

**KNOWLEDGE LEVEL AND ADOPTION BEHAVIOUR
OF VEGETABLE GROWERS WITH RESPECT TO
INTEGRATED PEST MANAGEMENT**

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BANGALORE

1996

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BASAVAPRABHU V. JIRLI

Thesis submitted to the
University of Agricultural Sciences, Bangalore
in partial fulfilment of the requirements
for the award of the Degree of

Master of Science (Agriculture)

IN

AGRICULTURAL EXTENSION

BANGALORE

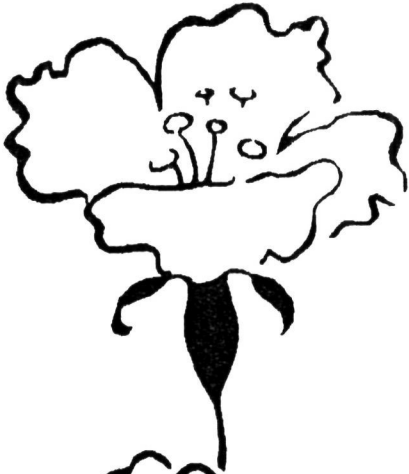
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AFFECTIONATELY DEDICATED
TO
MY BELOVED PARENTS

SHRI. VIRUPAKSHAPPA M. JIRLI
AND
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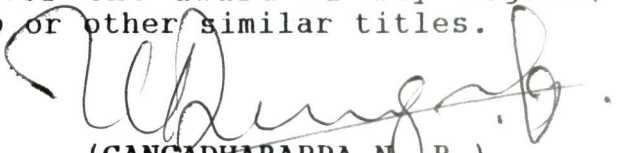
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MASTER OF SCIENCE (AGRICULTURE)
IN
AGRICULTURAL EXTENSION

to the University of Agricultural Sciences, Bangalore is a record of research work done by him during the period of his study in this University under my guidance and supervision that no part of the thesis had been submitted for the award of any degree, diploma, associateship, fellowship or other similar titles.

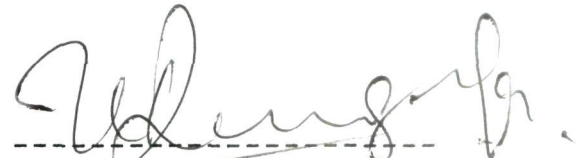
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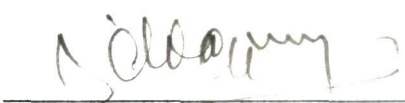
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ACKNOWLEDGEMENT

I take this opportunity to record my sincere feelings, deep sense of gratitude and respects to Dr. N. R. **GANGADHARAPPA**, associate professor, Department of Agricultural Extension, UAS, Hebbal, Bangalore and Chairman of my advisory committee for his constructive criticisms, valuable suggestions with keen interest and persistent encouragement throughout the course of this investigation. I am grateful for his untiring guidance. I feel proud and privileged for having him as my guide. I owe every word of this thesis to him and he deserves rich tributes and regards indeed.

I am indebted to the members of my advisory committee Dr. C. **SIDDAPPAJI** Professor and Head, division of Sericulture UAS, Bangalore, Dr. B. S. **SIDDARAMAIAH** Professor and Editor, Communication Centre, UAS, Hebbal, Bangalore, Mr. V. V. **SULLADMATH** Associate Editor, Communication Centre, UAS, Hebbal, Bangalore and Mr. M. N. **VENKATARAM** Professor and Head, Department of Statistics for their salutary advice, constant encouragement and valid criticism throughout the course of my research work.

My special regards to Dr. M. **MAHADEVAPPA** Vice-Chancellor, UAS, Dharwad, Dr. H. V. **NANJAPPA** Associate Professor, Dept. of Agronomy and Dr. G. **ESHWARAPPA**, Chief Instructor, FTI, Hebbal, Bangalore for their unforgettable help and constant encouragement throughout my postgraduate study.

I wish to express my sincere thanks to Dr. K. S. KRISHNA, professor and Head, Department of Agricultural Extension for encouragement during the course of the study.

I wish to thank all the faculty members of our Agril Extension family UAS, Bangalore for their co operation and suggestions in bringing out this thesis.

Needless to state that I am profoundly grateful to my elder brother Mr. Vijaykumar Jirli and babhi Mrs. Savitha Jirli for their abundant love, affection and were constant source of inspiration throughout my study.

I find no suitable words to acknowledge the love, affection and encouragement of my brother Mr. Shivashankar and sisters Sumitra and Vidyavathi and bothers-in-law Mr. Ashok Ingalagi and Mr. Nagaraj Doshetty.

I express my sincere gratitude to Sri. S. G. Sreekanteshwaraswamy, Executive Secretary, and all the staff of KRVP and Dr. T. S. Channesh, Fellow KSCST for their help and moral support during my research work.

It is my pleasure to reveal that the secret of my success are my friends who have worked behind the screen to complete this investigation. I specially thank my roommates Mr. Dhananjaya, Mr. Bhushan, who showed brotherly affection.

I wish to extend my sincere thanks to Mr. Prakash Khyad for helping in data collection. I will be failling in my duty if I do not say that.

It is my pleasure to express heartfelt thanks to Mr. Shivaraj, Mr. Naresh, Mr. Jagadish, Mr. Channabasappa, Mr. Yoganand, Mr. Balakrishna, Mr. Shivakuma Swamy, Mr. Thippeswamy, Mr. M. G. Patil, Mr. Mallikarjuna Swamy, Friends of G-9 and others for their help on various occasions.

I am extremely grateful to the authorities of Shri. K. M. Siddaramanna Hostel for providing me an accomodation during my post graduate study.

My greatest thanks go to the farmers of study area who whole heartedly treated me as their guest by providing food and data during my investigation.

My appreciation and thanks are due to Kiran Graphics, Basaveshwaranagar, Bangalore for typing the thesis correctly and neatly.

Bangalore

February


(BASAVAPRABHU. V. JIRLI)

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INTRODUCTION

CHAPTER - I

INTRODUCTION

Indian subcontinent is endowed with salubrious climate which permits growing of vegetables throughout the year. Vegetables play an important role in balanced nutrition as they are valuable sources of carbohydrates, proteins, vitamins and minerals. Per capita consumption of the vegetables in India is 160 g/day as against recommendation of 280 g/day/person. According to this standard we need to produce approximately 0.3 mt of vegetables per day for the present day population. Area being a constraint, we have to increase the yield to 20 t/ha/year. The present earning through vegetable export is little over Rs 300 crores.

Vegetables not only provide maximum output but also give more income per unit area of land. Vegetable cultivation among small land holders has always been source of supplementary income and provides gainful employment through intensive cultivation and thus vegetable growers are normally more prosperous than those who grow cereals because of higher returns.

In the recent past, efforts have been made to increase the production of vegetables by developing large number of high yielding, good quality and disease resistant varieties/hybrids and other required cultivation

packages. The high yielding varieties/hybrids are more input responsive. The critical inputs viz., fertilizer, if applied in excess, makes the plants to become succulent and thus attracts more of pests. To minimise the pest attack, farmer resorts to usage of chemical pesticides and their indiscriminate use create many problems like resurgence of pest species, destruction of natural enemies, more so of beneficial insects.

Emphasising the underlying principle of sustainability, Mahatma Gandhiji, thus spoke

" The earth provides enough
to satisfy every man's need
but not every man's greed "

Realising the limitations of indiscriminate use of chemical pesticides, recently scientists have developed the concept of integration of available eco-friendly, pest management practices.

Currently, vegetables are being grown in India in 6.23 m ha accounting for producing 66.58 mt which is second highest in the world next only to China. Among major vegetable crops, Tomato occupies maximum of 4,54,000 ha with a net productivity of 15.6 t/ha. From among the vegetable crops, the maximum productivity of 15.68 t/ha was recorded in cabbage crop and the area under this vegetable crop is 1,78,353 ha.

In Karnataka, vegetables are grown in an area of 2,15,293 ha with the production of 43,43,008 tonnes, with a maximum productivity of 23.49 t/ha in the country. In Karnataka, tomato is grown in an area of 32,073 ha with the production of 8,01,825 tonnes. Cole crops are grown in Karnataka on an area of 13,674 ha with the production of 3,28,176 tonnes.

Since tomato and cabbage are relatively more profitable among the vegetable crops, farmers do grow them intensively at least in and around urban areas. Tomato and cabbage can be grown in wide range of soils except in waterlogged and highly acidic soils. Tomato can be grown in all the three major seasons of the year while cabbage is a winter vegetable crop and prefers cool climate.

Since vegetables are succulent crops, they are more susceptible to the attack of pests and diseases. The problems vegetable growers often face are high input requirement, price fluctuation, high cost of cultivation and uncertain returns. The aspiration by the farmers for higher yields in all the crops following modern methods resulted in a race of increasing application of pesticides.

Indiscriminate use of pesticides, knowingly or unknowingly has caused many ecological problems. This has led to the emergence of resistant strains among major pests

and lesser known insect pests. Therefore the scientists have started working on how to maintain ecological balance without compromising the productivity. In India, the crop losses are estimated at Rs 6000 to Rs 7000 crores. Of this loss, 33 per cent is from weeds, 26 per cent from pests, diseases and rodents, another 26 per cent from birds, the rest from nematodes etc.

