of which 98.31 per cent were members and remaining 1.69 per cent were office bearer in the co-operative society.

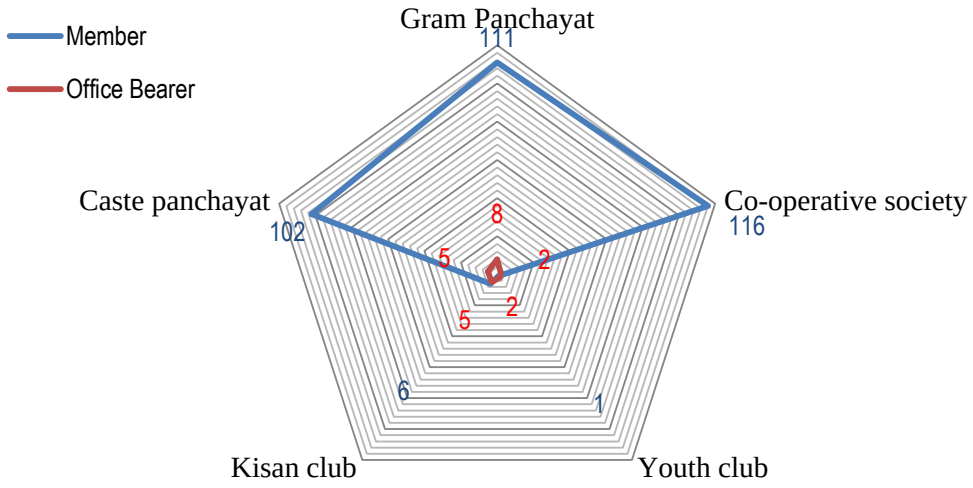

Fig 4.4: Distribution of the respondents according to type of participation

Participation in caste panchayat shows that 89.17 per cent of the respondent participated, of which 95.33 per cent were member and remaining 4.67 per cent were office bearer in the caste panchayat.

Participation in Kisan club shows that 9.17 per cent of the respondents were involved, of which 54.55 per cent were member and remaining 45.45 per cent participated as office bearer in the Kisan club. Participation in youth club showed that 2.50 per cent of the respondents had active participation in youth club, of which 33.33 per cent as member and 66.67 per cent participated as office bearer.

Similar findings were reported by Paikra (2014) who noted that cent per cent of the respondents had participation in Gram Panchayat (Gram Sabha) of which 81.66 per cent participated as member and remaining 18.34 per cent participated as office bearer in the Gram panchayat. Participation in co-operative society showed that 97.50 per cent participated, of which cent per cent participated as member.

Kumar *et al.* (2010) revealed that 20 per cent of the respondents were the members of social organization like panchayati raj institutions and village education committee.

4.1.2 Socio- economic characteristics of the respondents

The independent variables i.e. land holding, irrigation facility, occupation, annual income and credit acquisition were considered as socio-economic characteristics of the respondents.

4.1.2.1 Land holding

The distribution of the respondents according to their land holding is presented in the Table 4.8. The data regarding land holding indicate that of the total, slightly less than one third, i.e., 31.67 per cent of the respondent had up to 2.5 acre of land holding (Marginal farmers), followed by 27.50 per cent of the respondents had 2.51 to 5 acre of land holding (Small farmers), 21.67 per cent of the respondents had 5.01 to 10 acre of land holding (Medium farmers), while only 19.17 per cent of the respondents had more than 10 acre of land holding (Large farmers) .

Table 4.8: Distribution of respondents according to their land holding

(n=120)

Sl. No.	Land holding	Frequency	Percentage
1	Marginal (up to 2.5 acre)	38	31.67
2	Small (2.51 to 5.0 acre)	33	27.50
3	Medium (5.01 to 10.0 acre)	26	21.67
4	Large (more than 10.0 acre)	23	19.17

Almost similar findings were also reported by Gupta (1999) who concluded that 52.66 per cent of the respondents families had a land holding up to 2.5 acres followed by 41.33 per cent with land holding of 2.6 to 7.5 acres (medium farms) and only 9.00 per cent had land holding of more than 7.5 acres. Dongardive (2002) stated that nearly one-third (30.00%) of the chilli respondents were in the marginal group, followed by 26.67 per cent, 23.33 per cent and 20.00 per cent of them who had large, small, and medium size of land holding, respectively.

Selected respondents occupied a total of 987.66 acre land (Fig. 4.5), of which 48.42 per cent area falls under *Kanhar (Kachhar)*, followed by 23.24 per cent area covered by *Bhata*. While 20.00 per cent area was covered by *Matasi* and 8.34 per cent area was covered by *Dorsa*. This land situation may be due to selection of vegetable growing farmers as respondent.

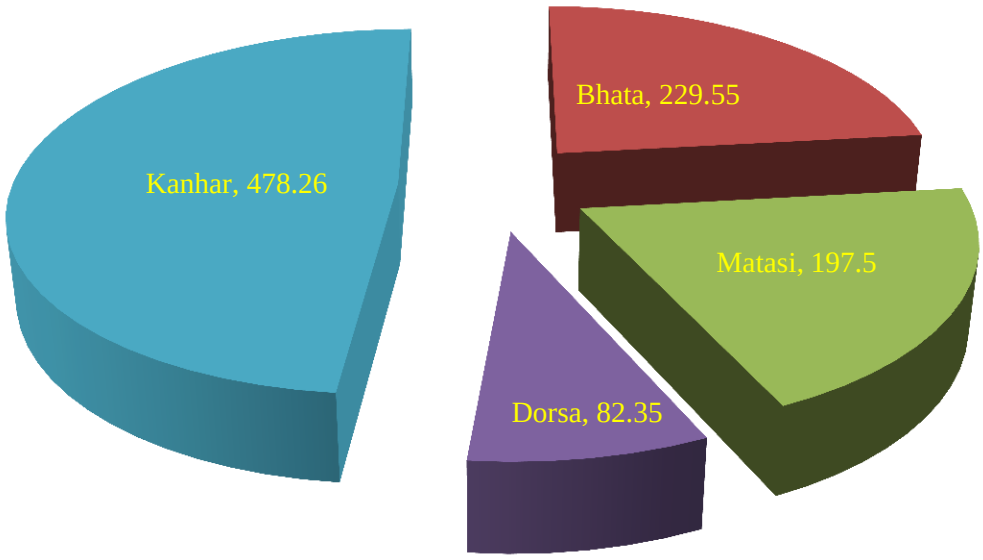

Fig. 4.5: Distribution of respondents according to land type (In acres)

Regarding extent of irrigation in different land type information was collected, tabulated, analysed and presented in Table 4.9.

Table 4.9: Extent of irrigation in different land type (in acre)

(n=120)

Sl. No.	Land type	Irrigated area		Unirrigated area	
		Area	Percentage	Area	Percentage
1	*Bhata*	220.15	95.91	09.4	04.09
2	*Matasi*	158.3	80.15	39.2	19.85
3	*Dorsa*	79.35	96.36	03.0	03.64
4	*Kanhar*	439.71	91.94	38.55	08.06

The data reveal that out of total 987.66 acre land, 90.87 per cent (897.51 acre) area falls under irrigated land, and only 9.13 per cent (90.15 acre) area was under unirrigated land.

The data depict that out of total 229.55 acre of *Bhata* land, 95.91 per cent (220.15 acre) area was irrigated, and only 4.09 per cent (9.4 acre) area was unirrigated.

The data further reveal that out of total 197.5 acres of *Matasi* land, 80.15 per cent (158.3 acre) area was irrigated and only 19.85 per cent (39.2 acre) area under was unirrigated.

Out of total 82.35 acres of *Dorsa* land, 96.36 per cent (79.35 acre) area was irrigated, and only 3.64 per cent (3.0 acre) area was unirrigated.

Further, out of total 478.26 acres of *Kanhar* land, 91.94 per cent (439.71 acre) area was irrigated and only 8.06 per cent (38.55 acre) area was unirrigated.

Almost similar findings were also observed by Parganiha (2002) who found that under the migrants group about 64 per cent of the land holding belongs to *Kanhar* type of soil, whereas 23 per cent under *Matasi*, 8 per cent under *Bhata* and 5 per cent under *Dorsa*. On other hand the non-migrants group, majority of the 73 per cent land holding covered under *Kanhar* type of soil, whereas, 23 per cent under *Matasi*, 3per cent under *Bhata* and 1per cent under *Dorsa*.

Dhruw (2014) also reported that under the farmers group about 70.32 per cent of the land belonged to *Kanhar* type of soil. Whereas, 19.54 per cent under *Matasi*, 9.68 per cent under *Dorsa* and only 0.46 per cent was *Bhata*.

4.1.2.2 Irrigation facility

Regarding irrigation facilities, Table 4.10 depicts that all the respondents (100%) were having irrigation facility. Since all the respondents were vegetable growers, they were having assured irrigation facility. Regarding availability of irrigation sources, data show that maximum respondents (75.83%) had personal tube-well, followed by 15.00 per cent respondents had river and *nala* each for irrigation. Well was the source of irrigation for 5.83 per cent respondents, while 2.5 per cent respondents had pond and only 0.83 per cent respondents had Small pond (*Dabari*), water for irrigation. The government subsidy on tube well by different departments under various schemes, may be the reason for enhancement in the number of personal tube well owners.

Table 4.10: Distribution of the respondents according to their irrigation facility

(n=120)

Sl. No.	Irrigation facility	Frequency*	Percentage
a.	Available	120	100.0
b.	Un available	00	0.00
Sources of irrigation			
1	Personal tube well	91	75.83
2	River	18	15.00
3	Pond	03	02.50
4	Small pond (*Dabari*)	01	0.83
5	Well	07	05.83
6	*Nala*	18	15.00

*Data are based on multiple responses

Almost similar findings were also observed by Sharma (1993) who revealed that the majority of the respondents (50.00%) adopted tube well for irrigating their wheat crop and 42.20 per cent were using canals as a source of irrigation. Mukim (2004) found that the highest coverage of area under irrigation was through tube well (42.19%) followed by canal + well (32.81%), canal + tube well and pond contributed 23.44 and 1.56 per cent area under irrigation, respectively.

4.1.2.3 Occupation

The data regarding involvement of the respondents in different occupation are given in the Figure 4.6 and Table 4.11. The data reveal that all the respondents (100.00%) were involved in Agriculture; followed by 15 per cent of the respondents involved in Agriculture labour, while 8.33 per cent of the respondents involved in Animal husbandry, while 3.33 per cent of the respondents were involved in Business and only 0.83 per cent respondents were involved in service.

Similar findings were also reported in their study by Kumar and Munjunath (2008) who revealed that the majority of the vegetable growers (88.75%) were dependent only on farming. Patel (2008) who observed that maximum number of the respondents (52.00%) were involved in farming, followed by farming + labour (14.00%), farming + service (12.66%), farming + animal husbandry + service (7.34%)

farming + others (8.00%) and farming + occupation + service (6.00%), respectively as their main occupation.

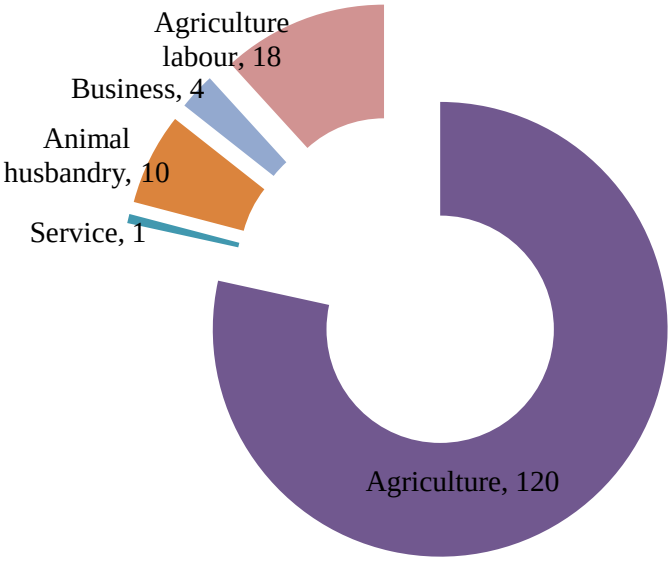

Fig. 4.6: Distribution of respondents according to involvement in various occupations

Regarding the involvement of the respondents in the occupation practiced, Table 4.11, the respondents were practicing the various occupations as main or sub occupation.

Table 4.11: Distribution of the respondents according to their occupation involvement

(n=120)

Sl. No.	Occupation	Type of occupation*			
		Main occupation		Sub occupation	
		F	%	F	%
1	Agriculture	112	93.33	08	6.67
2	Service	01	100.0	00	00
3	Animal husbandry	04	40.0	06	60.0
4	Business	03	75.0	01	25.0
5	Agriculture labour	00	00	18	100.0

*Based on multiple responses

When agriculture was considered although all the respondents were practicing agriculture, but majority of them were taking it as main occupation (93.33%) and the rest 6.67 per cent of them were having agriculture as sub occupation.

Service was done by only one respondent and he was practicing it as his main occupation. Out of the 8.33 per cent of the total respondents practicing animal

husbandry occupation 40.0 per cent of them were taking it as main occupation and the rest 60.0 per cent were having it as sub occupation.

Only 3.33 per cent of the total respondents were having business, out of which 75.0 per cent were practicing it as main occupation and rest 25.0 per cent were practicing business as sub occupation. Fifteen per cent of the total respondents were practicing agriculture labour and all of them were treating it as their sub occupation.

Similar findings were also reported by Painkra (2014) who observed that majority of the respondents were involved in farming (96.66%) as main occupation, followed by 3.33 per cent engaged in service as main occupation. Involvement in other labour (85.70%), agriculture labour (84.17%), animal husbandry (51.67%), other like NTFPs (36.66%), business (6.66%), service (4.16%) and agriculture farming (3.34%) was recorded as sub occupation of respondents.

4.1.2.4 Annual income

The data compiled in Table 4.12 and Fig.- 4.7, show the annual income received by the respondents from different occupations. It is evident from the table that, cent per cent respondents were involved in agriculture and thus received annual income from agriculture, of which 37.50 per cent respondents got income between Rs. 25001 to Rs. 50000, followed by 30.83 per cent respondents obtaining Rs. 50001 - Rs. 100000, 17.50 per cent respondents gained income up to Rs. 25000 and about 12.50 per cent respondents received income Rs. 100001 to Rs. 500000, while only 1.67 per cent respondents received income more than Rs. 500000 from agriculture as occupation.

Only one respondent (0.83%), received annual income from Service, who obtained income Rs. 50000 – Rs. 100000 from service in a year.

There were 8.33 per cent respondents, who obtained income from Animal husbandry, out of these, half of the respondents' accounted income up to Rs. 25000, while 40.00 per cent respondents received income Rs. 25001 to Rs.50000 and only 10.00 per cent of them gained income more than Rs. 50000 from animal husbandry in a year.

Only 3.33 per cent respondents had Business, of these, only half of the respondents received income between Rs. 50001 to Rs. 100000 and out of rest, 25.00 per cent respondents obtained income Rs. 25001 – Rs. 50000 and remaining one fourth were receiving Rs. 100000 – Rs. 500000 from business in a year.

Table 4.12: Distribution of respondents according to income share of different sources

(n=120)

Sl. No.	Occupation /Income	Agriculture (n=120)		Service (n=1)		Animal husbandry (n=10)		Business (n=4)		Agriculture labour (n=18)	
		F	%	F	%	F	%	F	%	F	%
1.	Up to Rs. 25000	21	17.50	00	0.0	05	50.0	00	0.0	18	100.0
2.	Rs. 25001-50000	45	37.50	00	0.0	04	40.0	01	25.00	00	0.0
3.	Rs. 50001-100000	37	30.83	01	100.0	01	10.0	02	50.00	00	0.0
4.	Rs. 100001-500000	15	12.50	00	0.0	00	0.0	01	25.00	00	0.0
5.	More than Rs. 500000	02	01.67	00	0.0	00	0.0	00	0.0	00	0.0

Only 15.00 per cent respondents were engaged in agriculture labour, of these, all the respondents received income between up to Rs. 25000.

Regarding overall annual income from all sources, Figure 4.7 depicts that 35.83 per cent respondents received only medium annual income (Rs. 25001 to Rs. 50000). While 30.00 per cent were found to have moderate annual income (Rs. 50001 to Rs. 100000), 16.67 per cent had low annual income (Up to Rs. 25000), 15.83 per cent had high annual income (Rs. 100001 to Rs. 500000), and only 1.67 respondents had Very high annual income (More than Rs. 500000).