In the global context, Japan uses 10,000 g , Europe uses 2000 g, USA uses 1500 g and India uses 640 g of insecticide per hectare. Though national use of pesticide per hectare is less compared to developed nations, there are pockets in India where usage is very high and more than the recommendation. During 1987, the farmers of Guntur, Andrapradesh used one tonne of pesticide formulation for 130 ha of cotton/157 ha of chilly crop.

STATEMENT OF THE PROBLEM

The average per hectare consumption of pesticides has gone up from 15.4 g/ha in 1960 to 640 g/ha in 1980. Pesticide production in India is approximately 124,000 mt, and the consumption of the same in the year 1994-95 was 85,000 mt. India has made commendable progress in exporting pesticides to countries like France, Japan, UK, Thailand, Kuwait, Mexico, Pakistan, USA, Australia, Netherlands and USSR.

High yielding varieties of tomato and cabbage are

more susceptible to pests and disease and the incidence of pests and diseases is stupendous, enormous and normally beyond the reach of the farmers. This paradox situation has made the farmers to use whatever pesticides/fungicides available in the market without considering the efficacy of chemical to get higher yields.

Pesticides leave residues that persist in the environment and contaminate the food chain. Over usage/reliance on pesticide pose a potential threat to the ecology and environment. Increased use of pesticides has contaminated soil, air, surface and ground waters besides crop plants and their products. To alleviate the problems that are created by indiscriminate use of pesticides/fungicides, any tool is good enough provided it meets the environmental needs, provides safety to the people and good harvest to the farmer. Judicious use of chemicals as a component of Integrated Pest Management (IPM) is the safest means of pest control among the methods available now.

DEFINITION OF INTEGRATED PEST MANAGEMENT

IPM is defined as " The blending of biological control agents with the intervention of chemical control"

The pest management system that in the context of associated environment and the population dynamics of pest species, utilises all suitable techniques and methods in as compatible manner as possible and maintains the pest population at levels below those causing economic injury."

IPM is described in the following steps :

- 1) Determine how life system of pest needs to be modified to reduce its number to tolerable levels.
- 2) Apply biological knowledge and current technology to achieve desired modification.
- 3) Device procedure for pest control suited to current technology and compatible with environmental quality aspect.

" IPM is a pest management that utilises all suitable techniques either to reduce the pest population or to manipulate the population that are prevented from causing injury".

" It is an approach that implies combination of techniques to control wide variety of potential pests that may threaten crops. It involves maximum reliance on natural pest population controls, along with a combination of techniques that may contribute to

suppression by cultural methods, pest specific diseases, resistant crop varieties, augmentation of parasites predators or pest specific chemical pesticides as needed"

IPM is also defined as an integrated and planned execution of different pest management strategies and tactics with the sole objective of reducing losses from pest with minimum ecological implications.

HARMFUL EFFECTS OF CHEMICAL PESTICIDES

- 1) The mounting residues of pesticides in the food have become serious threat to life itself.
- 2) Increased use of pesticides have caused contamination of soil, air, surface and ground water.
- 3) Owing to years of exposure many pests have become immune to insecticides.
- 4) In plants, effects like phytotoxicity, pollen sterility, growth retardation and residues are the resultants of extravagant use of pesticides.
- 5) Application of pesticides carelessly have killed people, animals and birds and destroyed crops.
- 6) Resistance in insects and mites to pesticides have developed in varying degrees to almost every chemical employed in crop production.

ADVANTAGES OF IPM

- 1) It offers more efficient, cheap and effective control.
- 2) It avoids upsetting balance of nature.
- 3) It will avoid or delay considerably the development of pesticide resistant strains of pests.
- 4) They will considerably minimise residue hazards of pesticide.
- 5) It fits well in the national economy especially of developing countries.

Integrated pest management comprises of cultural, mechanical, physical, biological, varietal, pest surveillance, forecasting, chemical and other control methods.

I] Cultural control

Cultural methods of insect pest control comprise regular farm operations, which are so performed as to destroy the insects or to prevent them from causing injury.

For achieving cultural control the following agronomic practices can be followed.

- i) Summer deep ploughing,
- ii) Use of clean seed varieties,
- iii) Regulating irrigation,
- iv) Use of resistant varieties,

- v) Manuring and stimulating plant growth,
- vi) Cropping scheme and trap crop,
- vii) Pruning and thinning,
- viii) Clean culture,
- ix) Time of sowing and harvesting.

II] Mechanical and physical control

Mechanical and physical control measures involve the use of force or physical factors of the environment with or without the aid of special equipment.

The control measures are generally ineffective on large scale and cannot be applied commercially. Hand picking, using hand nets, bagnets, shaking and jarring, use of light traps etc. are important methods of physical or mechanical factors.

III] Biological control

In a disturbed ecosystem, pests can be controlled by releasing more predators and parasitic insects, mites, fungi etc.. Biological control involves :

- i) Conservation of natural enemies,
- ii) Release of parasites,
- iii) Use of microbial agents, virus, fungi etc and
- iv) Use of predators.

The biological control agents must be chosen carefully as there are chances of new agents themselves becoming the pest.

IV] Varietal control

Use of varieties, resistant or tolerant to one or more pest is an important component of the IPM programme. The varietal resistance to insect pests is broadly classified into three categories i.e. tolerance, antibiosis and non preference.

V] Pest surveillance methodology

The surveillance programme is used as a tool by a pest manager to understand the biology and ecology of the pest and to know how they are governed by other influences from surrounding environment.

VI] Forecasting pest attack

IPM aims at accurate forecasting of pest attack so that control measures can be planned in advance with maximum efficiency.

VII] Chemical control

The main objective of IPM is to use insecticides exceptionally as a last resort and at the

same time effectively. There are two principles involved here and they are:

- i) Use of selective pesticides
- ii) Need based application of pesticides.

i) Use of selective pesticides

Monotoxic chemicals which will kill only one pest species and are harmless to other organisms are rarely discovered and used. The aim here is that it should be harmless to beneficial organisms and also to other non target organisms.

ii) Need based application of pesticides

Application of pesticides according to economic threshold level is one of the recommendation in IPM.

The chemical control components of IPM involves the following :

- i) Compulsory necessary treatment to protect seedlings against pests so that the initial pest population build up in the nursery can be prevented.
- ii) Minimum use of pesticide.
- iii) Timely need based use of pesticides by proper surveillance of pest

- iv) No time bound application of pesticide except in certain endemic areas.
- v) Proper application of proper pesticide at proper dosage.

Even though we know the ill effects of over using plant protection chemicals in cultivation, we still greatly rely on the chemicals which kill the pest indiscriminately. The results of which we are experiencing now as various disorders in human health. Though lot of research has been conducted to overcome these problems and are getting momentum slowly, farmers are becoming aware of danger of over use of chemicals in agriculture.

A study was conducted by the Indian Institute of Horticultural Research (IIHR), Hesaraghatta with respect to IPM on vegetables and came out with great success in giving IPM packages for major vegetables like tomato and cabbage. At this juncture it is necessary to study the knowledge level and adoption behavior of vegetable growers with respect to Integrated Pest Management. Therefore the study was undertaken with following objectives

- a) To find out knowledge level of vegetable grower with respect to Integrated Pest Management practices.
- b) To study the adoption behaviour of vegetable growers with respect to Integrated Pest Management practices.

- c) To understand the relationship, if any, between socio-psychological characteristics of vegetable growers and their knowledge level and adoption behaviour.
- d) To study the constraints faced by vegetable growers in adopting Integrated Pest Management practices.
- e) To document indigenous plant protection measures practiced by farmers.

Operational definitions

- a). Knowledge level of vegetables growers:

It's operationally defined as extent of knowledge that vegetable growers are familiar with Integrated Pest Management practices.

- b). Adoption level of vegetables growers:

It's operationally defined as the extent of practicing the recommended Integrated Pest Management practices by the vegetable growers.

Adoption level is further categorised as full adoption, partial adoption and no adoption.

Full adoption

If the respondent adopted the packages as recommended by the Indian Institute of Horticultural Research, Hesaraghatta.

Partial adoption

If the respondents adopt recommended practices with little deviations/modifications such as less than the recommended practices or more is defined as partial adoption.

No adoption

If the respondent has not applied any of the recommended Integrated Pest Management practices, is operationally defined as no adoption.

SCOPE AND LIMITATIONS OF THE STUDY

It is a unique research study which tries to test knowledge level and adoption behavior of farmers towards Integrated Pest Management. There are no systematic research studies done on Integrated Pest Management aspects. Therefore findings shall reveal the level of knowledge and adoption behavior towards Integrated Pest Management which are very useful to developmental departments of Government like Dept. of Horticulture, Pollution Control Board, other environmental concern department and Non Governmental Organisation (NGO's) working on sustainable agriculture. The Department of Agriculture is now seriously thinking of organic farming, integrated system of pest control and balanced nutrient application and hence it is an appropriate timely study.

The study is helpful in further programming of training to extension personnel to encourage farmers to take up Integrated control of pest. The study will be an eye opener regarding IPM practices and it helps the planners to develop strategy to adopt IPM on large scale.

Due to the limitations of time and resources of the researcher the study was conducted in two predominantly vegetable growing taluks viz., Malur from Kolar district and Bangalore North from Bangalore Urban district.

The findings of the study are confined to the situations prevailing in that area and could hardly be generalised to the entire state.

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ಗಾ.ಕೃ.ವಿ.ಕೆ., ಬೆಂಗಳೂರು-560 065.

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

A review of existing literature relevant to the study area helps the researcher to design the theoretical frame of the study and also assess the nature and quantum of studies already undertaken in the particular area of research. Very few/No reviews are available which are directly related to knowledge level and adoption behaviour of vegetable growers with respect to Integrated Pest Management, and hence, a brief review on the studies on plant protection measures (PPM) on vegetables and other crops are made.

The review of literature is presented in this chapter under the following headings :

- 2.1 Knowledge level about IPM/PPM.
- 2.2 Adoption behaviour about IPM/PPM.
- 2.3 Performance of IPM.
- 2.4 Relationship between knowledge level and socio-psychological characteristics.
- 2.5 Relationship between adoption behaviour and socio-psychological characteristics.
- 2.6 Constraints in adoption of recommended practices.
- 2.7 Indigenous plant protection measures.

2.1 KNOWLEDGE LEVEL ABOUT IPM / PPM

Aswathaiah and Krishna (1973) in a study on potato cultivation reported that 28.6 per cent of potato cultivators had no knowledge of plant protection measures.

Govindappa (1974) in his study reported that 55 per cent of small farmers had high knowledge about improved vegetable practices while only 44 per cent of others had high knowledge of improved vegetables practices.

Sinha (1981), revealed that majority of the small and other farmers possessed low knowledge about pests of wheat crop. The per centage of small farmers under low and medium knowledge category was 83.33 and 16.67 per centage respectively. None of them had high knowledge.

Patil and Jadhav (1987) indicated that majority of farmers did not have current knowledge of fertilizer requirement of the onion crop, its pests and disease and their control measures. Majority of the onion growers (54 per cent) stated that they did not have correct knowledge of pest and disease and their control measures.

Halakatti (1988) reported over seventy five per cent of the farmers had knowledge about the name of first plant protection chemical (97.50) and the name of second plant protection chemical was known to over 79 per cent of

farmers. Over sixty per cent of respondents had knowledge about practices like concentration of first chemical of plant protection measure (74.167), number of sprays of first chemical while 62.50 per cent of the farmers did know the concentration of second plant protection chemical.

Kantaraju (1989) indicated that ninety five per cent of coffee growers and seventy three per cent of cardamom growers had correct knowledge of plant protection measures against pests.

Prameelamma (1990), reported that all the three categories of respondents did not have complete knowledge about plant protection measures, time of application of chemical fertilizers, seed treatment and chemical weed control.

Yogananda (1992), reported that more than 80 per cent of the respondents in both groups were aware of termite control. In case of small growers only 31.66 per cent had awareness about rhinoceros beetle, whereas in case of big growers 73.33 per cent were aware of it.

Venkatesh (1995) reported that majority of trained farm youth had correct knowledge about different aspects of plant protection measures like names of major pests (83.33 per cent), name of pesticide (70.00 per cent), concentration of pesticide (50.00 per cent). However in case of untrained youth knowledge level was as follows : Name of major pests

(70.00 per cent), name of pesticide (41.66 per cent) and concentration of pesticide (11.66 per cent).

Arunkumar (1995), reported that 80 per cent of the sample farmers applied the Plant Protection Chemicals (PPC) along the wind direction which is correct practice, Almost all the farmers were averse for using the protective coverings like hand gloves, shoes and face masks. However, they reported that they wash hands and take bath after PPC application which according to them reduce adverse effects of PPC on their health.

2.2 ADOPTION BEHAVIOUR WITH RESPECT TO IPM/PPM

Khan et al. (1976) revealed that 80 per cent of the growers had sprayed the crop one to three times and 75 per cent of them had used sublethal doses, only 5 per cent of the farmers had sprayed the chemical in proper combination and in appropriate concentration.

Sinha (1981) indicated that only 1.67 per cent of small and 3.33 per cent of other farmers had adopted control measures against pests.

Geethakutty (1982), reported that comparatively higher per centage of farmers (85 per cent) with correct understanding of principles were adopters of high cost practices like plant protection chemicals, HYV seed and fertilizers. It was also observed that correct understanding

of principles and knowledge of procedure were cent percent or nearly cent percent adopters of practices irrespective of whether the practice is of low cost, no cost or high cost.

Gondi and Narayana Gowda (1983) in their report indicated that recommendations involving high cost such as use of fertilizers and plant protection chemicals have been only partially adopted by majority of farmers.

Himantha Raju (1984) revealed that a large majority of contact farmers received high degree of extension guidance for practices like plant protection measures 93.33 per cent, application of fertilizer 36 per cent etc.. However it was noted that 100 per cent of contact farmers had adopted the practices like depth of sowing and plant protection measures and weed control.

Manjunatha (1986), revealed that 61 per cent of farmers accept and adopted plant protection measures due to village adoption programme. Nevertheless before the village adoption programme, the area covered by plant protection measures was only 11 per cent but with the adoption of village it increased to 37 per cent.

Suresh (1987), in his study on motivation pattern and adoption behaviour of small and marginal contact farmers of National Agricultural Extension Project in Tumkur district indicated that non of the respondents had adopted

plant protection measures.

It was reported that in Kota area of Rajasthan, contact farmers had higher level adoption of Paddy cultivation practices like seed treatment, use of High Yielding Varieties (HYV), basal dose of fertilizers, top dressing and plant protection measures compared to non contact farmers (Anonymous 1989).

Jagadal (1989), reported that more than 75 per cent of the farmers knew about the occurrence of pests (90.83 per cent) and diseases (88.33 per cent) on cabbage crop.

Kantaraju (1989), reported that majority of the coffee growers and cardamom growers (nearly 58 per cent) were partial adopters of plant protection measures against pests. Whereas 27 per cent of coffee growers and 15 per cent of cardamom growers were high adopters of plant protection measures.

Vijaykumar (1989), revealed that although majority of the farmers used insecticides, it was discouraging to note that only 55 per cent of the farmers use recommended dose, while about 44.17 per cent of farmers applied below recommended dose of insecticides.

Mahadeva (1990) in his study, stated that 75 per cent of contact farmers adopted plant protection measures

as against 33 per cent of the fellow farmers.

Subhash Chander and Sharma (1990) indicated that knowledge index was less than 50 for disease and pest control by chemicals. 37 per cent of farmers were ignorant about chemicals, their doses and method of application.

Hanchinal et al. (1991) revealed that 17 per cent of the potato growers of Dharwad taluk adopted pest control practices and 82 per cent of potato growers partially adopted and 1 per cent of farmers had not adopted plant protection practices. They also reported that lack of knowledge about recommended quantity of chemicals for control of pests and high cost of Plant Protection Chemicals was the reason for partial adoption of pest control practices.

Nityashree, (1992) reported that 51 per cent of big and 32 per cent of small coffee growers have adopted plant protection measures as recommended. In contrast to this 28 per cent of small coffee growers and 12 per cent of big coffee growers did not adopt plant protection measures.

Yogananda (1992) reported that in respect of control of pests and diseases, 70 per cent of small growers have taken up measures to control the termite and rhinoceros beetle, where as in the case of big growers more than 70 per cent adopted measures to control not only termite and

rhinoceros beetle but also avoided spread of diseases like stem bleeding and Mahali.

Chandra Naik (1993a) reported recommended quantity of plant protection chemicals per acre of nursery and to main field, a good number of irrigated beneficiary rice farmers exhibited full to partial adoption behaviour in contrast to non beneficiary farmers who exhibited partial to non adoption behaviour. It was also observed that only 25 per cent of beneficiary and 10 per cent of non beneficiaries adopted recommended plant protection measures to nursery.

Chandra Naik (1993b) indicated that a large majority among rain fed beneficiary farmers, adopted recommended plant protection measures (70 per cent) but the adoption behaviour of non beneficiary deviated from the same (17.50 per cent).

Gopikrishna (1993) concluded that a small percentage of farmers in canal area (2.5 per cent) had undertaken spraying with recommended quantity of chemicals against pest and disease in nursery. Further, cent per cent of farmers under both tank as well as well irrigation systems had not taken up plant protection measures using recommended chemicals.

Manjula (1993), stated that around 15 per cent of trained respondents adopted practices like insecticides and

pesticide application use of fertilizers and gypsum application. While in case of untrained farm women the practices like pesticides, fertilizers and gypsum have been adopted by less than 5 per cent of them.

2.3 PERFORMANCE OF IPM

Performance of IPM and conventional pest management

Raodeo (1983) studied the integrated pest management (IPM) with and without biological control agents in cotton at Marathawada Agricultural University, Parbhani. The highest yield of 610 Kgs was obtained from the plot where IPM and biological control agents were used and about 491 Kgs per hectare obtained where only IPM measures adopted.