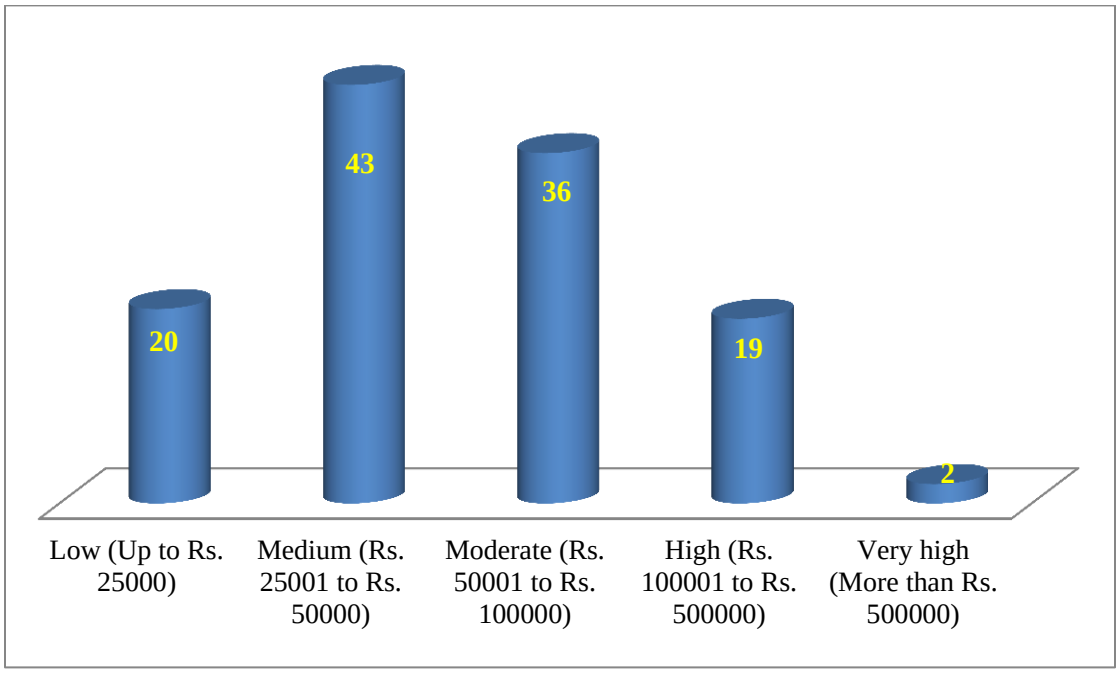

Fig. 4.7: Distribution of respondents according to total annual income

Almost similar findings were also noticed by Khan *et al.* (2007) in their studies. They reported that the majority of respondents (64%) came into medium income category while, rest were divided into low (20%) and high income group (16%). Sunil (2004) conducted a study of tomato growers in Belgaum district of Karnataka and found that majority of the respondents belonged to medium income category (48.33 per cent).

4.1.2.5 Credit acquisition

The share of the respondents who had acquired and not acquired credit is depicted in the Figure 4.8.

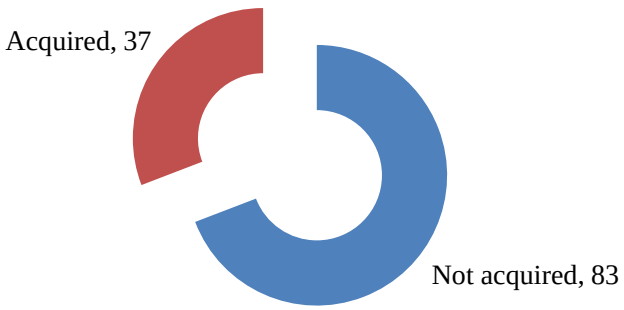

Fig. 4.8: Distribution of respondents according to credit acquisition

The graph indicated that the majority of the respondents (69.17%) had not acquired credit and only 30.83 per cent respondents had acquired credit.

The data related to the various aspects of the credit regarding the respondents who had acquired credit is compiled in Table 4.13.

Table 4.13: Distribution of respondents according to their credit acquisition

(n=37)

Particulars	Frequency	Percentage
Source of credit*		
➢ Nationalized bank	20	54.05
➢ Cooperative society	16	43.24
➢ Money lender	02	5.41
➢ Shop	01	2.70
➢ NGO	01	2.70
Duration of credit		
➢ Up to 6 months	15	40.54
➢ 6 – 12 months	18	48.65
➢ > 12 months	04	10.81
Amount of credit*		
Cash (n =34)	34	91.89
➢ Up to Rs. 25,000	05	14.71
➢ Rs. 25,001 to Rs. 50,000	08	23.53
➢ Rs. 50001 to Rs. 100000	08	23.53
➢ More than Rs. 100000	13	38.24
Kind (n =14)	14	37.84
➢ Up to Rs. 25,000	08	57.14
➢ Rs. 25,001 to Rs. 50,000	04	28.57
➢ More than Rs. 50,000	02	14.29
Utilization of credit*		
➢ Purchasing of fertilizer	36	97.30
➢ Purchasing of chemical	34	91.89
➢ Purchasing of machinery	01	02.70
Mode of repayment		
➢ Cash	37	100.00
➢ Kind	00	0.00

*Based on multiple responses

With regards to source of credit, out of total respondents who acquired credit, more than half (54.05%) of the respondents had obtained credit from nationalized bank, 43.24 per cent respondents had obtained credit from co-operative society, 5.41 per cent respondents had obtained credit from money lender, while only 2.70 per cent had taken credit from shop and NGO, each.

When duration of credit was considered, out of total credit acquired respondents, the majority (48.65%) of the respondents had taken loan for 6–12 months duration, followed by 40.54 per cent of respondents who had taken loan for duration up to 6 months and only 10.81 per cent of the respondents had taken loan for more than 12 months duration.

When the mode of credit was studied, it was revealed that the credit was disbursed in both modes, either cash or kind. Some of the respondents had taken credit in cash, while others had taken in kind. There were also some respondents who had taken both cash and kind under credit.

Out of total credit acquired respondents, 91.89 per cent respondents received credit as cash, of which, 38.24 per cent respondents received credit of more than Rs 100000, 23.53 per cent respondents each received credit of Rs. 25001 to Rs. 50000 and Rs. 50001 to Rs. 100000 each, while only 14.71 per cent respondents had received credit of up to Rs. 25000 as cash from different sources.

Out of total credit acquired respondents, 37.84 per cent respondents had received credit as Kind, of which 57.14 per cent respondents had taken indirect credit of up to Rs.25000, while 28.57 per cent respondents gained indirect credit of Rs. 25001 to Rs. 50000, and only 14.29 per cent respondents received indirect credit of more than Rs. 50000 from different sources.

With respect to utilization of credit by the respondents, it was found that 97.30 per cent of the respondents had used their credit for purchasing fertilizers, followed by 91.89 per cent of the respondents for purchasing chemical and only 2.70 per cent respondents for purchasing machinery.

In respect to mode of repayment of obtaining credit, it was observed that all the respondents (100.00%) were repaying their credit as cash, while none of the respondents had repaid credited in kind.

Almost similar findings were reported by Pandey *et al.* (2004) in their study, which revealed that majority of the respondents (66.25%) had not acquired the credit, whereas, only 33.75 per cent respondents had acquired the credit.

Dubey (2008) revealed that majority (63.07%) of the respondents had not acquired credit, whereas, only 36.93 per cent of respondents had acquired credit. Out of total credit acquired respondents (39.58%) had taken the medium term credit, followed by short-term credit (37.51%) and long-term credit (22.91%). The majority of the respondents had acquired medium term credit while, minimum percentage of respondents had acquired long-term credit.

Dhruw (2008) indicated that the majority of the respondents (50%) had taken loan from nationalized bank.

4.1.3 Communicational characteristics of the respondents

4.1.3.1 Sources of information

The data regarding utilization of information sources for seeking the information about use of insecticide and application pattern is incorporated in the Fig - 4.9.

The findings revealed that majority (96.67%) of respondents were getting information regarding use of insecticide and application pattern from input dealer, followed by 70.00 per cent were using progressive farmer, 63.33 per cent from RAEOs/RHEOs, 60.0 per cent respondents collected information from friends, 25.00 per cent from kisan mitra, 23.33 per cent from exhibition, 22.50 per cent from kisan mela, 19.17 per cent from agriculture scientist, 15.83 per cent from relatives, 14.17 per cent from neighbors and training each, 10.00 per cent respondents collected information from Television, 6.67 per cent from kisan call center, 5.00 per cent from kisan mobile salahkar, 4.17 per cent from sarpanch/panch, 3.33 per cent from internet 2.50 per cent from news paper and agriculture magazines, only 0.83 per cent

respondents gained information regarding application pattern of insecticide from radio.

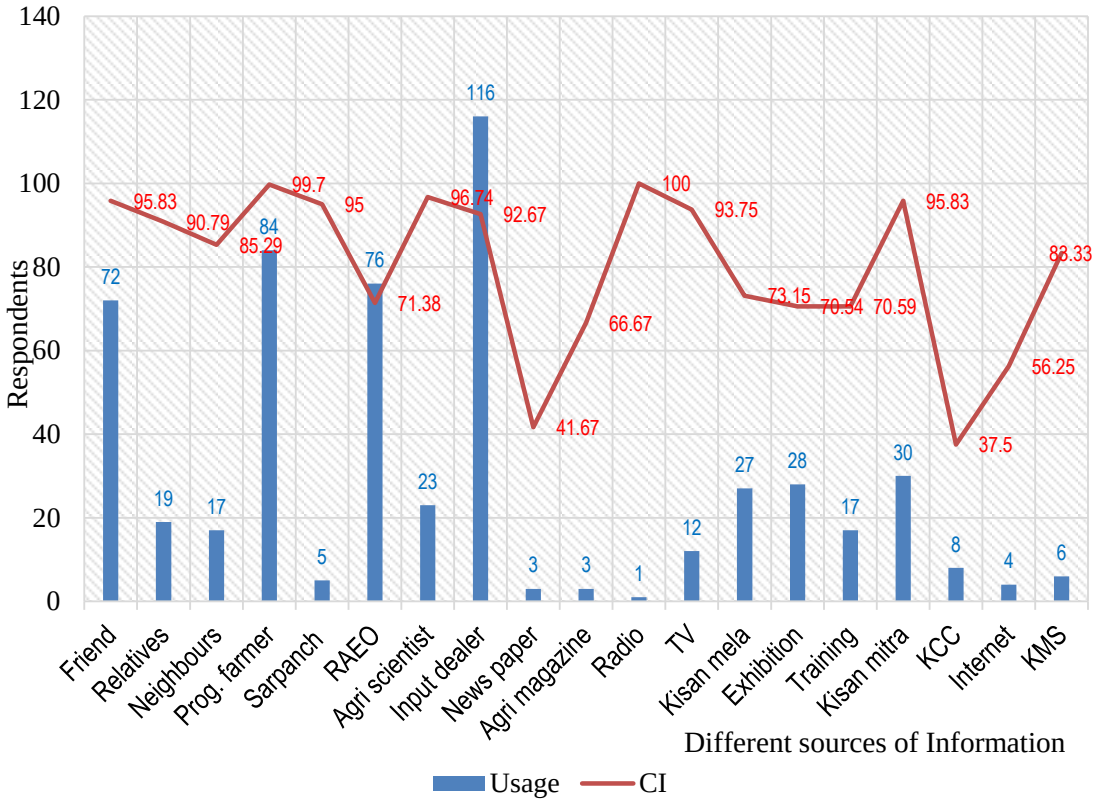

Fig - 4.9: Information source utilized by the respondents and their credibility

Regarding credibility of information sources being utilized by the respondents, data compiled in Fig - 4.9 shows that radio was fully credible source of information amongst the respondents, progressive farmers were having 99.70 credibility among the respondents, agriculture scientist were having 96.74 credibility among the respondents, friend and kisan mitra were having 95.83 credibility among the respondents, sarpanch/panch, television, input dealers, relatives, neighbors were also well credible sources among the respondents with 95.00,93.75, 92.67, 90.79 and 85.29 credibility, respectively.

Other sources like kisan mobile salahkar (83.33), kisan mela (73.15), RAEOs/RHEOs (71.38), training (70.59), exhibition (70.54), agriculture magazines (66.67) were also having a good credibility among the respondents. The not

commonly used information sources like internet and newspaper got, 56.25 and 41.67 credibility, respectively. While Kisan call center got 37.50 credibility as source for information.

Similar findings were also reported by Dhruw (2014) who reported that majority of the respondents (82.63%) had found information regarding summer rice cultivation from RAEOs. The study also revealed that, 79.16 per cent of the respondents had obtained the information from progressive farmer, followed by 59.72 per cent of respondents had obtained the information from friends.

4.1.3.2 Contact with extension agents

The data regarding contact with extension agents, presented in Table 4.14, show that 19.17 per cent of the respondents were in regular contacts with RAEOs/RHEOs, followed by 10.83 per cent respondents having regular contacts with KVK and about 7.50 per cent respondents had regular contacts with university scientists, only 0.83 per cent respondents were in regular contact with NGO.

Table 4.14: Extent of contact of the respondents with extension agents

(n = 120)

Sl. No.	Extension agents	Extent of contact							
		Never		Sometime		Often		Regular	
		F	%	F	%	F	%	F	%
1	RAEO/ RHEOs	44	36.67	20	16.67	33	27.50	23	19.17
2	KVK	99	82.50	05	4.17	03	02.50	13	10.83
3	University Scientists	108	90.00	01	0.83	02	01.67	09	07.50
4	NGO	119	99.17	00	0.00	00	0.00	01	0.83

Regarding frequency of contact with extension agents, majority (27.50%) of the respondents had often contacts with RAEOs/RHEOs. followed by 2.50 per cent respondents contacted with KVK and only 1.67 per cent respondents contacted with university scientists while NGO were not contacted often by the respondents.

Regarding some time contact with extension agents, maximum (16.67%) of respondents had contacts with RAEOs/ RHEOs. followed by 4.17 per cent respondents

contacted with KVK and only 0.83 per cent respondents contacted with university scientists while NGO were not contacted some time by the respondents.

Regarding never contact with extension agents, maximum (99.17%) of respondents had never contacts with NGO, followed by 90.00 per cent respondents never contacted with university scientist while 82.50 per cent respondents never contacted with KVK and 36.67 per cent respondents never contacted with RAEOs/ RHEOs.

Similar findings were also reported by Dhruw (2014) who noted that 56.25 per cent of the respondents often contact with RAEOs, followed by 31.94 per cent of the respondents regular contact and 11.18 per cent of the respondents rarely contact with RAEOs.

Narbaria (2013) studied regarding contact with agriculture college/university and found that majority of respondents (90.48%) had never contact, while only 9.52 per cent of them had sometimes contact. Regarding contact with NGO, the majority of respondents (90.41%) had never contact with NGO, while only 1.59 per cent of them had sometime contact.

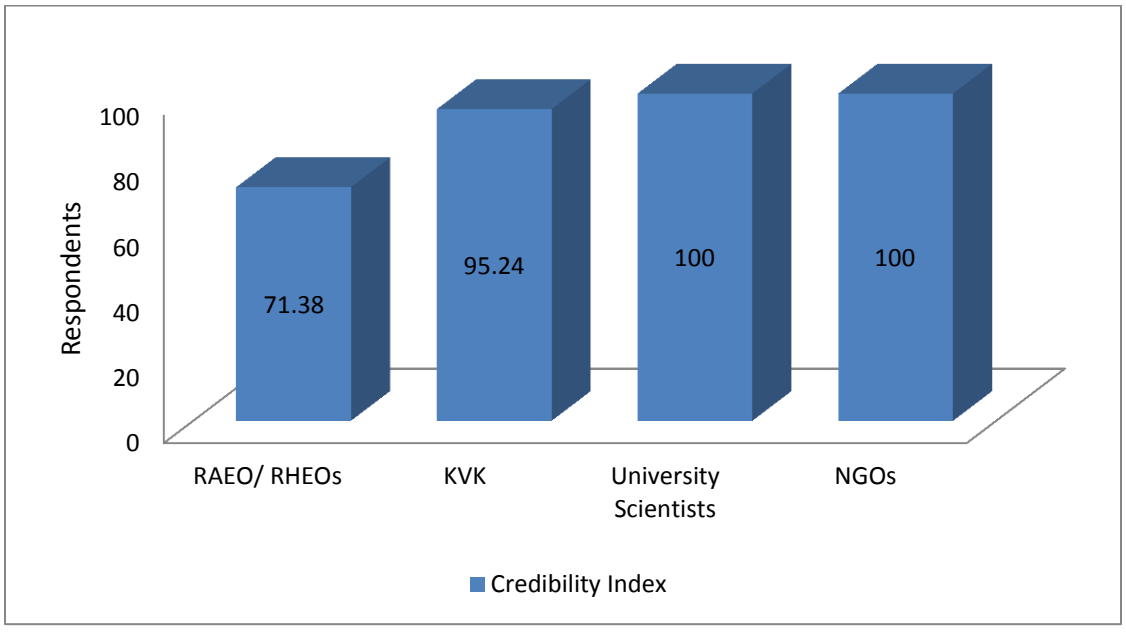

Fig. 4.10: Credibility of different extension agents among respondents

The credibility index of the different extension agencies was also calculated and is depicted in Figure 4.10. The findings revealed that university scientists and NGOs were having complete credibility, KVK were having credibility of 95.24 while RAEOs/RHEOs were having credibility of 71.38.

4.1.3.3 Information sources effecting decision of insecticide use

The decision is the selection of the best alternative available among the various options present before a person. The decision of a person depends upon various factors like his past experiences, his psychological conditions and the most important one is the opinions and suggestions of the persons or sources which are very credible and trustworthy for him. The data regarding the various sources of information which effects his decision were asked by the respondents and are listed in the following Table 4.15.

The first thing which comes in the insecticide use is that whether there is need of insecticide or not. Respondents were asked for the various sources which he refers to, when he has to decide whether there is any need of insecticide. Majority of the respondents were referring to progressive farmers (63.33%), input dealer (55.83%), RAEOs / RHEOs (32.50%) and friends (19.17%). The other sources referred for deciding for need of insecticide of insect were kisan mitra (18.33%), university scientists & relatives (9.17% each), training (8.33%), neighbours (7.50%), kisan mobile salahkar & television (4.17% each), sarpanch/panch (3.33%), news paper (2.50%), internet and agriculture magazine (1.67% each) and kisan mela, radio, kisan call centre & exhibition (0.83% each).

After coming to decision that there is a need for use of insecticide in the field, the next question arises of which insecticide to use. For coming to the decision regarding which insecticide to be used in the field, majority of the respondents referred to Input dealers (96.67%), progressive farmers (70.00%), RAEO / RHEOs (45.00%) and friends (30.00%). The other sources being referred for coming to the decision regarding which insecticide to be used in the fields were university scientists (19.17%), relatives (15.83%), neighbours & trainings (14.17% each),

Table 4.15: Various information sources effecting decision of insecticide use*

(n=120)

Sl. No.	Source of Information	Need of insecticide		Which insecticide to use		Dosage of insecticide		Application frequency		Sources of insecticide	
		F	%	F	%	F	%	F	%	F	%
1	Friends	23	19.17	36	30.00	36	30.00	36	30.00	62	51.67
2	Relatives	11	09.17	19	15.83	19	15.83	14	11.67	10	08.33
3	Neighbours	09	07.50	17	14.17	17	14.17	15	12.50	16	13.33
4	Progressive farmers	76	63.33	84	70.00	84	70.00	84	70.00	83	69.17
5	Sarpanch / Panch	04	03.33	05	04.17	05	04.17	03	02.50	05	04.17
6	RAEOs/RHEOs	39	32.50	54	45.00	54	45.00	49	40.83	17	14.17
7	University scientists	11	09.17	23	19.17	23	19.17	20	16.67	00	0.00
8	Input dealer	67	55.83	116	96.67	116	96.67	110	91.67	00	0.00
9	News papers	03	02.50	03	02.50	03	02.50	02	01.67	00	0.00
10	Agriculture magazines	02	01.67	03	02.50	03	02.50	03	02.50	00	0.00
11	Radio	01	00.83	01	00.83	01	00.83	01	00.83	00	0.00
12	Television	05	04.17	12	10.00	10	08.33	10	08.33	00	0.00
13	Kisan mela	01	00.83	01	0.83	01	0.83	01	0.83	00	0.00
14	Exhibition	01	00.83	02	1.67	02	1.67	02	1.67	01	00.83
15	Training	10	08.33	17	14.17	17	14.17	14	11.67	01	00.83
16	Kisan mitras	22	18.33	30	25.00	30	25.00	29	24.17	25	20.83
17	Kisan call center	01	00.83	08	06.67	08	06.67	07	05.83	00	0.00
18	Internet	02	01.67	04	03.33	04	03.33	04	03.33	00	0.00
19	KMS	05	04.17	06	05.00	06	05.00	06	05.00	00	0.00

*****Based on multiple responses

Television (10.00%), kisan call centre (6.67%), kisan mobile salahkar (05.00%), sarpanch/panch (4.17%), internet (3.33%), newspaper & agriculture magazines (2.50% each), exhibition (1.67%) and kisan mela & radio (0.83% each).

After coming to the decision which insecticide to be used, next comes the decision regarding what dosage the insecticide be used in the field. Majority of the respondents referred to Input dealer (96.67%), progressive farmers (70.00%), RAEOs/RHEOs (45.00%), friends (30.00%) and kisan mitra 25.00%).

The other sources referred for deciding dosage of insecticides were university scientists (19.17%), relatives (15.83%), neighbours & trainings (14.17% each), television (08.33%), kisan call centre (6.67%), kisan mobile salahkar (5.00%), internet (3.33%), newspapers & agriculture magazines (2.50% each), exhibition (1.67%) and kisan mela & radio (0.83% each).

When the dosage is finalized next comes the frequency of application of the insecticides, for which majority of the respondents referred to input dealers (91.67%), progressive farmers (70.00%), RAEOs/RHEOs (40.83%), friends (30.00%) and Kisan mitra (24.17%). The other sources being referred for deciding the frequency of application of the insecticides were university scientists (16.67%), neighbours (12.50%), relatives & trainings (11.67% each), television (08.33%), kisan call centre (05.83%), kisan mobile salahkar (05.00%), internet (3.33%), agricultural magazines & sarpanch / panch (02.50% each), newspapers & exhibition (1.67% each) and radio & kisan mela (0.83% each).

After deciding regarding need, dosage and frequency of insecticides, then comes the question regarding from where to procure the insecticide, i.e., what should be the source of purchase of the insecticide. Majority of the respondents referred to progressive farmers (69.17%), friends (51.67%), kisan mitra (20.83%), RAEOs/RHEOs (14.17%) and neighbours (13.33%). The other sources of information utilized for deciding the source of insecticides were relatives (08.33%), sarpanch / panch (04.17%), exhibition & training (0.83% each).

4.1.4 Socio-psychological characteristics of respondents

4.1.4.1 Risk orientation

Regarding risk orientation, data presented in Table 4.16 show that majority (60.00%) of respondents had medium level (64 to 74 score) of risk orientation, followed by 27.50 per cent of them had low level (less than 64 score) of risk orientation, while only 12.50 per cent of respondents were having high level (more than 74 score) of risk of orientation.

Table 4.16: Distribution of respondents according to their risk orientation

(n=120)

Sl. No.	Level of risk orientation	Frequency	Percentage
1.	Low level (less than 64 score)	33	27.50
2.	Medium level (64 to 74 score)	72	60.00
3.	High level (more than 74 score)	15	12.50
$\bar{X}$=64			SD=5.30

Similar findings were also reported in the study byPainkra (2014),who found that majority (86.66%) of respondents had medium level (19 to 23 score) of risk orientation followed by 10.88 per cent had low level (less than 19 score) of risk orientation, while only 2.50 per cent of respondents were having high level (more than 23 score).

4.1.4.2 Cosmopoliteness

Cosmopoliteness refers to the outside contact of individuals from his own social system. It may influence the adoption behaviour of respondents through exposure towards innovations. The data regarding cosmopoliteness are presented in Table 4.17. The results shows that half of the respondents (50.00%) had medium cosmopoliteness, followed by 18.33 per cent of them having low cosmopoliteness, 17.50 per cent of them were having high cosmopoliteness and only 14.17 per cent of them had nil cosmopoliteness.

Table 4.17**:** Distribution of respondents according to their cosmopoliteness

(n=120)

Sl. No.	Cosmopoliteness	Frequency	Percentage
1	Nil (Never)	17	14.17
2	Low (Once in a month)	22	18.33
3	Medium (Once in a week)	60	50.00
4	High (Twice or more in a week)	21	17.50

Similar findings were also reported by Yadav (2007) who revealed that majority of trained (57.56%) and untrained farmers (68.89%) were having medium level of cosmopoliteness. It was noted that 15.56, 22.22 per cent of trained farmers had low and very high level of cosmopoliteness, respectively.

4.1.5 Technological characteristics of the respondents

4.1.5.1 Source of insecticide

There are many sources, from where the respondents can procure the needed insecticide(s). The data regarding the sources of insecticide was collected, analysed, tabulated and is presented in Table 4.18.

Table 4.18: Sources of procurement of insecticide

(n=120)

Sl. No.	Source of insecticide procurement	Frequency*	Percentage
1.	Agriculture Department	19	15.83
2.	Co-operative Society	01	00.83
3.	Representatives of manufacturing companies	05	04.17
4.	Input dealer	120	100.0

* Based on multiple responses

The data reveal that all the respondents were procuring insecticides from the input dealers (100.0%), followed by agriculture department (15.83%), representatives of manufacturing companies (04.17%) and cooperative society (0.83%).

Similar findings were also reported by Jing (2015) who noted that majority of the farmers (90.8%) obtain their pesticides from local agrochemical input dealers. This is not surprising as the majority of the respondent base are unable to distinguish between different pest and disease pathogens and control measures such as

insecticides and fungicides and rely on information and advice provided by local agro-input dealers for the decision making.

4.1.5.2 Availability of insecticide

The information regarding the availability of insecticides from different sources were collected, tabulated, analysed and presented in Table 4.19.

Table 4.19: Availability of insecticide from different sources

(n=120)

Sl.No.	Availability of insecticide	Frequency	Percentage
1.	Availability of insecticide as per requirements of brand		
	➢ Fully	55	45.83
	➢ Partial	36	30.00
	➢ Nil	29	24.17
2.	Availability of insecticide as per required time		
	➢ Fully	67	55.83
	➢ Partial	34	28.33
	➢ Nil	19	15.83
3.	Availability of insecticide as per quantity		
	➢ Fully	84	70.00
	➢ Partial	24	20.00
	➢ Nil	12	10.00
4.	Availability of insecticide at local market		
	➢ Fully	25	20.83
	➢ Partial	57	47.50
	➢ Nil	38	31.67

When the farmers decides and goes to purchase the insecticide, it's availability is usually not as desired. The availability of insecticide was studied on four different aspects viz., availability of insecticide as per requirements of brand, as per required time, as per required quantity and availability at local market.

When the availability of insecticide as per requirement of brand was concerned, majority of the respondents reported that there was fully availability of the insecticide as per requirement of brand (45.83%), followed by partial availability (30.0%) and nil availability (24.17%).

Regarding the availability of insecticide as per required time, majority of the respondents reported that they were fully available when required (55.83%), followed by partially available (28.33%) and nil available on required time (15.83%).

Regarding the availability of insecticide as per quantity, majority of the respondents opined that they were fully getting the insecticides as per required quantity (70.0%), followed by in partial quantity (20.0%) and nil availability in required quantity (10.0%).

Required the availability of insecticide at local market, majority of the respondents reported that the insecticides were partially available at local market (47.50%) and they had to go to the nearby markets. While 31.67 per cent of the respondents reported that there was nil availability of insecticide at local market (31.67%) and they had to rely on nearby markets for the insecticides but 20.83 per cent of them reported that there was fully availability of the insecticides at local market.

4.1.5.3 Storage place of insecticides

The information regarding the storage of insecticide by respondents were collected, tabulated, analysed and presented in Table 4.20.

The data regarding storage of insecticide before application reveal that, 42.50 per cent of the respondents were storing in insecticide at their farm, followed by 36.67 per cent of the respondents who were storing insecticides at outer area of house.

Table 4.20: Distribution of respondents according to their storage place of insecticide

(n = 120)

Sl. No.	Storage place of insecticide	Frequency*	Percentage
1	Anywhere at home	01	0.83
2	Carefully at secured place	41	34.17
3	At outer area of house	44	36.67
4	Keep in farm	51	42.50
5	Buy at time of use (No storage)	20	16.67

* Based on multiple responses

While 34.17 per cent of the respondents were storing carefully at secured place, 16.67 per cent of the respondents were not storing insecticide but they bought insecticide at the time of use and 0.83 per cent of the respondents stored it carelessly anywhere at home.

4.1.5.4 Knowledge of toxicity symbol of different insecticide label

The information regarding the knowledge of toxicity symbols in the label of insecticides by respondents were collected, tabulated, analysed and presented in Table 4.21.

Table 4.21: Knowledge regarding toxicity symbol of different insecticide label

(n=120)

Sl. No.	Knowledge of toxicity symbol	Frequency	Percentage
1	Fully	29	24.17
2	Partially	15	12.50
3	Nil	76	59.17

The data presented in Table 4.21 reveal that knowledge regarding danger & toxicity level of insecticide by labels, 59.17 per cent of the respondents were having no knowledge about insecticide label (Red, Yellow, Blue and Green), 24.17 per cent of the respondents were having full knowledge about insecticide label and 12.50 per cent of the respondents were having partial knowledge about insecticide toxicity symbols in label.

4.1.5.5 Frequency of insecticide spray

The information regarding the frequency of insecticides spray at different growth stages of vegetable crops by respondents were collected, tabulated, analysed and presented in Fig. 4.11.

At the nursery stage of the crop, 7.5 per cent of the respondents were spraying insecticides only once, while 2.50 per cent of them were spraying twice.

At the transplanting stage, 48.33 per cent of the respondents were spraying two times, 35.83 per cent were spraying only once, while 10.00 per cent of them were spraying three times and 1.67 per cent were spraying insecticides four times.

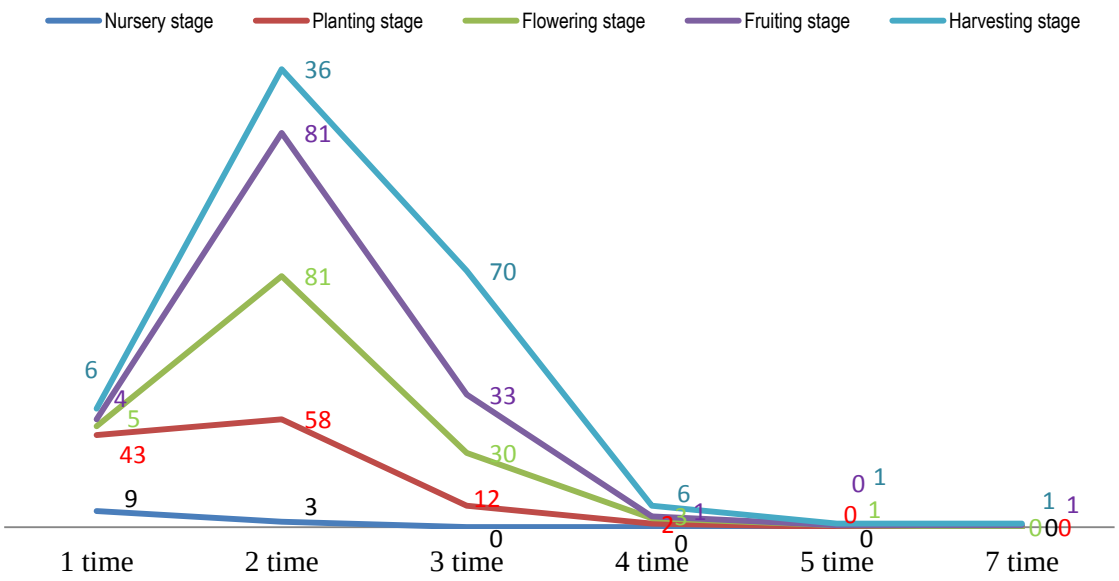

Fig. 4.11: Frequency of insecticide spray

At the flowering stage, 67.50 per cent of the respondents were spraying two times, 25.0 per cent were spraying three times, 4.17 per cent were spraying once, 2.50 per cent were spraying four times and 0.83 per cent were spraying insecticides five times on the crop.

At the fruiting stage, 67.50 per cent of them were spraying twice, 27.50 per cent were spraying thrice, 3.33 per cent were spraying once, while 0.83 per cent of them were spraying insecticides four and seven times each.

At the harvesting stages, just before picking up the ready vegetables for sending to market for sale, 58.33 per cent of them were spraying insecticides three times, 30.0 per cent were spraying two times, 5.0 per cent were spraying four times and 0.83 per cent of them were spraying insecticides five and seven times, each.

4.1.5.6 Application time of insecticide

The information regarding the application time of insecticides by respondents were collected, tabulated, analysed and presented in Fig.-4.12.