Kenmore (1984) conducted a study on integrated pest control (IPC) on rice in South east Asia. The first round of demonstration in the Philippines were compared with 4 treatments. Farmers practice no insecticide, the nationally recommended calender of applications and IPC rules. The results of these demonstrations showed that the IPC decision rules were most profitable and return on investment for IPC was higher than any other treatments.

Sundarmurthy (1985) conducted an operational research project on Integrated Pest Management on Cotton crop in Tamil Nadu. He concluded that inspite of the

prevailed drought situation in the project area, the various management measures were applied at varied degree as growth of crop was poor and insecticides used at action threshold level under supervision. The quantity of insecticides used in project area was varied from 209 to 2544 gms/ai/ha with mean value of 1377.47 gms/ai/ha. The average yield realised in project area was about 8.73 Quintals per hectare as against the average yield of about 7.75 Qtls per hectare in non project area where conventional pest management prevailed.

Ramamoorthy (1987) studied an economic evaluation on the impact of Integrated Pest Management on cotton cultivation in Tamil Nadu. He reported that the project farmers those who have adopted the IPM (Integrated Pest Management) practices have earned a net profit of Rs. 6439 per hectare whereas, the cotton growers of control village have earned only a net profit of Rs. 2412 per hectare. And excess profit of Rs 4027 per hectare was earned by IPM village farmers may be due to the cumulative impact of IPM techniques adopted at the project village.

Sundarmurthy (1987) conducted the operational research on integrated control of cotton insects during 1987-88 in Tamil Nadu. And he reported that appropriate insecticides were used at action threshold level under supervision. The mean quantity of insecticides used in the project area was 2808 gms per hectare as against 2686 gms

per hectare in non project area. The little higher quality of insecticides used in the project area was due to continued pressure of migrates of *Heliothis armigera* from sorghum crop. The per cent of boll worm damage was 5.40 to 8.03 in the project and non project area respectively. And the yield of seed cotton realised in the project and non project areas was 16.20 Qtls per hectare and 13.92 Qtls per hectare respectively. The results of investigation made during last two years showed that even under the drought situation the management system is also found to be effective in protecting the yield of seed cotton.

Petrov and Vasileva (1988) reported the reduction in the use of insecticides for the control of cabbage pests in the chuvash ASSR, USSR in recent years against the increased use of natural enemies, integrated control, resistant varieties and microbial pesticides. The main pests in the region were cabbage moth Mamestra brassicae, the diamond black moth Plutella xylostella and the large white Pieris brassicae.

Rosset (1988) reported general programme of Integrated Pest Management of tomato in Central America. The programme is divided into three stages associated with crop growth. For the first stage, the planting stage inter planting with beans is suggested as a primitive measure against the noctuids *spodoptera* species and *Heliothis* species during flowering and fruiting stage while

a nylon cover over the seed bed was suggested as a preventive measure against Bemisia tabaci.

Butter et al. (1989) conducted the trials to determine the efficiency of Integrated Pest Management strategy for the control of Cotton bollworms in Ludhiana (Punjab). The IPM strategy consisted of sprays of sexpheromones and insecticides as well as release of an egg parasite, Trichogramma chilonis during the last two years of study. The efficiency of IPM was compared with the recommended sprays of only insecticides and sexpheromones. The highest seed cotton yield of 1701 kgs per hectare was recorded in IPM treatment as against 1432 Kgs per hectare were recommended spray schedule of insecticides was followed. The IPM strategy has been found to be better in reducing the boll worm damage and there by increasing the seed cotton yield.

The farmer got 10.5t cauliflower and 7 t braccoli/ha due to IPM measures which was normal yield. However for the first time the former was able to harvest the crop without using toxic chemicals. Though the economic and practical IPM technology is now available; however, the farmer's habit of using insecticides make it difficult to fully utilise this technology (Anonymous 1990).

Pandurangadu and Raju (1990) conducted a study on economics of pesticides use on cotton farms in Guntur district of Andrapradesh. They concluded that an alarming

rise in the cost of cultivation of cotton was largely attributed to the increased use of quite expensive insecticides. They also opined that not only as an economy measure but also to avoid side effects of excessive use of pesticides, farmers should adopt Integrated Pest Management measures.

Ramamurthy (1990) conducted a study on economic evaluation on IPM program on cotton in Tamil Nadu, and observed that the per hectare net profit earned by IPM adopters was Rs.564 as against the loss of Rs 5708 by the farmers in control area.

A study conducted on IPM in Guntur and Prakasam district of Andrapradesh revealed that the farmers of both districts used packages recommended by Sandoz and experienced an increase in yields viz., 3-4 Qtls per acre, which represented a significant increase of more than 80 per cent. Also the total number of applications of pesticides was reduced by at least two rounds, resulting in significant savings in pest control cost. Educating the farmers on the right use of technology and, by following IPM practices, Heliothis on Cotton can be managed effectively (Anonymous 1992).

Sharma et al. (1992) conducted a study on the Integrated Pest Management of pink-bollworm on cotton in Hissar district (Haryana). Experiments were conducted to find out the suitability of gossypilure (checkmate PBW)

sexpheromone of pink bollworm. The results revealed that alternate use of insecticides and pheromone at an interval of 15 days gave a good control of the pest.

2.4 RELATIONSHIP BETWEEN KNOWLEDGE LEVEL AND SOCIO-PSYCHOLOGICAL CHARACTERISTICS

Kantaraj (1980) in his study indicated that education, land holding, mass media participation, extension contact were associated with knowledge level.

Ravindra (1980) reported that education, size of land holding, social participation, media participation, extension contact, extension participation had positive association with knowledge level of poultry farmers.

Dayananda Patel (1985) revealed that extension contact, mass media use, urban contact were found to be significantly related with knowledge level of farmers.

Lalitha (1985) found that extension contact, extension participation, mass media participation were not associated with knowledge level of trained farm women.

Umamahesha (1985) in his study reported that education had significant association with knowledge of respondents.

Kher and Halyal (1988) revealed that education and innovation proneness had significant association with

knowledge of respondents.

Aswathanarayana (1989) found that the level of knowledge of sericultural practices of farmers was significantly associated with education, social participation, mass media participation, extension participation, extension contact and cosmopolitaness whereas land holding did not reveal any significant association with knowledge level.

Premkumar (1989) indicated that education, mass media participation, extension contact had positive and significant relationship with gain in knowledge of the trainee.

Raghupathi (1989) revealed that the knowledge gain was significantly associated with innovativeness, achievement motivation and cosmopolitaness but non significant with extension participation of the respondents.

Sawant and Dalvi (1989) reported that education was highly significant with knowledge level of the respondents.

Uma and Sethu Rao (1989) concluded from the findings of their study that mass media participation had significant relationship with the knowledge level of mahila mandal members about improved practices of home gardening.

Satheesh (1990) in his study revealed that education, land holding, mass media participation, extension participation had positive and significant relationship with knowledge level of chawki practices.

Balavatti and Sundarswamy (1991) in their experimental study found that there was no significant association among education, extension contact, scientific orientation and knowledge.

Yogananda (1992) revealed that education, extension participation, mass media participation were significantly related to their knowledge level.

Thus, majority of the studies revealed a positive and significant relationship between socio-psychological variables and the knowledge level of respondents while few studies indicated non-significant relationship. This however, needs further confirmation.

2.5 RELATIONSHIP BETWEEN ADOPTION BEHAVIOUR AND SOCIO-PSYCHOLOGICAL CHARACTERISTICS

Gokulraj (1981) indicated that education, size of family, organizational participation did not have any significant association with the adoption level of farmers.

Raghavendra et al. (1982) reported that there was a significant association between education, mass media participation and adoption of recommended dairy management

practices.

Sainath (1982) revealed that extension contact and size of the holding were significantly associated with the adoption of recommended practices of grape cultivation .

Pallavan (1985) reported that extent of adoption of dairy management practices by farmers was significantly associated with their land holding, mass media participation, extension contact, extension participation and awareness about dairying.

✓ Choudhary et al. (1988) indicated in their study revealed that age, education, size of land holding were significantly associated with adoption level of trained farmers.

Aswathanarayan (1989) revealed that extent of adoption of sericultural practices by farmers was positive and significantly associated with their education, land holding, mass media participation, extension participation.

Sateesh (1990) concluded that education, land holding, mass media participation, extension participation had positive and significant relationship with adoption level.

Kaur and Singh (1991) revealed that extension contact, mass media exposure had positive and significant relationship with the extent of adoption.

Yogananda (1992) reported that education, extension participation, mass media participation and were significantly associated with their adoption level.

Manjula and Siddaramaiah (1994) indicated that the adoption was significantly correlated with age, land holding, extension participation and achievement motivation.

Majority of the research studies cited above have pointed out the positive relationship between education, extension contact, extension participation, mass media participation, size of holdings and adoption of recommended practices by farmers. Only few studies depicted nonsignificant relationship. This finding is put to test in this study for confirmation or rejection.

2.6 CONSTRAINTS IN ADOPTION OF RECOMMENDED PRACTICES

Rajgopal (1975) in his study on plant protection practices and problems of vegetable growers in Bangalore district reported that vegetable growers do recognise the need for plant protection measures but failed to recognise the importance of prophylactic measures.

Sheshachar (1980) reported that lack of knowledge, high cost of inputs, financial difficulty as constraints for non adoption of recommended chilli cultivation by farmers.

According to Bhoite and Nikalje (1983) the reasons for non adoption were inadequacy of capital (80.67%), lack of knowledge (80.00%), non-availability of seeds, fertilizers and pesticides (68.67%), non-availability of technical guidance (61.00%) and lack of improved implements (58.00%).

Bhoite and Thorat (1985) reported that non-availability of seeds in time, high price of inputs, lack of awareness, non-availability of required input and a near market were the major constraints in adopting the practices of rabi jowar.

Ram Ajoye (1986) indicated that lack of knowledge and lack of technical guidance were the major constraints in adoption of improved varieties of wheat.

Nayak and Bajaj (1989) reported that the major constraints in adoption were non-availability of certified seeds, high cost of fertilizers and non-availability of labour.

Patil et al. (1989) revealed that non-availability of inputs in time, non-availability of technical guidance and non-availability of improved implements and small and uneconomic holdings were the reasons for non-adoption.

Jaiswal and Sharma (1990) revealed that lack of knowledge and technical guidance regarding proper use of

plant protection measure were the important constraints in adoption of plant protection measure. More than 30 per cent respondents were not using plant protection measures due to non-availability of insecticides and suitable plant protection equipments. Poor economic condition of farmers also does not permit to adopt this technology, (90 per cent respondents) 16.67 per cent do not show any interest in this technology.

Rade et al. (1990) indicated that in plant protection technology, lack of knowledge about incidence of pest and diseases and their control (30.67 per cent); lack of finance for purchase of pesticides (15.33 per cent); non-availability of plant protection appliances (13.33 per cent) and non-availability of pesticides/insecticides in time at taluka places (10.67 per cent) were the major constraints in adoption of improved recommended technology in cultivation of groundnut crop.

Bhople et al. (1991) revealed that infrastructural constraints like lack of knowledge, non-availability of guidance, lack of skill, shortage of labour and non-availability of implements were the major constraints faced by farmers in adoption of technologies.

Mundhva and Patel (1991) in their study on constraints in adoption of rain fed wheat technology reported that lack of knowledge of plant protection measures, cost of plant protection chemicals were major

constraints. Further, constraints like high cost of plant protection equipment and complicated trade name of chemical were also recorded. This was because, most of the farmers were illiterate and did not have sufficient knowledge about plant protection methodology.

Phatke et al. (1992) indicated that high cost of weedicides, non-availability of weedicide and spray equipment are the major constraints faced by farmers.

Santha et al. (1992) revealed that the technological constraints like lack of knowledge about the recent technologies in paddy cultivation practices were the major constraints.

Yogananda (1992) reported that lack of equipment to take up plant protection measures, lack of knowledge and guidance, non availability of labour for application of farmyard manure were the major constraints in adoption of specific practices in coconut cultivation.

Herman and Cameron (1994) concluded that the actual time spent scouting in any field is too long for the personnel resources and efficient communication of scouting results is essential. Inefficient lines of communication led to unnecessary insecticide application to one crop and an application to the other crop was delayed one week. The later had high damage score than other IPM crops during 1991-92.

2.7 INDIGENOUS PLANT PROTECTION MEASURES

Sidappaji (1983) reported that Neem seed kernel (NSK) extract developed for first time (1978) and standardised its use (5 per cent spray) against Tur pod borer and other pulse crops and found to reduce the borer damage as an 'antefeedant' resulting in increased grain yield in Tur, Moong, Urd and Bengal gram. He evaluated this home made insecticide and found economically feasible and environmentally the safest compared to other insecticides including synthetic pyrethroids and popularised its use.

Mane (1990) reported that 4 - 5 pellets of camel dung placed near the rat burrows in the field and home kept away rats without causing any destruction.

Gupta and Patel (1992 a), in their research in Bharuch district of Gujarat revealed that the mixture of 15 ml of naffatiyas (*Ipomea fistulosa*) extract and 15 liters of water was sprayed over pigeon pea, it was found effective in controlling pest.

Gupta and Patel (1992 b), conducted study in Bharuch district of Gujarat and reported that "AYANI" (*Clerodendron multiflorum* "Anuchhad" is local name of plant) is collected and boiled in water and sprinkled over the plant for control of pest.

Gupta and Patel (1992 c) in their study reported

that the farmers boiled tobacco in water for half an hour and mixed with marthuthu ($\text{CuSO}_4 \cdot 2\text{H}_2\text{O}$) and resultant mixture was used as insecticide over pigeon pea crop.

Gupta and Patel (1992 d), reported that suspension of water in kerosene oil was sprayed on the castor plants for controlling the infection of "Lukani" (local name of the pest).

Gupta and Patel (1992 e), conducted study in Valsad district of Gujarat and reported that empty pod shells of kidney bean was burned with some green farm waste to fumigate the bean field to minimise the infestation of Aphid.

Gupta and Patel (1992 f), in their study in Sarni district of Gujarat revealed that Ash was dusted on lucerene (Medicago sativa) crop for controlling Aphids.

Gupta and Patel (1992 g), in a study in Kheda district of Gujarat reported that cow urine was sprinkled on the fennel (Foeniculom vulgare) crop to minimise the Aphid infestation.

Gupta and Patel (1992 h) conducted a research study in Surendra Nagar of Gujarat, and reported that the waste material of Tobacco was incorporated in the soil to control termite.

Patel and Kalyansundaram (1992) in their research

study in Bharuch district of Gujarat state reported that jaggery was dissolved in water and sprinkled over cotton crop through sprayer for white fly control.

Reddy and Chewande (1992 a) in their study conducted in Coimbatore district of Tamil Nadu reported that cowpea was grown as inter crop with groundnut. Being more succulent cowpea attracts sucking pests and thereby reduced the damage on the groundnut crop.

Reddy and Chewande (1992 b) conducted a research study in Guntur district of Andrapradesh and found that the control plants were raised on the boundary of chilly fields to attract thrips and jassids which otherwise would have caused heavy damage to chilly crop.

Reddy and Chewande (1992 c) conducted research study in Tungabhadra area of Karnataka and revealed the farmers controlled the leaf minor on groundnut crop by flooding the field to submerge the crop overnight and letting out water on the next morning.

Tewari (1993) reported that leaf extract of Ocimum sanctum was found to be potent fungicide against rice blast caused by Pyricularia grisea Sacc. Its ethanolic extract remain active for 240 days when stored at room temperature. The oil extracted from Ocimum sanctum leaves displayed thermostability upto 100°C. When the ethanolic extract was tested in rice fields located at various

agroecological regions, its performance was comparable to that of synthetic fungicide.

MATERIAL AND METHODS

CHAPTER - III

METHODOLOGY

A brief description of the scientific procedure followed in achieving the objectives of the study are presented in this chapter under the below mentioned headings :

- 3.1 Population of the study.
- 3.2 Locale of the study.
- 3.3 Sampling procedure.
- 3.4 Measurement of variables.
- 3.5 Constraints in adoption of IPM practices.
- 3.6 Instruments for data collection.
- 3.7 Statistical methods employed.

3.1 POPULATION OF THE STUDY

The vegetable grower who had knowledge and adopted minimum of one or more Integrated Pest Management packages/practices in Karnataka constitute the population of the present research study.

3.2 LOCALE OF THE STUDY

The study was conducted in one each purposively selected taluk of Bangalore Urban and Kolar districts of Karnataka. The district were selected

because of the following reasons :

- 1) Most of the farmers grew at least one of the vegetable crops.
- 2) The area under the vegetables was considerably high in these districts.
- 3) These two districts are nearer to the two important technology generating institutions like University of Agricultural Sciences, Bangalore and Indian institute of Horticultural Research, Hesaraghatta.
- 4) The crops selected for this research are most popular in these districts.

Then, taluks coming under each district were listed. From among these taluks one taluka was selected purposively in consultation with Assistant Director of Horticulture (ADH), Extension Education unit of UAS Bangalore and scientists from IIHR considering the Tomato and Cabbage area under cultivation. Thus, the selected taluks for this study are Malur from Kolar district and Bangalore north from Bangalore urban district.

Malur taluk of Kolar district had an area of 3809 ha under vegetables and Bangalore North of Bangalore Urban district had area under vegetables 1,075 ha.

3.3 SAMPLING PROCEDURE

3.3.1 Selection of villages

Assistant Director of Horticulture of the selected taluks were consulted for selecting villages and they were asked to suggest villages where in the farmers are adopting Integrated Pest Management practices partially or fully. These villages were listed alphabetically. From among the listed villages following villages were selected randomly.

KOLAR DISTRICT

Araleri
Bingipura
Chikkakadatur
Doddakadatur

BANGALORE URBAN DISTRICT

Chellahalli
Haniyuru
Karlapura
Karlapura Pallya

3.3.2 Selection of the respondents

The list of farmers growing tomato and cabbage was prepared village wise. From these, 45 farmers who were either had knowledge or adopted partially or as recommended

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were selected purposively in consultation with local leaders of respective villages. Thus, there were 90 selected farmers constituted the sample for the research study.