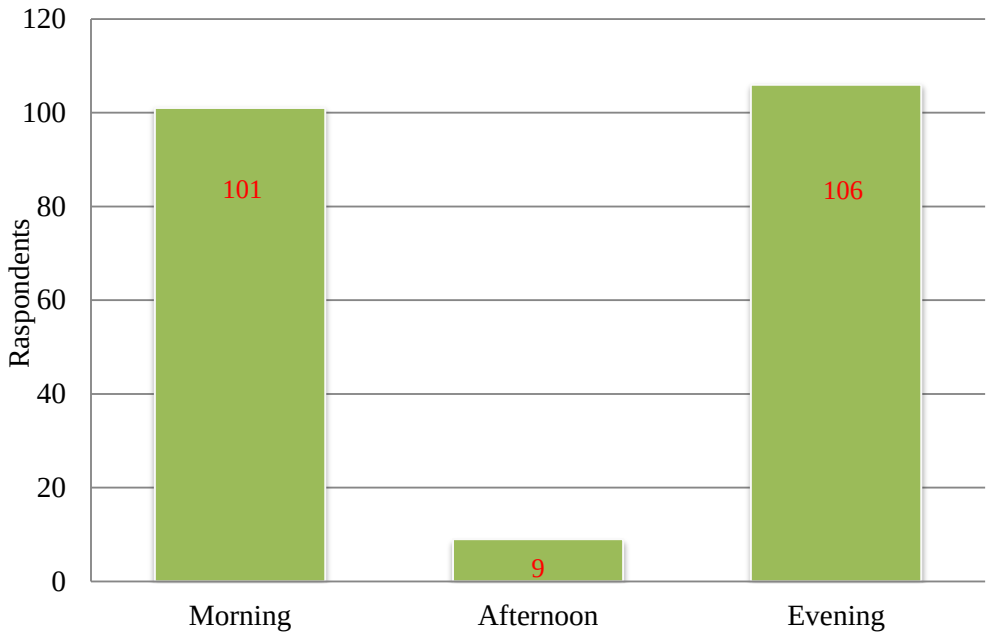

Fig 4.12: Time of insecticide application

The information regarding time of insecticide application revealed that, 88.33 per cent of the respondents were applying insecticide in the evening time, followed by 84.17 per cent of the respondents applying insecticide at morning time and only 7.50 per cent of the respondents were applying insecticide at afternoon.

4.1.5.7 Application technique of insecticides used by the farmers

The information regarding the application technique of insecticides use by respondents were collected, tabulated, analysed and presented in Table 4.22.

Regarding spray of insecticide done by the respondents, it was revealed that majority of the respondents (95.83%) were themselves spraying the insecticides in the field while 46.67 per cent of them were depending on hired labours for the spray of insecticide.

Table 4.22: Techniques of insecticide application

(n=120)

Sl. No.	Techniques for use of insecticide	Frequency*	Percentage
1.	Spray by		
	➢ Self	115	95.83
	➢ Laboures	56	46.67
2.	Type of Sprayer		
	➢ Manual sprayer	118	98.33
	➢ Power sprayer	18	15.00
3.	Ownership		
	➢ Manual sprayer	118	98.33
	➢ Power sprayer	02	01.67

* Based on multiple responses

Regarding type of sprayer used for insecticide spray, it was revealed that majority (98.33%) were spraying insecticide by manual sprayer while 15.00 per cent of them were using power sprayer.

Regarding ownership of the implement of insecticide application, it was revealed that majority (98.33%) of the respondents were using manual sprayer while only 1.67 per cent of the respondents were using a power sprayer.

4.1.5.8 Precautions during insecticide application

Since the insecticides are poisonous chemicals and any negligence in its use may prove lethal. The person using the insecticides must be very cautious in following the safety measures. The knowledge and adoption of the precautions during the spray of insecticides by the respondents was collected, analysed, tabulated and presented in Table 4.23.

Regarding the respondents' knowledge of the precautions during the insecticide spray the table reveals that they were having no knowledge regarding use of cap to cover their hairs during spray (0.83%) and washing of hands with soap after spray (0.83).

They were having partial knowledge regarding use of cap (37.50%), use of goggles to protect their eyes (33.33%), use of shoes (25.0%), use of gloves (6.67%),

not consuming any eatables during spray (1.67%), washing of hands with soap after spray and changing the clothes after spray of insecticides (0.83% each).

They were having full knowledge regarding use of mask to cover the face (100%), spraying the insecticides along with the application according to wind direction (100%), Suitability of sprayer nozzle (100%), changing cloth after spray (99.17%), washing of hands with soap after spray (98.33%), not consuming any eatables during spray (98.33%), use of gloves (93.33%), use of shoes (75.00%), use of goggles (66.67%) and use of cap (61.67%).

Regarding adoption of the precautions, the respondents had not adopted use of goggles (90.00%), use of cap (84.17%), use of shoes (82.50%), use of gloves (55.00%), not consuming any eatables (21.67%), changing cloth after insecticide spray (11.67%) and use of mask (0.83%).

They sometimes adopted precautions regarding changing cloth after insecticide spray (49.17%), not consuming any eatables during spray (46.67%), use of gloves (40.83%), use of shoes (17.50%), use of mask and use of cap (14.17% each), use of goggles (10.00%), application of the insecticides according to wind direction (2.50%) and washing of hands with soap after spray (0.83%).

They often adopted the precautions regarding changing cloth after insecticide spray (30.00%), not consuming any eatables during spray (21.67%), use of mask (17.50%), application of the insecticides according to wind direction (15.00%), suitability of sprayer nozzle (9.17%), washing of hands with soap after spray (6.67%), and use of gloves (1.67%).

They were having regular adoption regarding washing of hands with soap after spray (92.50%), Suitability of sprayer nozzle (90.83%), spraying the insecticides along with the application according to wind direction (82.50%), use of mask (67.50%), not consuming any eatables during spray (10.00%), changing cloth after insecticide spray (9.17%), use of gloves and use of cap (1.67%).

Table 4.23: Distribution of respondents according to their precautions of insecticide application

(n=120)

Sl. No.	Precaution	Knowledge*						Adoption*							
		Nil		Partially		Fully		Never		Sometime		Often		Regular	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	Use of Mask	00	0.00	00	0.00	120	100.0	01	00.83	17	14.17	21	17.50	81	67.50
2	Use of Gloves	00	0.00	08	06.67	112	93.33	66	55.00	49	40.83	02	01.67	03	02.50
3	Use of Shoe	00	0.00	30	25.00	90	75.00	99	82.50	21	17.50	00	0.00	00	0.00
4	Use of Goggles	00	0.00	40	33.33	80	66.67	108	90.00	12	10.00	00	0.00	00	0.00
5	Use of Cap	01	0.83	45	37.50	74	61.67	101	84.17	17	14.17	00	0.00	02	01.67
6	Post application hand wash	01	0.83	01	00.83	118	98.33	00	0.00	01	00.83	08	06.67	111	92.50
7	Post application cloth change	00	0.00	01	00.83	119	99.17	14	11.67	59	49.17	36	30.00	11	09.17
8	Application according to wind direction	00	0.00	00	0.00	120	100.0	00	0.00	03	02.50	18	15.00	99	82.50
9	Consumption of eatables during spray	00	0.00	02	01.67	118	98.33	26	21.67	56	46.67	26	21.67	12	10.00
10	Suitability of sprayer nozzle	00	0.00	00	0.00	120	100.0	00	0.00	00	0.00	11	9.17	109	90.83

* Based on multiple responses

4.1.5.9 Use of empty insecticide container

The information regarding the use of empty insecticide container by respondents were collected, tabulated, analysed and presented in Table 4.24.

Table 4.24: **U**se of empty insecticide container

(n=120)

Sl. No.	Use of empty insecticide container	Frequency*	Percentage
1	Reuse after washing	11	9.17
2	Just throw at farm any where	56	46.67
3	Bury in soil	24	20.00
4	Burn	21	17.50
5	Sell to *kabaadi*	22	18.33

* Based on multiple sources

Regarding their use of empty insecticide container, majority (46.67%) of the respondents were very careless, as they used to just throw empty insecticide container anywhere at farm, followed by 20.00 per cent of the respondents who used to bury the empty insecticide container in soil, while 18.33 per cent of the respondents used to sell empty insecticide container to *kabaadi*, whereas 17.50 per cent of the respondent used to burn empty insecticide container and 9.17 per cent of them used to reuse empty insecticide container after washing.

4.1.5.10 Knowledge and adoption of waiting period of insecticide

Information regarding the knowledge level of the respondents of the waiting period of the different insecticides used for the various insects for the major vegetable crops was collected, tabulated, analysed and is presented in Table 4.25 and Fig 4.13.

When the tomato crop was studied, there were three major insects viz. fruit borer, white fly and cut worm**.** Majority of the respondents were having no knowledge (38.33%) regarding waiting period of the insecticides for the control of fruit borer of tomato, followed by partial (27.50%) and complete (19.17%) knowledge. The knowledge index came out to be 32.92.

The respondents were having no knowledge (38.33%) regarding waiting period of the insecticides for the control of white fly of tomato followed by partial (27.50%) and complete (19.17%) knowledge. The knowledge index came out to be 32.92.

The respondents were having no knowledge, partial and complete (3.33% each) regarding waiting period of the insecticides for the control of cut worm of tomato. The knowledge index came out to be 5.00.

When the brinjal crop was studied, there were four major insects' viz. fruit borer and stem borer, white fly mite and Jassid. Majority of the respondents were having no knowledge (47.50%) regarding waiting period of the insecticides for the control of fruit and stem borer of brinjal, followed by partial (30.83%) and complete (18.33%) knowledge. The knowledge index came out to be 33.75.

The respondents were having no knowledge (25.83%) regarding waiting period of the insecticides for the control of white fly of brinjal followed by partial (16.67%) and complete (11.67%) knowledge. The knowledge index came out to be 20.00.

The respondents were having partial knowledge (8.33%) regarding waiting period of the insecticides for the control of mite of brinjal followed by complete knowledge (5.00%) and no knowledge (4.17%). The knowledge index came out to be 9.17.

The respondents were having partial knowledge (5.00%) regarding waiting period of the insecticides for the control of Jassid of brinjal followed by complete knowledge (2.50%) and no knowledge (00%). The knowledge index came out to be 5.00.

Table 4.25: Knowledge and Adoption of waiting period of insecticide

(n=120)

Sl. No.	Crop/Insect	Knowledge						Adoption					
		Nil		Partial		Complete		Nil		Partial		Complete	
		F	%	F	%	F	%	F	%	F	%	F	%
1	Tomato												
	Fruit Borer	46	38.33	33	27.50	23	19.17	74	61.67	28	23.33	00	00
	White Fly	46	38.33	33	27.50	23	19.17	74	61.67	28	23.33	00	00
	Cut worm	04	03.33	04	03.33	04	03.33	06	05.00	06	05.00	00	00
2	Brinjal												
	Fruit Borer	57	47.50	37	30.83	22	18.33	87	72.5	29	24.17	00	00
	White Fly	31	25.83	20	16.67	14	11.67	48	40.00	17	14.17	00	00
	Mite	05	04.17	10	08.33	06	05.00	13	10.83	08	06.67	00	00
	Jassid	00	00	06	05.00	03	02.50	04	03.33	02	01.67	00	00
3	Chili												
	Fruit Borer	22	18.33	18	15.00	12	10.00	38	31.67	14	11.67	00	00
	White Fly	22	18.33	18	15.00	12	10.00	38	31.67	14	11.67	00	00
	Thrips	21	17.50	16	13.33	12	10.00	35	29.17	14	11.67	00	00
	Aphid	03	02.50	02	01.67	06	05.00	04	03.33	07	05.83	00	00
	Mite	02	01.67	00	00	03	02.50	02	01.67	03	02.50	00	00
4	Cabbage & Cauliflower												
	DBM	31	25.83	21	17.50	10	08.33	48	40.00	14	11.67	00	00

When the chilli crop was studied, there were five major insects viz. fruit borer, white fly, thrips, aphid and mite. Majority of the respondents were having no knowledge (18.33%) regarding waiting period of the insecticides for the control of fruit borer of chilli, followed by partial (15.00%) and complete (10.00%) knowledge. The knowledge index came out to be 17.50.

The respondents were having no knowledge (18.33%) regarding waiting period of the insecticides for the control of white fly of chilli, followed by partial (15.00%) and complete (10.00%) knowledge. The knowledge index came out to be 17.50.

The respondents were having no knowledge (17.50%) regarding waiting period of the insecticides for the control of thrips of chilli, followed by partial (13.33%) and complete (10.00%) knowledge. The knowledge index came out to be 16.67.

The respondents were having complete knowledge (5.00%) regarding waiting period of the insecticides for the control of aphid of chilli, followed by no knowledge (2.50%) and partial (1.67%) knowledge. The knowledge index came out to be 5.83.

The respondents were having complete knowledge (2.50%) regarding waiting period of the insecticides for the control of mite of chilli, followed by no knowledge (1.67%) and partial (00%) knowledge. The knowledge index came out to be 2.50.

When the cabbage and cauliflower crop was studied, there were only one major insect i.e., diamond back moth. Majority of the respondents were having no knowledge (25.83%) regarding waiting period of the insecticides for the control of DBM of cabbage & cauliflower, followed by partial (17.50%) and complete (8.33%) knowledge. The knowledge index came out to be 17.08.

Information regarding the adoption level of the respondents of the waiting period of the different insecticides used for the various insects for the crops was collected, tabulated, analysed and is presented in Table 4.25.

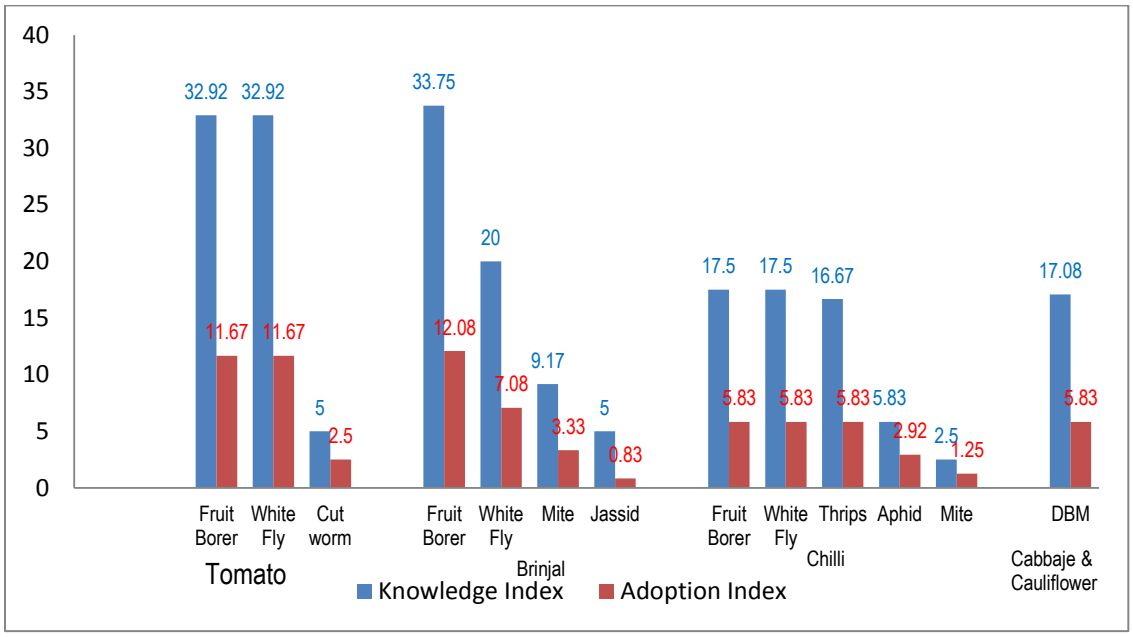

Fig. 4.13: Knowledge and adoption of waiting period of insecticide

When the tomato crop was studied, there were three major insects viz. fruit borer, white fly and cut worm. Majority of the respondents were having no adoption (61.67%) regarding waiting period of the insecticides for the control of fruit borer of tomato, followed by partial (23.33%) and complete (0.00%) adoption. The adoption index came out to be 11.67.

The respondents were having no adoption (61.67%) regarding waiting period of the insecticides for the control of white fly of tomato, followed by partial (23.33%) and complete (0.00%) adoption. The adoption index came out to be 11.67.

The respondents were having no adoption (5.00%) regarding waiting period of the insecticides for the control of cut worm of tomato, followed by partial (5.00%) and complete (0.00%) adoption. The adoption index came out to be 2.50.

When the brinjal crop was studied, there were four major insects viz fruit and stem borer, white fly, mite and Jassid. Majority of the respondents were having no adoption (72.50%) regarding waiting period of the insecticides for the control of fruit borer and stem borer of brinjal, followed by partial (24.17%) and complete (0.00%) adoption. The adoption index came out to be 12.08.