3.4 MEASUREMENT OF VARIABLES

3.4.1 Dependent variables used in the study

- 1) Knowledge level
- 2) Adoption level

3.4.2 The independent variables used in the study

- 1) Education
- 2) Land holding
- 3) Mass media use
- 4) Extension contact
- 5) Extension participation
- 6) Innovation proneness
- 7) Scientific orientation

3.4.1 Dependent variables

3.4.1 - 1 Knowledge level

The teacher made test as suggested by Anasthi (1961) was employed to measure the knowledge level of respondents. Based on the Indian Institute of Horticultural Research recommendation a list of knowledge items on Integrated Pest Management practices

was prepared. In consultation with IIHR scientists and experts, 52 items were finally selected for the inclusion in the knowledge test. Each knowledge item was credited with one score. The maximum score that one could obtain was 52.

The knowledge score of each individual was converted into knowledge index using the following formula:

$$\text{Knowledge index} = \frac{\text{Number of correct responses}}{\text{Total number of knowledge items}} \times 100$$

Thus after computing the knowledge index the respondents were grouped into low medium and high categories by taking mean and standard deviation as a measure of check.

<u>Category</u>	<u>Score</u>
High (X + 1/2 S.D)	More than 75.11
Medium(X ± 1/2 S.D)	Between 51.33 and 75.11
Low (X - 1/2 S.D)	Less than 51.33

3.4.1 - 2 Adoption behavior

The procedure followed by Sengupta(1967) for calculation of adoption quotient was utilised to measure the general adoption level of respondents. Accordingly, the following formula was used to calculate the general adoption level :

$$\text{Adoption quotient} = \frac{\text{Adoption score of the respondent}}{\text{Maximum adoption score one could get}} \times 100$$

The partial adoption technique suggested by Supe (1973) and Sinha and Kotte (1974) were followed with necessary modification for scoring the practices followed by respondents.

The Integrated Pest Management practices recommended by Indian Institute of Horticulture Research were used for the study. The scores for each one of the individual practices adopted were arrived at viewing relative importance of the items in consultation with specialist of University of Agricultural Sciences and Indian Institute of Horticultural Research .

<u>Items</u>	<u>Score</u>
Full adoption	2
Partial adoption	1
No adoption	0

Partial adoption was arrived at taking cognizance any deviation from normal recommendation.

Depending upon the total scores obtained by each one of the respondents, they were grouped into

three categories with mean and standard deviation as a measure of check.

<u>Category</u>	<u>Score</u>
High : ($X + 1/2$ S.D)	More than 68.19
Medium : ($X \pm 1/2$ S.D)	Between 43.96 & 68.19
Low : ($X - 1/2$ S.D)	Less than 43.96

3.4.2 Independent variables

3.4.2 - 1 Education

Education is operationally defined as the number of years of formal education acquired by the respondent. This variable was measured by using Trivedi's (1963) scale with some modifications. The scoring pattern is as follows :

Level of education	Score
1) Illiterate	0
2) Can read and write	1
3) Primary school	2
4) Middle school	3
5) High school	4
6) PUC	5
7) Degree	6
8) Post graduation	7

The mean of educational scores of all the

respondents were computed and respondents were grouped into low, medium and high categories keeping mean and standard deviation as check as indicated below :

<u>Category</u>	<u>Score</u>
High : ($X + 1/2 S.D$)	Above 4.01
Medium: ($X \pm 1/2 S.D$)	2.5 to 4.01
Low : ($X - 1/2 S.D$)	Below 2.5

3.4.2 - 2 Size of holding

The respondents were asked to indicate the extent of land holding possessed by them with respect to wet land, garden land and dry land. Each type of holding was converted into a common denomination of standard acre by following the procedure of Karnataka Land reforms Act 38 of 1966. According to the Act one acre of garden land or wet land is equal to three acres of dry land.

The respondents were grouped into three categories as per the criteria used by small Farmers Development Agency, Bangalore and they are as follows :

Category	No. of standard acres
Small farmers	Less than 5 acres
Medium farmers	5 to 10 acres
Big farmers	Above 10 acres

3.4.2 - 3 Mass media use

In order to assess the extent of use of various mass media by the respondents, different mass media were listed and the respondents were asked to indicate as to how often they used each of these mass media. The procedure used by Trivedi (1963) was adopted for measuring mass media use of the respondents.

Sl. no.	Source	Extent of use		
		Regular	Occasional	Never
1.	Reading Newspaper	2	1	0
2.	Listening to agricultural programme in radio	2	1	0
3.	Reading Farm Magazine	2	1	0
4.	Watching agricultural programs in Television	2	1	0

Thus the maximum score one could get was 8, minimum being zero.

Based on the score obtained, the respondents were grouped into three categories using mean and standard deviation.

<u>Category</u>	<u>Score</u>
High : ($X + 1/2 S.D$)	Above 4.94
Medium : ($X \pm 1/2 S.D$)	2.95 to 4.94
Low : ($X - 1/2 S.D$)	Below 2.95

3.4.2 - 4 Extension contact

This variable was measured by using procedure followed by Byra Reddy (1971) with slight modifications.

Number of contacts by the respondent with extension workers was considered to measure the degree of contact with the extension agency by the respondent. The scores assigned were listed as follows :

Extension workers	Once in a week	Once in 15 days	Once in a month	Never
1. Agricultural Assistant	3	2	1	0
2. Asst. Agriculture Officer	3	2	1	0
3. Asst. Dir. of Agriculture	3	2	1	0
4. Extension guide	3	2	1	0
5. Asst. Horticulture Officer	3	2	1	0
6. Asst. Dir. of Horticulture	3	2	1	0
7. University Staff/Researcher	3	2	1	0

The maximum score that one could get was 21 and the minimum being zero.

Based on the scores obtained, the respondents were grouped into three categories using mean and standard deviation.

<u>Category</u>	<u>Score</u>
High : ($X + 1/2$ S.D)	Above 2.72
Medium: ($X \pm 1/2$ S.D)	1.21 to 2.72
Low : ($X - 1/2$ S.D)	Below 1.21

3.4.2 - 5 Extension participation

This variable was quantified by following the procedure given by Ravikumar (1979), with slight modification. A list of extension activities were prepared and the respondents were asked to indicate their extent of participation in each one of them. The scoring procedure followed as follows :

Extension activities	Regular	Occasional	Never
1. Training Program	2	1	0
2. Group meeting/Discussions	2	1	0
3. Exhibition/Krishimela	2	1	0
4. Demonstration	2	1	0
5. Field days	2	1	0
6. Field visit/tour	2	1	0

Thus the maximum score one could get was 12 and

the minimum being zero.

Based on the scores obtained the respondents were grouped into three categories using mean and standard deviation as a measure of check.

<u>Category</u>	<u>Score</u>
High : ($X + 1/2$ S.D)	Above 3.05
Medium: ($X \pm 1/2$ S.D)	1.55 to 3.05
Low : ($X - 1/2$ S.D)	Below 1.55

3.4.2 - 6 Innovation proneness

This is defined as a socio-psychological orientation of an individual to get linked or closely associated with change, adoption and innovative ideas and practices.

Prasad (1983) has used innovation proneness scale developed by Feaster (1968) with slight modification in the scoring pattern to measure innovation of rice growing farmers. The same procedure was followed in the present investigation to know the innovation proneness of vegetables growers practicing IPM .

In this scale 8 statements were included with three response categories as 'Yes', 'Undecided' and 'No'. For the first four statements, a score of two was assigned to 'Yes' response, a score of one for Undecided and zero for No response. The scoring procedure was reversed in

the case of last four statements. The summation of the scores obtained by the respondents for all the statements indicated his innovation proneness score. The total score ranged from 0 to 16.

Statements	Yes	No	Undecided
a) Do you want to learn new ways of farming	2	0	1
b) If Agriculture extension worker gives a talk on improved cultivation aspect would you attend	2	0	1
c) If Government would help you to establish a farm else where would you move	2	0	1
d) Do you want a change in your way of life	2	0	1
e) A farmers should try to farm the way his parents did	0	2	1
f) Do you want your sons to be farmers	0	2	1
g) It is better to enjoy today and let tomorrow take care of itself	0	2	1
h) A mans future is in the hands of god	0	2	1

The maximum score one could get was 16 and minimum was zero.

Based on the scores obtained, the respondents were grouped into three categories using mean and standard

deviation.

<u>Category</u>	<u>Score</u>
High : ($X + 1/2 \text{ S.D}$)	Above 14.04
Medium: ($X \pm 1/2 \text{ S.D}$)	11.51 to 14.04
Low : ($X - 1/2 \text{ S.D}$)	Below 11.51

3.4.2 - 7 Scientific orientation

This is defined as a degree to which a vegetable grower following IPM practices as a use of the scientific method.

This variable was quantified by using scientific orientation scale developed by of Supe (1967) with slight modifications. Five statements were included for the present study with three response categories as Agree, Undecided and disagree. For each statement, a score 2 was assigned to 'agree', a score 1 for 'undecided' and 0 for 'disagree' response. The summation of scores obtained by farmers practicing IPM for all five statements will indicate his scientific orientation. The total score ranged from 0 to 10.