The respondents were having no adoption (40.00%) regarding waiting period of the insecticides for the control of white fly of brinjal, followed by partial (14.17%) and complete (0.00%) adoption. The adoption index came out to be 7.08.

The respondents were having no adoption (10.83%) regarding waiting period of the insecticides for the control of mite of brinjal, followed by partial (6.67%) and complete (0.00%) adoption. The adoption index came out to be 3.33.

The respondents were having no adoption (3.33%) regarding waiting period of the insecticides for the control of jassid of brinjal, followed by partial (1.67%) and complete (0.00%) adoption. The adoption index came out to be 0.83.

When the chilli crop was studied, there were five major insects viz. fruit borer, white fly, thrips, aphid and mite. Majority of the respondents were having no adoption (31.67%) regarding waiting period of the insecticides for the control of fruit borer of chilli, followed by partial (11.67%) and complete (0.00%) adoption. The adoption index came out to be 5.83.

The respondents were having no adoption (31.67%) regarding waiting period of the insecticides for the control of White fly of chilli, followed by partial (11.67%) and complete (0.00%) adoption. The adoption index came out to be 5.83.

The respondents were having no adoption (29.17%) regarding waiting period of the insecticides for the control of thrips of chilli, followed by partial (11.67%) and complete (0.00%) adoption. The adoption index came out to be 5.83.

The respondents were having partial adoption (5.83%) regarding waiting period of the insecticides for the control of aphid of Chilli, followed by no Adoption (3.33%) and complete (0.00%) adoption. The adoption index came out to be 2.92.

The respondents were having partial adoption (2.50%) regarding waiting period of the insecticides for the control of mite of chilli, followed by no adoption (1.67%) and complete (0.00%) adoption. The adoption index came out to be 1.25.

When the cabbage and cauliflower crop was studied, there was only one major insects viz. DBM. Majority of the respondents were having no adoption (40.00%) regarding waiting period of the insecticides for the control of DBM of cabbage &

cauliflower, followed by partial (11.67%) and complete adoption (0.00%). The adoption index came out to be 5.83.

Similar findings were also reported in their studies by Miah *et al.* (2014) who stated that pesticide application in the study area as well as whole country is depends upon seasons, crop types, infestation rates and vegetables for instance, in the rainy season pesticides are usually used each day or in every alternative day. In addition, fast growing vegetables (e.g., brinjal, cabbage, cauliflower, cucumber, lady's finger, yard long bean, tomato etc.) that are to be harvested in alternative days or two-three days in a week receive indiscriminate use of pesticides. The current study found that on an average 4%, 19%, 18% and 58% respondents spray pesticides over their vegetable fields in each day, alternative day, two and one times in a week respectively.

4.1.5.11 Reasons for the non adoption of waiting period of insecticides

The information regarding reasons for the non adoption of waiting period of insecticides was collected, tabulated, analysed and is presented in Table 4.26.

When the tomato crop was studied, the major reasons for non adoption of waiting period of insecticides for fruit borer insect came out to be carelessness (45.83%), the respondents were aware of the ill-effect of the insecticides but they bothered a little, they were having not much concern regarding the poisonous and toxic residual effects of the insecticides over the consumers of the vegetables. Followed by no knowledge of the waiting period of insecticides (38.33%) and no time interval between insecticide spray and marketing (0.83%) because of very sensitive price fluctuation in the market. For the white fly of tomato the reasons were careless attitude (45.83%), no knowledge (38.33%) and for immediate marketing (0.83%). For non adoption regarding the cut worm of tomato, the reasons were careless attitude (7.50%), no knowledge (2.50%).

When the brinjal crop was studied, the major reasons for non adoption of waiting period of insecticides for fruit borer and stem borer insect came out to be carelessness (48.33%), no knowledge of the waiting period of insecticides (47.50%) and no time interval between insecticide spray and marketing (0.83%) because of very

sensitive price fluctuation in the market. For the white fly of brinjal the reasons were careless attitude (28.33%), no knowledge (25.83%). The mite of brinjal the reasons were careless attitude (13.33%), no knowledge (4.17%) and the jassid of brinjal the reasons were no knowledge (7.50%).

Table 4.26: Reasons for the non adoption of waiting period of insecticides

(n=120)

Sl. No.	Crop/ Insect	Lack of knowledge		Carelessness		For immediate marketing	
		F	%	F	%	F	%
A	Tomato						
1	Fruit Borer	46	38.33	55	45.83	01	0.83
2	White Fly	46	38.33	55	45.83	01	0.83
3	Cut worm	03	02.50	09	07.50	00	00
B	Brinjal						
1	Fruit Borer	57	47.50	58	48.33	01	0.83
2	White Fly	31	25.83	34	28.33	00	00
3	Mite	05	04.17	16	13.33	00	00
4	Jassid	09	07.50	00	00	00	00
C	Chilli						
1	Fruit Borer	22	18.33	29	24.17	01	0.83
2	White Fly	22	18.33	29	24.17	01	0.83
3	Thrips	21	17.50	27	22.50	01	0.83
4	Aphid	03	02.50	08	06.67	00	00
5	Mite	02	01.67	03	02.50	00	00
D	Cabbage & Cauliflower						
1	DBM	31	25.83	30	25.00	01	0.83

When the chilli crop was studied, the major reasons for non adoption of waiting period of insecticides for fruit borer insect came out to be carelessness (24.17%), no knowledge of the waiting period of insecticides (18.33%) and no time interval between insecticide spray and marketing (0.83%) because of very sensitive price fluctuation in the market. For the white fly of chilli the reasons were careless

attitude (24.17%), no knowledge (18.33%). and for immediate marketing (0.83%). For the thrips of chilli the reasons were careless attitude (22.50%), no knowledge (17.50%) and for immediate marketing (0.83%). For the aphid of chilli the reasons were careless attitude (6.67%) and no knowledge (2.50%). For the mite of chilli the reasons were careless attitude (2.50%) and no knowledge (1.67%).

When the cabbage and cauliflower crop was studied, the major reasons for non adoption of waiting period of insecticides for DBM insect came out to be no knowledge (25.83%), carelessness (25.00%), and no time interval between insecticide spray and marketing (0.83%) because of very sensitive price fluctuation in the market.

4.1.5.12 Season wise crop varieties used by respondents

The data regarding season wise crop varieties used by the respondents was collected, tabulated, analysed and is presented in Table 4.27.

The table reveals that during *kharif* and *zaid* season, the vegetables crops were sown by very few respondents while *Rabi* was the main cropping season of vegetables for them. The probable reason may be that during *kharif* almost all the farmers of Chhattisgarh are engaged in paddy cultivation, which is the sole dominating crop of the state and during the *zaid* season, there is scarcity of irrigation and also very scorching sunlight. Due to these reasons the *Rabi* is occurring as the major season for vegetables cultivation.

During *Kharif* season, the major crops undertaken by the respondents were tomato (2.50%), brinjal (12.50%) and chilli (3.33%). The varieties of tomato sown by the respondents are VNR – 5005 (100%) and Namdhari - 592 (33.33%).

The varieties of brinjal sown by the respondents were VNR – 212 (100%) and VNR – 218 (6.67%). The varieties of chilli sown by the respondents were VNR – 305 (50.0%), VNR – 328 (25.0%) and VNR – 435 (Shilpa) (25.0%).

Table 4.27: Distribution of respondents according to season wise cultivation of different varieties of vegetable crops

(n=120)

Sl. No.	Season/Crop/Variety	Frequency*	Percentage
A	Kharif		
1	Tomato (n=3)	03	02.50
	VNR – 5005	03	100.0
	Namdhari – 592	01	33.33
2	Brinjal (n=15)	15	12.50
	VNR – 212	15	100.0
	VNR – 218	01	06.67
3	Chilli (n=4)	04	03.33
	VNR – 305	02	50.00
	VNR – 328	01	25.00
	VNR – 435 (Shilpa)	01	25.00
B	Rabi		
1	Tomato (n=102)	102	85.00
	VNR-5005	23	22.55
	Nandhari - 592	04	03.92
	Nandhari - 562	04	03.92
	VNR-3335	21	20.59
	Karisma	15	14.71
	Avilash	07	06.86
	Kohinoor	06	05.88
	T-98	11	10.78
	VNR (HYV) – H - 63	02	01.96
	VNR – Red pari	04	03.92
	VNR – 3137	05	04.90
	Vaishali	04	03.92
2	Brinjal (n=114)	114	95.00
	VNR – 212	91	79.82
	Utkal	09	07.89
	Kala moti	04	03.51
	VNR – 218	05	04.39
	VNR – 125	05	04.39
	Mukta Round	06	05.26
3	Chilli (n=52)	52	43.33
	VNR – 305	27	51.92
	VNR – 328	03	05.77
	VNR – 725 (Vidya)	06	11.54
	VNR – 435 (Shilpa)	06	11.54
	VNR – 200	06	11.54
	VNR – 332 (Notified seed)	04	07.69
4	Cauliflower (n=63)	63	52.50

	Sangro - 110	08	12.70
	Sakata- White Prajar	13	20.63
	Seminis - Girja	42	66.67
5	Cabbage (n=26)	26	21.67
	Maiko - 261	02	07.69
	Bahar	20	76.92
	Maiko - 139	02	07.69
	Sakata - Charment	02	07.69
C	Zaid		
1	Tomato (n=6)	6	05.00
	VNR-5005	02	33.33
	VNR-3335	01	16.67
	Karishma	02	33.33
	VNR – Red Pari	01	16.67
2	Brinjal (n=1)	01	00.83
	VNR – 212	01	100.0
3	Chilli (n=1)	01	00.83
	VNR – 328	01	100.0

* Based on multiple responses

During *Rabi* season, the major crops undertaken by the respondents were tomato (85.00%), brinjal (95.00%), chilli (43.33%), cauliflower (52.50%) and cabbage (21.67%). The varieties of tomato sown by the respondents were VNR – 5005 (22.55%), Namdhari – 592 (3.92%), Namdhari – 562 (3.92%), VNR-3335 (20.59%), Karishma (14.71%), Abhilash (6.86%), Kohinoor (5.86%), T-98 (10.78%), VNR (HYV) – H-63 (1.96%), VNR – Red pari (3.92%), VNR – 3137 (4.90%) and Vaishali (3.92%).

The varieties of brinjal sown by the respondents were VNR – 212 (79.82%), Utkal (7.89%), Kala moti (3.51%), VNR -218 (4.39%), VNR – 125 (4.39%) and Mukta round (5.26%).

The varieties of chilli sown by the respondents were VNR – 305 (51.92%), VNR – 328 (5.77%), VNR – 725 (Vidya) (11.54%), VNR – 435 (Shilpa) (11.54%), VNR – 200 (11.54%) and VNR – 332 (Notified seed) (7.69%).

The varieties of cauliflower sown by the respondents were Sangro - 110 (12.70%), Sakata- White Prajar (20.63%) and Seminis - Girja (66.67%). While the

varieties of cabbage sown by the respondents were Maiko - 261 (7.69%), Bahar (76.92%), Maiko - 139 (7.69%), Sakata - Charment (7.69%).

During Zaid season, the major crops undertaken by the respondents were tomato (5.00%), brinjal (0.83%) and chilli (0.83%). The varieties of tomato sown by the respondents were VNR – 5005 (33.33%), VNR-3335 (16.67%), Karishma (33.33%), and VNR – Red Pari (16.67%). While the only variety of brinjal sown by the respondents was VNR – 212 (100%) and the variety of chilli was VNR – 328 (100%).

4.1.5.13 Crop wise common insecticides used by respondents

The information regarding crop wise commonly used insecticides by the respondents was collected, tabulated, analysed and is presented in Table 4.28. Tomato is one of the major crops of the region. Like other different crops, tomato also suffered from attack of different insects. The major insects attacking the tomato crop as reported by the respondents were fruit borer, white fly and cut worm.

Fruit borer, one of the major insect of tomato, is being controlled by Chloronantraniliprole (45%), Flubendiamide 39.35% w/w (17.5%), Propanophos 40% + Cypermethrin 4% (12.50%), Chloropyriphos 50% + Cypermethrin 5% (4.17%). Other important insecticides constituting 06.67 per cent were Trizophos 25% + Deltamethrin 1%, Cloropyriphos 50%, Methomyle 40% and Thaidicarb.

The other major insect of tomato, as reported by the respondents was, white fly, being controlled by Acytameprid 10% WP (45.83%), Emidacloropid 17.8 (32.50%), Dichlorovos 76% EC (4.17%),

The other major insect of tomato crop was cut worm, being controlled by Chloronantraniliprole (7.50%), Propanophos 40%+Cypermethrin 4% (1.67% each) and Flubendiamide 39.35% w/w (0.83).

Brinjal is other major crop of the region. Brinjal also suffers from the attack of different insects. The major insects of brinjal crop, as reported by the respondents were fruit and stem borer, white fly, mite and jassid.

Table 4.28: Crop wise commonly used insecticides

(n=120)

Sl. No.	Crop/Insect/ Insecticide*	F	%
1	Tomato		
	i. Fruit Borer		
	Flubendiamide 39.35% w/w	21	17.50
	Chloronantraniliprole	54	45.00
	Chloropyriphos 50%+Cypermethrin5%	05	04.17
	Propanophos 40%+Cypermethrin4%	15	12.50
	Others	08	06.67
	ii. White Fly		
	Acytameprid 10% WP	55	45.83
	Emidacloropid 17.8	39	32.50
	Dichlorovos 76% EC	05	04.17
	iii. Cut worm		
	Flubendiamide 39.35% w/w	01	00.83
	Propanophos 40%+Cypermethrin 4%	02	01.67
	Chloronantraniliprole	09	07.50
2	Brinjal		
	i Fruit and stem borer		
	Flubendiamide 39.35% w/w	24	20.00
	Chloronantraniliprole	63	52.50
	Chloropyriphos 50%+Cypermethrin 5%	05	4.17
	Propanophos 40%+Cypermethrin 4%	16	13.33
	Others	08	6.67
	ii White Fly		
	Acytameprid 10% WP	30	25.00
	Emidacloropid 17.8%	23	19.17
	Dichlorovos 76% EC	12	10.00
	iii Mite		
	Meothrine 30%	16	13.33
	Carbofuran	05	4.17
	iv Jassid		
	Phorate 10 G	09	7.50
3	Chili		
	i. Fruit Borer		
	Flubendiamide 39.35% w/w	10	8.33
	Chloronantraniliprole	28	23.33
	Propanophos 40% + Cypermethrin 4%	10	8.33

	Others	04	3.33
ii.	White Fly		
	Acytameprid10% WP	27	22.50
	Emidacloropid 17.8%	15	12.50
	Dichlorovos 76% EC	10	8.33
iii	Thrips		
	Acytameprid 10% WP	30	25.00
	Emidacloropid 17.8%	19	15.83
iv.	Aphid		
	Emidacloropid 17.8%	07	5.83
	Emidacloropid 78.8%	04	3.33
v.	Mite		
	Meathrine 30%	02	1.67
	Corbofuran	02	1.67
4	Cabbage & Cauliflower		
i	DBM		
	Methomyle 40%	18	15.00
	Chloronantraniliprole	35	29.17
	Cypermethrin 25%	04	3.33
	Others	05	4.17

* Based on multiple responses

Fruit and stem borer is a major insects of brinjal crop, causing a very huge damage to the fruits of the crop. For control of fruit borer, the insecticides being used by the respondents were Chloronantraniliprole (52.50%), Flubendiamide 39.35% w/w (20%), Propanophos 40% + Cypermethrin 4% (13.33%), Chloropyriphos 50% + Cypermethrin 5% (4.17%). The other important insecticides, constituting 06.67 per cent were Trizophos 25% + Deltamethrin 1%, Chloropyriphos 50%, Methomyle 40% and Thaidicarb. The other major insect, causing severe damage to brinjal crops, as reported by the respondents was, white fly. For the control of white fly, the insecticides being applied by the respondents were Acytameprid 10% WP (25.00%), Emidacloropid 17.8% (19.17%) and Dichlorovos 76% EC (10.00%).

As reported by the respondents, mite was another major insect damaging brinjal crop, being controlled by Meothrine 30% (13.33%), and Carbofuran (4.17%).

Phorate 10 G was applied by 7.50 per cent of the respondents for the control of jassid, which is another insect causing damage to the brinjal crop.

Chilli is another major crop of the region. Chilli also suffered by attack of different insects. The major ones as reported by the respondents were fruit borer, white fly, thrips, aphid and mite.

Fruit borer is one of the major insect damaging chilli crop, being controlled by Chloronantraniliprole (23.33%), Flubendiamide 39.35% w/w and Propanophos 40% + Cypermethrin 4% (8.33% each). The other important insecticides, constituting 3.33 per cent were Trizophos 25% + Deltamethrin 1%, Chloropyriphos 50% + Cypermethrin 5%, Chloropyriphos 50%, Thaidicarb.

White fly is another major insect of chilli, being controlled by Acytameprid10% WP (22.50%), Emidacloropid 17.8% (12.50%), Dichlorovos 76% EC (8.33%).

Thrips is also causing severe damage to chilli crop, being controlled by Acytameprid 10% WP (25.00%) and Emidacloropid 17.8% (15.83%),

While for the control of aphid in chilli, Emidacloropid 17.8% (5.83%) and Emidacloropid 78.8%(3.33%). were applied by the respondents, and for the control of Mitein chilli, Meathrine 30% (1.67%) and Corbofuran (1.67%) were employed by the respondents.

Cabbage and cauliflower are also the major crops of the region. Cabbage and cauliflower also suffered from attack of different insects. DBM is the single most major insect causing severe damage to cabbage & cauliflower crop as reported by the respondents. For the control of DBM on cabbage and cauliflower crops, respondents were reportedly applying Chloronantraniliprole (29.17%), Methomyle 40% (15.00%) and Cypermethrin 25% (3.33%). The other important insecticides, constituting 4.17 per cent were Propanophos 40% + Cypermethrin 4% and Dichlorovos 76% EC.

4.1.5.14 Extent of crop damage by different insects

The Extent of the insect depends upon its extent of crop damage and the use of insecticides is directly proportional to the severity. The data regarding the extent of

crop damage by the different insects was collected, tabulated, analysed and is presented in Table. 4.29.

Table 4.29: Extent of crop damage by different insects

(n=120)

Sl. No.	Crops/Insect	< 25%		26-50%		51-75%		>75%	
		F	%	F	%	F	%	F	%
(A)	Tomato								
1	Fruit Borer	33	27.50	58	48.33	09	07.50	02	01.67
2	White Fly	49	40.83	39	32.50	12	10.00	02	01.67
3	Cut worm	09	07.50	03	02.50	00	0.00	00	0.00
(B)	Brinjal								
1	Fruit and stem borer	06	05.00	42	35.00	57	47.50	11	09.17
2	White Fly	45	37.50	24	20.00	03	2.50	00	0.00
3	Mite	21	17.50	05	04.17	00	0.00	00	0.00
4	Jassid	11	9.17	01	00.83	00	0.00	00	0.00
(C)	Chili								
1	Fruit Borer	14	11.67	33	27.50	05	04.17	01	00.83
2	White Fly	32	26.67	18	15.00	02	01.67	00	0.00
3	Thrips	24	20.00	24	20.00	02	01.67	02	01.67
4	Aphid	09	07.50	00	0.00	00	0.00	00	0.00
5	Mite	05	04.17	00	0.00	00	0.00	00	0.00
(D)	Cauliflower								
1	DBM	14	11.67	38	31.67	08	6.67	01	00.83
(E)	Cabbage								
1	DBM	07	05.83	18	15.00	02	01.67	01	00.83

The extent of crop damage of tomato by fruit borer was reported as 26-50 per cent (48.33%), up to 25 per cent (27.50%), 51 -75 per cent (7.50%) and more than 75 per cent (1.67%). The extent of crop damage of tomato by white fly was reported as up to 25 per cent (40.83%), 26-50 per cent (32.50%), 51 -75 per cent (10.00%) and more than 75 per cent (1.67%). The extent of crop damage of tomato by cut worm was reported as up to 25 per cent (7.50%), 26-50 per cent (2.50%), 51 -75 per cent and more than 75 per cent (0.0%).

The extent of crop damage of brinjal by fruit and stem borer was reported as 51 – 75 per cent (47.50%), 26 – 50 per cent (35.00%), more than 75 per cent (9.17%) and up to 25 per cent (5.00 %).

The extent of crop damage of Brinjal by White fly was reported as up to 25 per cent (37.50%), 26 – 50 per cent (20.00%), 51 – 75 per cent (2.50%) and more than 75 per cent (00%).

The extent of crop damage of brinjal by mite was reported as up to 25 per cent (17.50%), 26 – 50 per cent (4.17%), 51 – 75 per cent and more than 75 per cent (00%).

The extent of crop damage of Brinjal by jassid was reported as up to 25 per cent (9.17%), 26 – 50 per cent (0.83%), 51 – 75 per cent and more than 75 per cent (00%). The extent of crop damage of chilli by fruit borer was reported as 26 – 50 per cent (27.50%), up to 25 per cent (11.67%), 51 – 75 per cent (4.17%) and more than 75 per cent (0.83%). The extent of crop damage of chilli by white fly was reported as up to 25 per cent (26.67%), 26 – 50 per cent (15.00%), 51 – 75 per cent (1.67%) and more than 75 per cent (00%).

The extent of crop damage of chilli by thrips was reported as up to 25 per cent and 26 – 50 per cent (20.00% each), 51 -75 per cent and more than 75 per cent (1.67% each).

The extent of crop damage of chilli by aphid was reported as upto 25 per cent, 26-50 per cent, 51 – 75 per cent and more than 75 per cent (7.50% each). The extent of crop damage of Chilli by mite was reported as upto 25 per cent, 26 – 50 per cent, 51 – 75 per cent and more than 75 per cent (4.17% each).

The extent of crop damage of cauliflower by DBM was reported as 26 – 50 per cent (31.67%), up to 25 per cent (11.67%), 51 – 75 per cent (6.67%) and more than 75 per cent (0.83%).

The extent of crop damage of cabbage by fruit borer was reported as 26 – 50 per cent (15.00%), up to 25 per cent (5.83%), 51 – 75 per cent (1.67%) and more than 75 per cent (0.83%).

4.2 Dependent variables

4.2.1 Application pattern of insecticide by vegetable growers

The information regarding the application pattern of insecticides by respondents were collected, tabulated, analysed and presented in Table 4.30. The data

reveal that 91.67 per cent of the respondents were mixing more than one insecticides before application while rest 8.33 per cent of the respondents were not mixing the insecticide and were applying single insecticide.

Similar findings were also reported in their studies by Jipanin *et al.* (2001) who noted that farmers in the survey applied pesticides by both single and mixed method. Few farmers (about 9%) apply one chemical at a time. However, majority of (91%) the farmers applied the pesticides in mixtures. Farmers believe that a "cocktail" application is always more effective and reduce labour cost.

Table 4.30: Application Pattern of Insecticides

(n=120)

Application pattern of Insecticides	Frequency	Percentage
Application of insecticide (n=120)		
➢ By mixing of insecticide	110	91.67
➢ One insecticide	10	08.33
Decision taken for mixing of insecticides (n=110)*		
➢ Based on compatibility	106	96.36
➢ Based on suggestions of other farmers	12	10.91
➢ Based on suggestions of input dealers	93	84.55
➢ Based on approximation	04	03.64

* Based on multiple responses

As regards to decision taken for mixing of insecticides, 96.36 per cent of the respondents were mixing the insecticides based on compatibility of the different insecticides, followed 84.55 per cent of the respondents were mixing the different insecticides based on suggestions of other farmers, 10.91 per cent of the respondents were mixing them on the basis of suggestions of input dealers and 3.64 per cent of the respondents were mixing the insecticides by their own approximation and not based on any suggestions.

4.2.2 Adoption of IPM practices

The information regarding the adoption of the practices regarding Integrated Pest Management (IPM) of vegetables was collected, tabulated analysed and are presented in the following Table 4.31.

Table 4.31: Practice wise adoption regarding integrated pest management in major vegetable crops

(n=120)

Sl. No.	IPM Practices	Nil		Partial		Complete		Adoption Index
		F	%	F	%	F	%	
1	Cultural Practices	00	0.00	01	00.83	119	99.17	99.58
	➢ Field Sanitation	00	0.00	00	0.00	120	100.0	100.0
	➢ Summer ploughing	00	0.00	00	0.00	120	100.0	100.0
	➢ Resistant varieties	113	94.17	01	00.83	06	05.00	05.42
	➢ Seed treatment	38	31.67	17	14.17	65	54.17	61.25
	➢ Sowing time	39	32.50	29	24.17	52	43.33	55.42
2	Mechanical practices	112	93.33	01	00.83	07	05.83	06.25
	➢ Staking	112	93.33	01	00.83	07	05.83	06.25
	➢ Light trap	119	99.17	00	0.00	01	00.83	00.83
	➢ Pheromone trap	116	96.67	00	0.00	04	03.33	03.33
3	Biological practices	117	97.50	01	00.83	02	01.67	02.08
	➢ Parasites	117	97.50	01	00.83	02	01.67	02.08
4	Chemical practices	00	0.00	01	00.83	119	99.17	99.58
	➢ Insecticide	00	0.00	01	00.83	119	99.17	99.58

The data reveal that almost all the respondents were adopting cultural practices, 99.17 per cent of them were having complete adoption and only 0.83 per cent were having partial adoption, with the Adoption Index of 99.58.

Cent per cent of the respondents had adopted field sanitation and summer ploughing with the adoption Index of 100.0. Resistant varieties were not adopted by majority of the respondents (94.17%), only five per cent of the respondents had adopted, while was partially adopted by 14.17 per cent of them. A little more than half of the respondents (54.17%) had adopted seed treatment, while 31.67 per cent had not adopted and 14.17 per cent of them had partially adopted. When the sowing time was studied, it was revealed that 43.33 per cent of them had adopted, while 32.50 per cent of them had not adopted and 24.17 per cent had partially adopted sowing time.

There was a very poor adoption of the mechanical practices, as majority of the respondents (93.33%) had not adopted any of the mechanical practices, only 0.83 per

cent had partially adopted them and 5.83 per cent of them had completely adopted the mechanical practices. Adoption index of the mechanical practices was 6.25.

Staking was completely adopted by 5.83 per cent of the respondents, partially by 0.83 per cent and rest 93.33 per cent of them had not adopted. Light trap was completely adopted by only 0.83 per cent of the respondents and 3.33 per cent of them had adopted completely the pheromone trap. The adoption index for staking, light trap & pheromone trap was 6.25, 0.83 and 3.33, respectively.

The adoption of biological practices was also very poor, as only 1.67 per cent of the respondents had adopted the parasites completely and 0.83 per cent partially with adoption index of 2.08.

As obvious the chemical practices was almost completely adopted by the respondents, as 99.17 per cent had completely and 0.83 per cent had partially adopted it, with adoption index of 99.58.

Similar findings were also reported by Vathsala (2005) who revealed that, majority of the respondents (60.00%) were high adopters, 28.9 per cent of the respondents were medium adopters and 11.1 per cent of the respondents were low adopters of integrated pest management practices in cabbage.

4.3 Correlation coefficient of independent variables with application pattern of insecticides and adoption of IPM practices

The data given in Table 4.32 reveal that education, farming experience, annual income and sources of insecticide were positive and significantly correlated with application pattern of insecticide at 0.01 level of probability and availability of insecticide was positive and significantly correlated with application pattern of insecticide at 0.05 level of probability.

Where family type, land holding, irrigation facility, credit acquisition, source of information, contact with extension agents, risk orientation, cosmopoliteness and knowledge of waiting period of insecticide non-significantly correlated with application pattern of insecticide.

Table 4.32: Correlation coefficient of independent variables with application pattern of insecticides and adoption of IPM practices

(n=120)

Sl. No.	Variable	Correlation coefficient ("r" value)	
		Application pattern of insecticides	Adoption of IPM practices
1	Education	0.210**	0.396**
2	Family type	-0.159	-0.084
3	Farming experience	0.236**	0.174
4	Land holding	0.008	0.612**
5	Irrigation facility	0.039	-0.086
6	Annual income	0.271**	0.512**
7	Credit acquisition	0.059	0.427**
8	Sources of information	0.063	0.423**
9	Contact with extension agents	0.128	0.450**
10	Risk orientation	0.172	0.285**
11	Cosmopoliteness	0.030	0.034
12	Source of insecticide	0.254**	0.577**
13	Availability of insecticide	0.199*	0.479**
14	Knowledge of waiting period of insecticide	0.015	0.304**

** Significant at 0.01 level of probability (0.232) * Significant at 0.05 level of probability (0.178)

In the case of adoption of IPM practices education, land holding, annual income, credit acquisition, source of information, contact with extension agents, risk orientation, source of insecticide, availability of insecticide and knowledge of waiting period of insecticide were positively and significantly correlated with adoption of IPM practices at 0.01 level of probability. Whereas family type, farming experience, irrigation facility, cosmopoliteness were non-significantly correlated with adoption of IPM practices.

4.4 Multiple regression analysis of independent variables with application pattern of insecticides and adoption of IPM

The data presented in Table 4.33 reveal that out of the 14 variables under study, two variables viz. farming experience and annual income had positive and

significant contribution towards for application pattern of insecticide at 0.01 level of probability. Land holding had negative significant contribution towards for application pattern of insecticide at 0.01 level of probability and only family type negative significant contribution towards for application pattern of insecticide at 0.05 level of probability. Whereas education, irrigation facility, credit acquisition, sources of information, contact with extension agents, risk orientation, cosmopoliteness, source of insecticide, availability of insecticide and knowledge of waiting period of insecticide had non-significant contribution for application pattern of insecticide**.**

It was also seen that all the 14 independent variables have jointly explained the variation to the extent of 30 per cent towards application pattern of insecticide by vegetable growers.

The findings state that the independent variables altogether had 30 per cent prediction ability to application pattern of insecticide by vegetable growers. We have to give adequate focus on increasing, farming experience and annual income. Although other variables individually had non-significant contribution, but it is clear from the R^2 value of the multiple regression analysis that these variables had quite impressive contribution in application pattern of insecticide.

The data presented in Table 4.35 reveal that out of the 14 variables under study four variables viz. only land holding had positive and significant contribution towards for adoption of IPM practices at 0.01 levels of probability and education, farming experience, source of insecticide had positive and significant contribution towards for adoption of IPM practices at 0.05 level of probability. Whereas, family type, irrigation facility, annual income, credit acquisition, sources of information, contact with extension agents, risk orientation, cosmopoliteness, source of insecticide, availability of insecticide and knowledge of waiting period of insecticide had non-significant contribution for adoption of IPM practices.

Table 4.33: Multiple regression analysis of independent variables with application pattern of insecticides and adoption of IPM practices.

(n=120)

Sl. No.	Characteristics	Respondents			
		Application pattern		Adoption of IPM	
		"b" Value	"t" Value	"b" Value	"t" Value
1	Education	0.011	1.524	0.132	2.467*
2	Family type	-0.133	-2.252*	-0.569	-1.316
3	Farming experience	0.008	3.572**	0.035	2.019*
4	Land holding	-0.009	-2.687**	0.148	5.564**
5	Irrigation facility	0.019	0.310	-0.716	-1.594
6	Annual income	8.99E	4.213**	1.31E	0.839
7	Credit acquisition	-0.055	-0.976	0.646	1.556
8	Sources of information	0.004	0.322	0.152	1.515
9	Contact with extension agents	-0.014	-0.990	-0.013	-0.124
10	Risk orientation	0.001	0.086	0.045	0.356
11	Cosmopoliteness	0.026	0.961	-0.068	-0.343
12	Source of insecticide	0.136	1.499	1.597	2.415*
13	Availability of insecticide	-0.060	-0.788	-0.110	-0.196
14	Knowledge of waiting period of insecticide	-0.002	-0.397	-0.065	-1.527

** Significant at 0.01 level of probability (value=2.617) R^2= 0.307 & 0.654

* Significant at 0.05 level of probability (value=1.98)

It is also seen that all the 14 independent variables have jointly explained the variation to the extent of 65 per cent towards adoption of IPM practices

The findings state that the independent variables together had 65 per cent prediction ability to adoption of IPM practices. We have to give adequate focus on increasing land holding, education, farming experience and source of insecticide. Although other variables individually had non-significant contribution, but it is clear from the R^2 value of the multiple regression analysis that these variables had quite impressive contribution in the adoption.

4.5. Constraints

The information regarding the constraints faced by respondents in application of insecticides and adoption of IPM were collected, tabulated, analysed and presented in Table 4.34.