Statements	Agree	Undecided	Disagree
a) New methods like IPM give better results than older ones	2	1	0
b) Even a farmer with lot of experience should use new technologies like IPM	2	1	0

Cont....

Statements	Agree	Undecided	Disagree
c) Tough it takes time for a farmer to learn new methodology in the management it is worth the efforts	2	1	0
d) A good farmer experiments with new ideas of farming	2	1	0
e) Traditional methods of farming has to be changed in order to raise the levels of living of farmers	2	1	0

The maximum score that one could get was 10 and minimum being 0.

Based on the scores obtained the respondents were grouped into three categories using mean and standard deviation.

<u>Category</u>	<u>Score</u>
High : ($X + 1/2$ S.D)	Above 9.43
Medium: ($X \pm 1/2$ S.D)	7.43 to 9.43
Low : ($X - 1/2$ S.D)	Below 7.43

3.5 CONSTRAINTS IN ADOPTION OF IPM PRACTICES

To identify the probable constraints in adoption of IPM practices by vegetable growers, the farmers were asked to indicate their opinions as 'Yes' or 'No' against

twenty one probable and common constraints identified in the adoption of such practices . There individual responses are expressed in terms of percentages.

3.6 INSTRUMENT FOR DATA COLLECTION

The information was elicited from the respondents with the help of structured pretested schedule. After locating ambiguity necessary corrections were made in the interview schedule and the final schedule was prepared. A copy of the interview schedule is furnished in Appendix - I.

Data collection was made during October 1995 by personally interviewing the respondents.

3.7 STATISTICAL METHODS EMPLOYED

- 1). Frequency and per centages were used to explain the different socio-psychological characteristics of vegetable growers. Besides mean and standard deviation was computed to categorise the respondents based on some of the socio-psychological characteristics of vegetable growers.
- 2). The correlation coefficients were computed between knowledge, adoption and other socio-psychological characteristics of vegetable growers.
- 3). Multiple regression analysis was also utilised to identify the extent of contribution of independent

variables on the variation in the dependent
variables under consideration.

RESULTS

CHAPTER IV

RESULTS

The findings of the investigation have been presented under the following headings :

- 4.1 Overall Knowledge level of vegetable growers with respect to Integrated Pest Management practices
 - 4.2 Adoption behaviour of vegetables growers with respect to Integrated Pest Management practices.
 - 4.3 Relationship between socio psychological characteristics of vegetable growers and their knowledge level.
 - 4.4 Relationship between selected socio-psychological characteristics of vegetable growers and adoption behaviour.
 - 4.5 Profile of vegetable growers.
 - 4.6 Constraints in adoption of Integrated Pest Management technologies.
 - 4.7 Documentation of indigenous plant protection measures.
- 4.1 **OVERALL KNOWLEDGE LEVEL OF VEGETABLE GROWERS WITH RESPECT TO INTEGRATED PEST MANAGEMENT PRACTICES**

The data in Table I reveals that 31 per cent of

Table I

Overall knowledge level of vegetable growers with respect to
Integrated Pest Management.

(n = 90)

Sl. No.	Knowledge level	No.	Percent
1.	Low	22	24.44
2.	Medium	40	44.44
3.	High	28	31.11

$\bar{X} = 63.22$

SD = 23.78

vegetable growers had higher level of knowledge with respect to Integrated Pest Management practices. Nearly 44 per cent of farmers had medium level of knowledge and only 24 per cent of the farmers had low knowledge level with respect to Integrated Pest Management practices.

4.1.1 Component wise knowledge level of vegetable growers with respect to IPM practices on cabbage crop

The component wise knowledge level of vegetable growers about the Integrated Pest Management practices on cabbage crop are presented in Table II.

It is evident from the table, that more than 58 per cent of farmers have medium knowledge about cultural package of IPM to be used in the cultivation of cabbage crop upto 31 per cent possessed higher knowledge of the same package, and only 10 per cent of the farmers had low knowledge of cultural control Measures. With regard to mechanical control of IPM, more than 95 per cent respondents had higher knowledge while only few (4 per cent) farmers had low knowledge. Majority of the respondents (94 per cent) knew about insecticides of plant origin. With respect to chemical control measures 47 per cent of vegetable growers had medium level of knowledge and 31 per cent of the respondent farmers had low level of knowledge about chemical control measures, while only 21 per cent

Table II

Component wise knowledge level of vegetable growers with respect
to IPM practices on cabbage crop

(n = 90)

Sl. No.	Components	Low		Medium		High	
		No.	%	No.	%	No.	%
1.	Cultural control	9	10.00	53	58.88	28	31.11
2.	Mechanical control	4	4.44	0	0.00	86	95.55
3.	Insecticide of plant origin	1	1.11	4	4.11	85	94.44
4.	Chemical control	28	31.11	43	47.77	19	21.11
	\bar{X}						
	SD						
1.	63.12			29.52			
2.	95.00			2.00			
3.	96.7			13.78			
4.	64.23			28.51			

of the respondents had high knowledge about the same.

4.1.2 Component wise knowledge level of Vegetable growers with respect to IPM practices on tomato crop

It is apprent from the table III that 50 per cent of vegetable growers had medium level of knowledge, more than 33 per cent had high level of knowledge and only 16 per cent of the farmers had low level of knowledge about cultural measures on tomato crop.

It is evident from the table that majority of the farmers (64 per cent) had low level of knowledge, more than 30 per cent of the farmers had high level of knowledge and 44 per cent of the farmers had medium level of knowledge about biological control measures.

With respect to chemical control measures, a little over 50 per cent of the farmers had medium level of knowledge, 30 per cent of the farmers had higher knowledge and only 10 per cent of the respondents possessed low knowledge.

4.1.3 Specific Knowledge of vegetable growers with respect to cabbage IPM practices

The perusal of Table IV and V depicts specific knowledge level of farmers about Integrated Pest Management

Table III

**Component wise knowledge level of vegetable growers with
respect to IPM practices on tomato crop**

(n = 90)

Sl.No.	Components	Low		Medium		High	
		No.	%	No.	%	No.	%
1)	Cultural control	15	16.66	45	50.00	30	33.33
2)	Biological control	58	64.44	4	4.44	28	31.11
3)	Chemical control	9	10.00	54	60.00	27	30.00

	\bar{X}	SD
1.	56.04	33.67
2.	21.97	33.73
3.	73.82	28.77

practices on cabbage crop. They reveal that cent per cent of the farmers had knowledge about summer deep ploughing as a cultural control measure. A great majority of vegetable growers (90 per cent) possessed the correct knowledge on identification of major pests, intra row spacing of cabbage and tomato and age of cabbage and tomato seedlings while transplanting. More than 85 per cent of the vegetable growers could identify minor pests on crop and had knowledge of covering nursery with nylon mesh. 41 per cent of the farmers had knowledge of growing marigold as a trap crop in tomato crop. More than 30 per cent of the vegetable growers had correct knowledge of growing mustard as a trap crop in cabbage, time of sowing of mustard in cabbage, simultaneous planting of tomato and marigold, row proportion of cabbage and mustard, row proportion of tomato and marigold, intra row spacing of tomato and marigold and intra row spacing of cabbage and mustard.

With regard to mechanical control measures, majority of the farmers (89 per cent) did know about the hand picking of larva from cabbage crop. More than 90 per cent of the vegetable growers possessed knowledge of Neem seed kernel extract which was considered as insecticide of plant origin and procedure of preparation of Neem seed kernel extract. Further, majority of the respondents (90 per cent) had knowledge on concentration of Neem seed kernel extract and frequency of spraying Neem seed kernel extract on cabbage crop.

Table IV

Specific knowledge of vegetable growers with respect to cabbage

IPM practices

(n=90)

Sl. No.	Practices	Cabbage growers No.	%
I Cultural control			
1)	Identification of pests		
	a) Major pest	81	90.00
	b) Minor pest	77	85.55
2)	Growing mustard as trap crop	29	32.22
3)	Time of sowing of mustard	28	31.11
4)	Row proportion of cabbage and mustard	28	31.11
5)	Inter row spacing between mustard and cabbage	28	31.11
6)	Intra row spacing of cabbage	81	90.00
7)	Intra row spacing of mustard	27	30.00
8)	Age of cabbage seedling while transplantation	81	90.00
9)	Critical stage for protecting the crop from pest	81	90.00
10)	Summer deep ploughing	90	100.00
II Mechanical control			
1)	Hand picking of larva	80	88.88
III Insecticide of plant origin			
1)	Knowledge about Neem seed Kernel extract	85	94.44
2)	Preparation of Neem seed Kernel extract	82	91.11

Cont.....