Table 4.34: Constraints faced in application pattern of insecticide by vegetable grower and adoption of IPM practices

(n=120)

Sl. No.	Constraints	F	%	Rank
1.	Labour problem	53	44.17	V
2.	Non availability of sufficient sprayers	13	10.83	VI
3.	Lack of technical knowledge of IPM practices	112	93.33	I
4.	High Price of insecticides	11	9.17	VIII
5.	Toxic effect of insecticides in body	05	4.17	IX
6.	Non-availability of biopesticides & traps	102	85.00	II
7.	High cost of power sprayer	12	10.00	VII
8.	Complex and labour intensive nature of IPM	81	67.50	III
9.	Non availability of resistant variety	54	45.00	IV

* Based on multiple responses

All the respondents reported that there was lack of technical knowledge of IPM practices (93.33%) due to which they are unable to adopt the IPM practices, 85.00 per cent of the respondents reported that non-availability of biopesticides & traps was also a major problem because they wish and want to adopt the IPM practices but they are not available, then how could they go for adoption.

While 67.50 per cent of respondents reported that IPM practices are very complex and are also very labour intensive in nature so they are unable to adopt them. 45.00 per cent of respondents reported that non availability of resistant varieties is also a major constraint.

The other constraints faced by them were labour problem for spray of insecticides (44.17%), non availability of sprayers in sufficient quantity (10.83%), high cost of power sprayer (10.0%), high price of insecticides (9.17%) and toxic effect on body (4.17%).

4.6 Suggestions to overcome the constraints

The information regarding the suggestions to overcome the constraints faced by respondents in application of insecticides and adoption of IPM by respondents were collected, tabulated, analysed and presented in Table 4.35.

Table 4.35: Distribution of respondents according to suggestions to overcome the constraints faced by them

(n=120)

Sl. No.	Suggestions	F*	%	Rank
1.	Input should be timely available in market (bio-agents, resistance variety and traps etc).	105	87.50	II
2.	Insecticides should be made available in local shops	21	17.50	VI
3.	Awareness be provided to take proper precaution at the time of insecticide spray	14	11.67	VII
4.	Subsidy should be given on insecticides & related equipments	84	70.00	IV
5.	Extension agencies should conduct regular training about IPM practices	107	89.17	I
6.	Spurious insecticides sell should be strictly controlled	92	76.67	III
7.	Trained persons for sprayer repairing should be there	27	22.50	V

* Based on multiple responses

Regarding suggestions to overcome the constraints, 89.17 per cent suggested that extension agencies should conduct regular training about IPM practices, followed by 87.50% suggested that input should be timely available in market (bio-agents, resistance variety and traps etc), 76.67 per cent suggested that spurious insecticides sell in the market should be strictly controlled and 70.00 per cent suggested that subsidy should be given on insecticides & related equipments.

Other suggestions were trained persons for sprayer repairing should be there (22.50%) as there is lack of trained persons for sprayer repairing. Insecticides should be made available in local shops (17.50%) and Awareness be provided to take proper precaution at the time of insecticide spray (11.67%).

CHAPTER-V

SUMMARY AND CONCLUSION

In Chhattisgarh, the total area under vegetables is 377,212 hectares with production of 4,965,331 MT and an average productivity is 13.1 MT/ha.

In commercial cultivation vegetable crops are grown intensively; sometimes even two or more crops are taken in a season. Introduction of high yielding technology creates microclimatic conditions which favors the rapid multiplication of insect pest and diseases. However, for controlling these losses excessive and indiscriminate use of pesticides not only increases the cost of production but also results in many human health problems and environmental pollution.

Although IPM tactics have been used to varying degrees during the past 100 years, formal strategies were neither well recognized nor crafted into practices until the 1970s. Pest management in vegetable crops had not received the same level of attention as in agronomic crops because of the vast number of vegetable crops, diversity in production systems and arthropod complexes (Capinera, 2001) and lower investments in research and educational efforts.

Vegetable cultivation is one of the most important component of agriculture and they share an important place in our everyday diet. Insecticides have became essential part of vegetable cultivation today. No study have been undertaken till today for use and application pattern of insecticides in major vegetable crops.

Looking to this aim, the present study entitled **"A study of insecticides use and application pattern on major vegetable crops by the farmers of Balodabazar - Bhatapara district of Chhattisgarh"** was undertaken during the year 2015 – 16 with the following objectives:

1. To study the Socio-economic profile of vegetable growers,
2. To assess the existing management and application pattern followed by the respondents for important insect-pests of major vegetables,
3. To assess the use and application knowledge of insecticides by the respondents,

4. To study the extend of adoption of IPM practices by the respondents,
5. To identify the constraints faced by the respondents in adopting IPM practices and their suggestions to overcome them.

The study was conducted in Balodabazar-Bhatapara district of Chhattisgarh, during the year 2015-16. The villages selected from the Bhatapara block were Tikuliya, Dhurrabandha, Tarenga and Karhi Bazar whereas Simga, Kachlon, Jaroud, and Marrakona were selected from the Simga block. Fifteen vegetable growers from each selected village were selected randomly, thus, a total of 120 farmers (15x 8=120) were selected for the study.

The data were collected through personal interview with the help of well prepared structured interview schedule and were analyzed by using different appropriate statistical methods. The major findings of the study are summarized under the following sub-heads.

Independent variables

Socio-personal characteristics of the vegetable growers

The study revealed that majority (55.00%) of the respondents belonged to the middle age group (between 36 to 55 years), 30.83 per cent of selected vegetable growers had primary school level of education, majority of the respondents (94.17%) belonged other backward classes, 73.00 per cent respondents were having joint family, 49.00 per cent respondents were having medium size of family (6 to 10 members), 48.33 per cent respondents were having small size of working members (up to 3 members). Majority (21.7%) of the respondents were having 16 to 20 years of farming experience. The data reveals that 99.17 per cent of the respondents were participating in gram panchayat, of which 93.28 per cent participated as member and remaining 6.72 per cent participated as office bearer in the gram panchayat.

Socio- economic characteristics of the respondents

The data reveals that maximum number of the respondents (31.67%) were having marginal size of land holdings (up to 2.5 acre), selected respondents occupied a total of 987.66 acre land of which 48.42 per cent area falls under *Kanhar(Kachhar)*.

Out of total 987.66 acre land, 90.87 per cent (897.51 acre) area falls under irrigated land and only 9.13 per cent (90.15 acre) area was under unirrigated land. Cent per cent of respondents had irrigation facility and maximum respondents (75.83%) had personal tube-well

Cent per cent respondents were involved in agriculture with majority of them (93.33%) as main occupation. Regarding overall annual income from all sources, 35.83 per cent respondents received only medium annual income (Rs. 25001 to Rs. 50000). Majority of the respondents (69.17%) had not acquired credit and out of total respondents who acquired credit, more than half (54.05%) of the respondents had obtained credit from Nationalized bank, the majority (48.65%) of the respondents had taken loan for 6 – 12 months duration, majority of the respondents 97.30 per cent had used their credit for purchasing fertilizers, In respect to mode of repayment of credit, it was observed that all the respondents (100.00%) were repaying their credit as cash.

Communicational characteristics of respondents

That majority (96.67%) of respondents were getting information regarding use of insecticide and application pattern from input dealers, majority had contact with RAEO/ RHEOs. University scientist and NGOs were the most credible source of information.

Socio-psychological characteristics of respondents

Majority (60.00%) of respondents had medium level (64 to 74 score) of risk orientation and half of the respondents (50.00%) were having medium cosmopoliteness.

Technological variables

The data reveal that all the respondents were procuring insecticides from the input dealers (100.0%). Majority of the respondents 42.50 per cent were storing the insecticide at their farm, 59.17 per cent were having no knowledge about toxicity symbols in insecticide label, 67.50 per cent were spraying two times in flowering and fruiting stage and 88.33 per cent of the respondents were applying insecticide in the evening time.

Majority of the respondents (95.83%) were themselves spraying the insecticides in the field, 98.33 per cent were spraying insecticide by manual sprayers, 98.33 per cent were owing a manual sprayer. Majority of the respondents were having knowledge of the precautions during the insecticide spray viz., use of mask, application according to wind direction as precaution during spray but adopted only washing hand with soap after spray. Majority (46.67%) of the respondents were very careless, as they used to Just throw empty insecticide container anywhere at farm.

As regards to knowledge and adoption of waiting period of insecticide of respondents, majority had partial to complete knowledge of fruit borer and white fly in tomato, brinjal and chilli but were having nil to partial adoption. Majority of the respondents perceived that 51-75% extent of crop damage was caused by Brinjal fruit and stem borer.

Dependent variables

The data reveal that majority of the respondents (91.67%) were mixing more than one insecticides, Almost all the respondents were adopting cultural practices, 99.17 per cent of them were having complete adoption with the Adoption Index of 99.58. Cent per cent of the respondents had adopted field sanitation and summer ploughing with the adoption Index of 100.0. Majority of the respondents (93.33%) had not adopted any of the mechanical practices with the adoption index of 6.25 only. Only 1.67 per cent of the respondents had adopted the parasites completely with adoption index of 2.08, while 99.17 per cent had completely adopted chemical practices with adoption index of 99.58.

Correlation analysis

The coefficient of correlation was found by analyzing the data with the help of computer. The variables education, farming experience, annual income, and sources of insecticide were positively and significantly correlated with application pattern of insecticide by vegetable growers at 0.01 level of probability and availability of insecticide was positively and significantly correlated with application pattern of insecticide at 0.05 level of probability.

In the case of adoption of IPM practices, education, land holding, annual income, credit acquisition, source of information, contact with extension agents, risk orientation, source of insecticide, availability of insecticide and knowledge of waiting period of insecticide were positive and significantly correlated with adoption of IPM practices at 0.01 level of probability.

Multiple regression analysis

The Multiple regression was found by analyzing the data with the help of computer. Out of the 14 variables under study two variables viz. farming experience and annual income had positive and significant contribution towards application pattern of insecticide at 0.01 level of probability.

It was also observed that all the 14 independent variables had jointly explained the variation to the extent of 30 per cent towards application pattern of insecticide.

In the case of adoption of IPM practices land holding had positive and significant contribution towards for adoption of IPM practices at 0.01 level of probability and education, farming experience and source of insecticide had positive and significant contribution towards for adoption of IPM practices at 0.05 level of probability.

It was also observed that all the 14 independent variables have jointly explained the variation to the extent of 65 per cent towards adoption of IPM practices.

Constraints faced by application pattern of insecticide and adoption of IPM practices All the respondents reported that there was lack of technical knowledge of IPM practices (93.33%) and 85.00 per cent of the respondents reported for Non-availability of biopesticides & traps. whereas 67.50 per cent of respondents reported that IPM practices are very complex and are also very labour intensive in nature so they are unable to adopt them. 45.00 per cent of respondents that non availability of resistant varieties is also a major constraint.

The other constraints faced by them were labour problem for spray of insecticides (44.17%), non availability of sprayers in sufficient quantity (10.83%),

high cost of power sprayer (10.00%), high price of insecticides (9.17%), toxic effect on body (4.17%),

Suggestions given by vegetable growers to overcome the constraints during application pattern of insecticide and adoption of IPM practices 89.17 per cent suggested that extension agencies should conduct regular training about IPM practices, followed by 87.50% input should be timely available in market (bio-agents, resistance variety and traps etc) and 76.67 per cent spurious insecticides sell in the market should be strictly controlled and 70.00 per cent suggested that subsidy should be given on insecticides & related equipments.

Other suggestions were trained persons for sprayer repairing should be there (22.50%) as there is lack of trained persons for sprayer repairing. Insecticides should be made available in local shops (17.50%) and Awareness be provided to take proper precaution at the time of insecticides spray (11.67%).

Conclusion

Majority of the respondents were middle age group (36 to 55 years), educated up to Primary class (up to 5^{th} class), belonging to other backward classes, had Joint family, with medium size of family (6 to 10 members), having three working members, having up to 10 years of farming experience, were member and office bearer of Gram Panchayat.

Majority had marginal size of land holding of kanhar soil with assured irrigation from personal tube well, agriculture as main and sub occupation with medium annual income of Rs. 25,001-50,000/-, had acquired credit from the Nationalized bank for 6 to 12 month of duration for purchasing of fertilizers and Cash repayment .

Majority had contact with RAEO/ RHEOs, university scientist as most credible source of information and obtained information about vegetable cultivation and application pattern of insecticide from the input dealer and termed radio as most credible source of information.

Majority of the respondents had medium level of risk orientation, with medium cosmopoliteness.

Majority obtained insecticide from Input dealers in regular supply, stored insecticide in farm, had no knowledge of Toxicity symbol of different insecticide label, sprayed two times at flowering stage in evening time, had knowledge of use of mask, application according to wind direction as precaution during spray but adopted only washing hand with soap after spray and just throw the insecticide container anywhere at farm.

As regards to knowledge and adoption of waiting period of insecticide of respondents, majority had partial to complete knowledge of waiting period of insecticides used for control of fruit borer and white fly of tomato, brinjal and chilli but had adopted nil to partial the waiting period in these crops. Majority of the respondents applied insecticide by mixing as per compatibility of the different insecticides.

Adoption of IPM was maximum of chemical and cultural practices and minimum of biological and mechanical practices.

The variable education, farming experience, annual income, and sources of insecticide were positively and significantly correlated with application pattern of insecticide at 0.01 level of probability and availability of insecticide was positively and significantly correlated with application pattern of insecticide at 0.05 level of probability.

In the case of adoption of IPM practices education, land holding, annual income, credit acquisition, source of information, contact with extension agents, risk orientation, source of insecticide, availability of insecticide and knowledge of waiting period of insecticide were positively and significantly correlated with adoption of IPM practices at 0.01 level of probability.

Farming experience and annual income had positive and significant contribution towards for application pattern of insecticide at 0.01 level of probability.

In the case of adoption of IPM practices, land holding had positive and significant contribution towards adoption of IPM practices at 0.01 level of probability

and education, farming experience and source of insecticide had positive and significant contribution towards adoption of IPM practices at 0.05 level of probability.

The major constraints were lacking technical knowledge of IPM practices, Non-availability of biopesticides & traps and complex and labour intensive nature of IPM and suggested that extension agencies should conduct regular training for IPM practices, input should be timely available in market (bio-agents, resistance variety and traps etc) and spurious insecticides sell should be strictly controlled.

Suggestions for future research work

On the basis of experience gained and result obtained from the investigation, the following points are suggested for future studies:-

1. Similar studies should be conducted in large area involving more number of vegetable crops for the generalization of results.
2. Detailed study should be conducted involving a larger number of variables on a larger area.

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छत्तीसगढ़ के बलौदा बाजार–भाटापारा जिले के कृषको द्वारा सब्जी फसलों में कीटनाशी का उपयोग एवं उपयोग करने के तरीकों के अध्ययन हेतु

शोध साक्षात्कार प्रश्नावली

क्रमांक..... दिनांक.....

परामर्शदाता
डॉ. राजेश कुमार साहू
सहायक प्रध्यापक
कृषि विस्तार विभाग
कृषि महाविद्यालय भाटापारा

शोधकर्ता
चन्द्रकान्त दुबे
एम.एस.सी. (कृषि) अन्तिम वर्ष
कृषि विस्तार विभाग
इं गॉ. कृ. वि. रायपुर (छ.ग.)

1). कृषक का नाम :– .....

2). ग्राम :– ..... 3). विकासखण्ड :– .....

4). कृषक की उम्र :– .....वर्ष 5). शिक्षा :– अशिक्षित / .....

6). जाति :– अ.जा. / अजजा / अपिव. / सामान्य

8). परिवार के कुल सदस्यों की संख्या :– महिला.....पुरूष.....बच्चे..... योग .....

9). परिवार में कार्यशील सदस्यों की संख्या :– महिला..... पुरूष..... योग.....

10). परिवार के प्रकार :– सयुंक्त / एकाकी

10). आप सब्जी की खेती कब से कर रहे हैं :–.....वर्ष से ।

11). क्या आप ग्राम या ग्राम के बाहर की किसी संस्था के सदस्य हैं ?

क्र.	संगठन	भागीदारी (हॉ / नहीं)	सदस्यता का प्रकार	
			सदस्य	पदाधिकारी
1.	ग्राम पंचायत			
2.	सहकारी समिति			
3.	युवा मंडल			
4.	किसान क्लब			
5.	जाति पंचायत			
6.	अन्य			

12). कृपया अपनी भूमि संबधी जानकारी दीजिए (एकड में) :– .....

क्र.	भूमि का प्रकार	क्षेत्रफल (एकड़ में)	
		सिंचित	असिंचित
1.	भाटा		
2.	मटासी		
3.	डोरसा		
4.	कन्हार		

13). आप के पास सिंचाई के कौन कौन से स्त्रोत हैं ?

स्वयं का नलकूप / नदी / तालाब / डबरी / कुंआ / अन्य.....

14). आपका मुख्य व्यवसाय क्या है और विभिन्न व्यवसायों से होने वाली कुल वार्षिक आय कितनी है ?

क्र.	स्त्रोत	व्यवसाय		वार्षिक आय (रूपयों में)
		मुख्य	सहायक	
1.	कृषि			
2.	नौकरी			
3.	पशुपालन			
4.	व्यवसाय			
5.	कृषि मजदूरी			
6.	अन्य			

15). क्या आपने पिछले वर्ष सब्जी की खेती हेतु ऋण लिया था ? (हॉ / नहीं) यदि हां तो कृपया जानकारी दीजिए।

क्र	स्त्रोत	ऋण की राशि (रू)		ऋण का उद्देश्य	ऋण की अवधि	ऋण का भुगतान	
		नगद	सामग्री			नगद	सामग्री
1	राष्ट्रीयकृत बैंक						
2	को–आपरेटिव सोसायटी (सहकारी समिती)						
3	साहूकार						
4	दुकानदार						
5	अशासकीय संगठन						
6	अन्य						

16). आप जोखिम संबंधित निम्न कथनों से किस स्तर तक सहमत हैं।

क्र.	विचार	पूर्ण सहमत	सहमत	कुछ कह नहीं सकते	असहमत	पूर्ण असहमत
1.	जोखिम उठाने से अच्छा हैं की कम मुनाफा कमाया जाये।					
2.	जो किसान जोखिम उठाता है, उसकी आर्थिक स्थिती अच्छी होती हैं।					
3.	किसानो को जोखिम तब उठाना चाहिये जबकी उसे सफलता प्राप्त करने की संभावना अधिक लगे।					
4.	नई तकनीक/विधि जोखिम पूर्ण होती है। परंतु उससे समृध्दि आती है।					
5.	अधिक फसलें एक साथ उगाकर जोखिम कम किया जा सकता है।					
6.	किसानो को नई तकनीक तब तक नही अपनाना चाहिए जब तक की अन्य कृषक उसे सफलता पूर्वक न अपनावें।					

17). आप के विस्तार कार्यकर्ताओं से संपर्क के संबंध मे निम्न जानकारी दीजिये ।

क्र.	विस्तार कार्यकर्ता	संपर्क का स्तर				विश्वसनियता का स्तर			
		कभी नहीं	कभी कभी	ज्यादातर	नियमित	कम	मध्यम	ज्यादा	पुर्णतः
1.	ग्रामीण कृषि विस्तार अधिकारी								
2.	कृषि विज्ञान केन्द्र								
3.	विश्वविद्यालय वैज्ञानिक								
4.	गैर सरकारी संगठन								
5.	अन्य								

18). सब्जी की फसलों मे कीटनाशी दवाओं के उपयोग एवं उपयोग के तरीको की जानकारी आपको किन स्त्रोतों से प्राप्त होती है एवं वे कितनी विश्वसनीय होती हैं।

क्र.	स्त्रोत	हॉ / नहीं	विश्वसनियता का स्तर			
			कम	मध्यम	ज्यादा	पुर्णतः
1.	मित्र					
2.	रिश्तेदार					
3.	पडोसी					
4.	प्रगतिशील किसान					
5.	पंच / सरपंच					
6.	ग्रा. कृ. वि. अधि.					
7.	कृषि वैज्ञानिक					
8.	आदान विक्रेता					
9.	समाचार पत्र					
10.	कृषि पत्रिकाएं					
11.	रेडियो					
12.	टेलीविजन					
13.	किसान मेला					
14.	प्रदर्शन					
15.	प्रशिक्षण					
16.	किसान मित्र					
17-	किसान काल सेन्टर					
18-	ईन्टरनेट					
19-	किसान मोबाइल सलाहकार					
20-	अन्य.....					

19). मुख्य सब्जी की फसलों में लगने वाले प्रमुख कीट एवं उनके प्रबंधन

सीजन	सब्जी	किस्म	मुख्य कीट एवं उनके प्रबंधन	
			कीट का नाम	दवा का नाम
खरीफ				
रबी				
जायद				

20). कीटनाशी दवा के उपयोग के फैसले में आप किन स्त्रोतों पर निर्भर करते हैं ?

क्र.	**स्त्रोत**	कीटनाशी **की आवश्यकता**	**कौन सी दवा का उपयोग**	**दवा की मात्रा**	**कितनी बार**	**दवा खरीदने के स्त्रोत**
1.	मित्र					
2.	रिश्तेदार					
3.	पडोसी					
4.	प्रगतिशील किसान					
5.	पंच/सरपंच					
6.	ग्रा. कृ. वि. अधि.					
7.	कृषि वैज्ञानिक					
8.	आदान विक्रेता					
9.	समाचार पत्र					
10.	कृषि पत्रिकाएं					
11.	रेडियो					
12.	टेलीवीजन					
13.	किसान मेला					
14.	प्रदर्शन					
15.	प्रशिक्षण					
16.	किसान मित्र					
17-	किसान काल सेन्टर					
18-	ईन्टरनेट					
19-	किसान मोबाइल सलाहकार					
20.	अन्य.....					

21). आप कीटनाशी दवा किन स्त्रोतों से प्राप्त करते है :– कृषि विभाग / सहकारी संस्था/ कीटनाशी उद्योग के प्रतिनिधी / आदान विक्रेता

22). क्या आप कीटनाशी दवाओं के उपयोग का तरीका :–

क्रं.	कीटनाशी उपयोग का तरीका	हॉ	नहीं,
1	एक से ज्यादा कीटनाशाी को मिश्रीत कर उपयोग करते हैं		
2	एक कीटनाशी का उपयोग करते हैं		

यदि हॉ तो मिश्रण के बारे में कैसे फैसला करते हैं :– अनुकूलता के आधार पर/अन्य किसानों की सलाह पर/आदान विक्रेता की सलाह पर/अनुमान से

23). सब्जी की फसलों मे कीटनाशी दवाओं के उपयोग एवं तरीकों की जानकारी प्राप्त करनें के लिए आप अपने आस पास के गांव/शहर/ब्लॉक से कितना संपर्क रखते हैं।
1). कभी नहीं 2). माह में एक बार 3). सप्ताह में एक बार 4). सप्ताह में दो या अधिक बार

24). आपको कीटनाशी दवा की उपलब्धता कितनी होती है

क्रं.	आधार	उपलब्धता		
		कभी नहीं	आंशिक	पूर्णतः
1.	आवश्यक ब्रांड़ के अनुसार			
2.	आवश्यकता के समय के अनुसार			
3.	आवश्यकता की मात्रा के अनुसार			
4.	स्थानीय बाजार में उपलब्धता			

25). कीटनाशी दवाओं को आप उपयोग के पूर्व कैसे भण्ड़ारित करते हैं :–
घर में कहीं भी रख देते हैं / सावधानीपूर्वक सुरक्षित स्थान पर रखते हैं / घर में, पर निवास स्थान के बाहर रखते हैं / खेत में रखते हैं / उपयोग के समय में ही खरीदते हैं / अन्य.....
.....

26) कीटनाशी दवाओं के डिब्बों में लगे रंगों से भरे निम्न आकृतियों को देखकर क्या आप कीटनाशक के विषाक्तता के स्तर को पहचान पाते हैंः– पूर्ण / आंशिक / निरंक

27). कीटनाशी दवाओं के छिडकाव के तरीकों के बारे मे जानकारी दें।

(अ) फसल की अवस्था

क्र.	फसल अवस्था	कितनी बार
1.	बुआई अवस्था	
2.	थरहा अवस्था	
3.	पुष्पन अवस्था	
4`	फल अवस्था	
5.	तोडाई के पहले	

(ब) आप कीटनाशी दवाओं को खेत में अक्सर कब डालते हैं :– सुबह/दोपहर/शाम

(स) आप कीटनाशी दवाओं को फसल में अक्सर कैसे ड़ालते हैं :– 1.) स्वयं/मजदूरों द्वारा, 2.) हांथ चलित स्प्रेयर/पावर स्प्रेयर द्वारा 3.) आप के पास अपना खुद का स्प्रेयर व डस्टर है :–हॉ/नही

(द) क्या आपको कीटनाशी दवाओं के छिडकाव करते समय बरती जाने वाली सावधानियां के बारे में जानकारी हैं एवं क्या आप उसे उपयोग करते समय उन सावधानियों का ख्याल रखते हैं।

क्र.	सावधानी	जानकारी का स्तर*	अंगीकरण का स्तर*
1.	मुखोटा का उपयोग करना		
2.	दस्ताने का उपयोग करना		
3.	पैरो पर जूता का उपयोग करना		
4.	ऑखो पर चश्मा लगाना		
5.	ॅसीर पर टोपि लगाना		
6.	साबून से हांथ धोना		
7.	कपडा बदलना		
8.	हवा के बहाव के दिशा में कीटनाशी दवाओं का छिडकाव करना		
9.	किसी भी प्रकार का खाद्य पदार्थ का सेवन न करना		
10.	अन्य.....		

* **जानकारी का स्तर** :– 1. पूर्ण 2. आंशिक 3. निरंक *** अंगीकरण का स्तर** :– 1. कभी नहीं 2. कभी–कभी 3. अक्सर 4. हमेशा

(ई) उपयोग के पश्चात कीटनाशी के डब्बे/बोतल का आप क्या करते हैं :– धोकर पुनः उपयोग में ले आते हैं/खेत में कहीं भी फेंक देते हैं/गढ्ढा खोद कर दबा देते हैं/जला देते हैं/अन्य..... .....

28). कीटनाशी दवाओं के प्रतिक्षा अवधि (वा उपयोग व उसे खाने के मध्य प्रतिक्षा अवधि की जानकारी दें ।

मुख्य सब्जी फसलो मे लगने वाले कीट व दवा	ज्ञान का स्तर*	अंगीकरण का स्तर*	ना अपनाने के कारण
1. टमाटर			

2.	बैगन			
3.	मिर्च			
4.	फुल गोभी			
5.	पत्ता गोभी			

***ज्ञान का स्तर :–** 1. पुर्ण 2. आंशिक 3. निरंक ***अंगीकरण का स्तर :–** 1. पुर्ण 2. आंशिक 3. निरंक

29). प्रमुख सब्जी फसल में समन्वित कीट प्रबंधन तकनीक के अंगींकरण के बारे में निम्न जानकारी देवें ।

क्र.	**सब्जी फसल में कीट प्रबंधन तकनीक**	**अंगीकरण का स्तर**
1).	क्या आप सब्जीयों के समन्वित कीट प्रबंधन तकनीक में शामिल होने वाले विधियाँ को अपनाते हैं? (हाँ/नहीं) यदि हाँ तो विवरण दें :– (अ) कर्षण क्रियाएँ .... (ब) याँत्रिक क्रियाएँ .... (स) जैविक क्रियाएँ .... (द) रासायनिक क्रियाएँ	

	(ई) अन्य क्रियाएँ	
(अ)	**कर्षण क्रियाएँ**	
i.	क्या आप सब्जीयों के समन्वित कीट प्रबंधन मे शामिल होने वाले कर्षण क्रियाएँ को अपनाते हैं? (हाँ/नहीं) यदि हाँ तो विवरण दें। (ग्रीष्मकालीन गहरी जुताई, खेतों की साफ–सफाई, फसलचक्र, प्रतिरोधी किस्मों का प्रयोग, अंतरवर्तीय खेती, बीजोपचार, बुआई का समय, निराई गुड़ाई, सिंचाई, अन्य)	
ii.	क्या आप सब्जीयों के समन्वित कीट प्रबंधन तकनीक में कर्षण क्रियाएँ के अंतर्गत खेतों की साफ–सफाई व पौधो के अवशेषों को नष्ट करने की सभी क्रियाओं को अपनाते हैं? (हाँ/नहीं) यदि हाँ तो विवरण दें। (कीटों की सुसुप्त अवस्थाओं को नष्ट करना)	
iii.	क्या आप सब्जीयों के समन्वित कीट प्रबंधन तकनीक में कर्षण क्रियाओं के अंतर्गत प्रतिरोधी किस्मों को अपनाते हैं? (हाँ/नहीं) यदि हाँ तो विवरण दें।	
iv.	क्या आप सब्जीयों के समन्वित कीट प्रबंधन में कर्षण क्रियाओं के अंतर्गत बीजोपचार की प्रक्रिया को अपनाते हैं? (हाँ/नहीं) यदि हाँ तो विवरण दें।	
v.	क्या आप सब्जीयों के समन्वित कीट प्रबंधन में कर्षण क्रियाओं के अंतर्गत बुआई की सही समय को अपनाते हैं? (हाँ/नहीं) यदि हाँ तो विवरण दें।	

vi.	अन्य क्रियाएँ	
ब)	**यांत्रिक क्रियाएँ**	
i.	क्या आप सब्जीयों के समन्वित कीट प्रबंधन में शामिल होने वाले यांत्रिक क्रियाओं को अपनाते हैं? (हाँ/नहीं) यदि हाँ तो विवरण दें। (खुटीयाँ, प्रकाश प्रपंच, फिरोमोन प्रपंच, आदि).....	
ii.	क्या आप सब्जीयों के समन्वित कीट प्रबंधन में यांत्रिक क्रियाओं के अंतर्गत प्रकाश प्रपंच को अपनाते हैं? (हाँ/नहीं) यदि हाँ तो विवरण दें। (प्रकाश प्रपंच रात में उपयोग करते हैं जिससे इसमें लगे कटोरे में प्रौढ़ कीट फँस जाते हैं, और उन्हें हर दिन सुबह नष्ट कर दिया जाता है।)	
iii.	क्या आप सब्जीयों के समन्वित कीट प्रबंधन में यांत्रिक क्रियाओं के अंतर्गत फिरोमोन प्रपंच को अपनाते हैं? (हाँ/नहीं) यदि हाँ तो विवरण दें। (हर सुबह इनमें इक्टठी पंखीयों को नष्ट कर दें, एवं एक हेक्टेयर में पाँच फिरोमोन प्रपंच लगाना चाहिए।)	
iv.	अन्य क्रियाएँ	
स)	**जैविक क्रियाएँ**	
i.	क्या आप सब्जीयों के फसलों में समन्वित कीट प्रबंधन में शामिल होने वाले सभी जैविक क्रियाओं को अपनाते हैं? (हाँ/नहीं) यदि हाँ तो विवरण दें।	
ii.	अन्य क्रियाएँ	

	....	
द)	**रासायनिक क्रियाएँ**	
i.	क्या आप सब्जीयों के समन्वित कीट प्रबंधन में शामिल होने वाले सभी रासायनिक क्रियाओं को अपनाते हैं? (हाँ/नहीं) यदि हाँ तो विवरण दें।	
ii.	क्या आप सब्जीयों के समन्वित कीट प्रबंधन में विभिन्न रासायनिक कीटनाशीयों को अपनाते हैं? (हाँ/नहीं) यदि हाँ तो विवरण दें। कीटनाशक :–	
iv.	अन्य क्रियाएँ	
(ई)	**अन्य क्रियाएँ**	

*1. पूर्ण 2. आंशिक 3. निरंक

30). कीटों के द्वारा सब्जी के उपज में कमी के बारे मे जानकारी दें ।

क्र.	सब्जी फसल	कीट	उपज में कमी का स्तर			
			< 25%	26 – 50%	51 – 75%	>75%

31). सब्जी फसल में कीटनाशीयों के उपयोग के तरीको व समन्वित कीट प्रबंधन तकनीक के अंगींकरण में आप को मुख्यतः क्या दिक्कतें आती हैं :

1. .....
2. .....
3. .....
4. .....
5. .....

32). सब्जी फसल में कीटनाशी उपयोग के तरीको व समन्वित कीट प्रबंधन तकनीक के अंगींकरण में आने वाली मुख्य दिक्कतों के निराकरण हेतु आप के क्या सुझाव हैं :

1. .....
2. .....
3. .....
4. .....
5. .....

Fig. : Researcher interacting with Farmer

Fig. : Researcher interacting with farmer at field

VITA

Name : Chandrkant Dubey

Date of birth : 10/05/1988

Present Address : Dau Jagdev Sao Boys Hostel, I.G.K.V., Krishak Nagar, Jora, Raipur (C.G.) Pin code - 492012

Phone no. 8878739701

E. mail bbayang.dubey@gmail.com

Permanent address: Vill.- Bayang, Po.- Kachhar, Dis.- Raigarh (C.G), Pin.No.-496001

Academic Qualification:

Degree	Year	University/Institute
1. Higher Secondary	2008	C.G.B.S.E., Raipur
2. B. Sc. (Ag.)	2013	I.G.K.V., Raipur
3. M. Sc. (Ag.)	2016	I.G.K.V., Raipur

Professional Experience (If any): R.A.W.E. U.G. 6 month

Membership of Professional Societies (If any):

Awards / Recognitions (If any):

Publications (If any): -

Signature