Cont.....Table IV

Sl. No.	Practices	Cabbage growers No.	%
3)	Concentration of Neem seed Kernel extract	72	80.00
4)	Frequency of spraying Neem seed extract	74	82.22
IV Chemical control			
1)	Name of the insecticide sprayed to control major pest	81	90.00
2)	Concentration of pesticide	81	90.00
3)	Name of the insecticide used to control minor pest	81	90.00
4)	Concentration of pesticide	81	90.00
5)	Addition of sticker/spreader	71	78.88
6)	Concentration used	71	78.88
7)	Time interval between sprays	79	87.77
8)	Name of insecticide used on mustard	27	30.00
9)	Concentration used	27	30.00
10)	Fungicide used to control white rust on mustard	22	24.44
11)	Concentration	22	24.44

Table V

Specific knowledge of vegetable growers with respect to Tomato
IPM practices

(n = 90)

Sl. No.	Practices	Tomato growers No.	%
I	Cultural control		
1)	Identification of pests		
	a) Major pests	81	90.00
	b) Minor pests	80	88.88
2)	Covering nursery with nylon mesh	77	85.55
3)	Growing marigold as a trap crop	37	41.11
4)	Row preparation of Marigold and tomato	31	34.44
5)	Inter row spacing between marigold and tomato	29	32.22
6)	Intra row spacing of tomato	81	90.00
7)	Intra row spacing of marigold	29	32.22
8)	Age of seedlings while transplantation		
	a) Tomato	81	90.00
	b) Marigold	31	34.44
9)	Simultaneous planting	29	32.22
II	Biological control		
1)	Use of NPV	31	34.44

Cont.....

Cont....Table V

Sl. No.	Practices	Tomato growers	
		No.	%
2)	Concentration of NPV	10	11.11
3)	Name of sticker used in NPV	28	31.11
4)	Concentration of sticker used	10	11.11
III Chemical control			
1)	Insecticide used to control white fly in nursery	79	87.77
2)	Concentration	79	87.77
3)	Insecticide used to control fruit boner	81	90.00
4)	Concentration used	81	90.00
5)	Name of the sticker used	66	73.33
6)	Concentration	59	65.55
7)	Insecticide used on marigold	27	30.00
8)	Concentration	26	28.88
9)	Time interval between sprays	81	90.00

More than 30 per cent of the farmers had knowledge of use of NPV as a bio control measure and the sticker to be used in NPV, While 11 per cent of the farmers knew the concentration of NPV to be sprayed and the concentration of the stickers/spreader to be used in NPV on tomato crop.

In case of chemical control measures, a great majority of the vegetable growers (88 per cent) had knowledge of insecticide name to be used against the major and minor pests, concentration of the pesticide to be used, time interval between sprays on both the crops and the insecticide to be used to control white fly in tomato nursery and its concentration. 78 per cent of the farmers knew about the addition of sticker/spreader and its concentration to be used for cabbage crop, while more than 65 per cent of the farmers had knowledge of sticker/spreader to be used and its concentration for tomato crop. More than 28 per cent of the vegetable growers had knowledge of name and concentration of insecticide to be used against the trap crops. Small percentage of farmers (24 per cent) knew about fungicide to be used to control white rust on mustard and its concentration also.

4.2 OVERALL ADOPTION BEHAVIOUR OF VEGETABLE GROWERS

Table VI presents the overall adoption behaviour

Table VI

Overall adoption behaviour of vegetable growers with respect to

Integrated Pest Management

(n = 90)

Sl. No.	Adoption bahaviour	No.	%
1.	Low	20	22.22
2.	Medium	43	47.77
3.	High	27	30.00

$\bar{X} = 56.08$ $SD = 24.23$

of vegetable growers with respect to Integrated Pest Management practices. Data in the table heralds that nearly 48 per cent of vegetables growers are medium adopters, 30 per cent of the respondents are high adopters and only 22 per cent of the respondents are low adopters of Integrated Pest Management practices.

4.2.1 Component wise adoption level of vegetable growers with respect to IPM practices on cabbage crop

The distribution of farmers with respect to extent of adoption of specific cabbage IPM practices is presented in table VII. An examination of table reveals that 49 per cent of the respondents come under medium adoption category, while 31 per cent of the farmers come under high adopter category but only 20 per cent of farmers come under low adopter category of cultural control methods on cabbage crop. More than 50 per cent farmers (64 per cent) were high adopters of mechanical pest control packages. Insecticides of plant origin, Neem seed kernel extract, was adopted by 59 per cent of farmers, while 29 per cent of farmers were low adopters but 12 per cent of vegetable growers were medium adopters.

Table VII

Component wise adoption level of vegetable growers with respect to IPM practices on cabbage crop

(n = 90)

Sl. No.	Components	Low		Medium		High	
		No.	%	No.	%	No.	%
1)	Cultural control	18	20.00	44	48.88	28	31.11
2)	Mechanical control	32	35.55	0	0.00	58	64.44
3)	Insecticide of plant origin	26	28.88	11	12.22	53	58.88
4)	Chemical control	18	20.00	46	51.11	26	28.88

	\bar{X}	SD
1.	52.86	32.74
2.	19.50	34.67
3.	54.44	26.75
4.	50.09	27.93

4.2.2 Component wise adoption level of vegetable growers with respect to IPM practices on tomato crop

Table VIII reveals the extent of adoption of tomato IPM practices by vegetable growers. It is evident from the table that 40 per cent of farmers come under low adopter category of cultural control methods on tomato crop, where as 31 per cent of vegetables growers were high adopters of cultural control methods. However only 29 per cent of respondents were medium adopters, the large majority of the farmers (74 per cent) were non adopters of biological control packages, but 26 per cent of the farmers lie under high adopter category. With respect to chemical control measures, 46 per cent of farmers belonged to medium adopter category, 30 per cent of the respondents lie under high adopter category but only 13 per cent of farmers belonged to low adopter category.

4.2.3 Extent of adoption of cabbage IPM practices by vegetable growers

An examination of Table IX and X projects the extent of adoption of integrated pest management practices by vegetable growers. It is seen from the table that cent per cent of the farmers adopted summer deep ploughing as a measure of cultural packages. More than 83 per cent of vegetables growers had adopted intra row spacing of cabbage

Table VIII

Component wise adoption level of vegetable growers with respect to IPM practices on tomato crop

(n = 90)

Sl. No.	Components	Low		Medium		High	
		No.	%	No.	%	No.	%
1)	Cultural control	36	40.00	26	28.88	28	31.11
2)	Biological control	00	00.00	0	00.00	23	25.55
3)	Chemical control	12	13.33	41	45.55	27	30.00

	\bar{X}	SD
1)	52.86	32.74
2)	19.50	34.67
3)	58.44	26.75

and tomato, transplanted the appropriate aged seedlings of tomato and cabbage and had taken up plant protection measures at critical stages. More than 65 per cent of the farmers had not adopted cultural control measures such as growing mustard crop in cabbage and marigold in tomato as trap crops, appropriate time of transplanting of cabbage crop and marigold, row proportion of mustard and cabbage and tomato and marigold, inter row spacing between 'mustard and cabbage' and 'tomato and marigold', intra row spacing of mustard and marigold and simultaneous planting of marigold with tomato.

Majority of the vegetables growers (79 per cent) fully adopted mechanical control measures and hand picking of larva.

It is evident from the table that 87 per cent of the farmers adopted the spraying of Neem seed kernel extract as an insecticide of plant origin for cabbage crop. More than 63 per cent of the respondents used the Neem seed kernel extract with correct concentration on cabbage to control diamond black moth, stem borer and gram caterpillar.

Further, the table also clearly indicates that more than 85 percent of the vegetables growers adopted appropriate insecticide to control major and minor pests and its concentration and also maintained time interval between sprays. More than 75 per cent of the farmers adopted the practice of addition of sticker/spreader to the insecticide

Table IX
Extent of adoption of cabbage IPM practices by vegetable growers

Sl. No.	Practices	Cabbage growers		
		FA	PA	NA
I Cultural control				
1)	Growing mustard as a trap crop	28 (31.11)	-	62 (68.88)
2)	Time of sowing of mustard			
	a) First sowing	28 (31.11)	-	62 (68.88)
	b) Second sowing	18 (20.00)	8 (08.88)	64 (71.11)
3)	Row proportion of cabbage and mustard	27 (30.00)	1 (01.11)	62 (68.88)
4)	Inter row spacing between cabbage and mustard	29 (32.22)	-	61 (67.77)
5)	Intra row spacing of cabbage	76 (84.44)	3 (03.33)	11 (12.22)
6)	Inter row spacing of mustard	26 (28.88)	3 (03.33)	61 (67.77)
7)	Age of cabbage seedlings while transplantation	75 (83.33)	1 (01.11)	14 (15.55)
8)	Critical stage for protecting the crop from pest	79 (87.77)	1 (01.11)	10 (11.11)
9)	Summer deep ploughing	90 (100.00)	-	-
II Mechanical control				
1)	Hand picking of larva	71 (78.85)	8 (08.88)	11 (12.22)
III Insecticide of plant origin				
1)	Preparation of Neem seed Kernel extract	57 (63.33)	26 (28.88)	7 (07.77)

Cont....

Cont.... Table IX

Sl. No.	Practices	Cabbage growers		
		FA	PA	NA
2)	Concentration of NSKE	57 (63.33)	26 (28.88)	7 (07.77)
3)	Frequency of spraying NSKE	78 (86.66)	7 (07.77)	5 (05.55)
IV Chemical control				
1)	Appropriate insecticide to control major pest	80 (88.88)	1 (01.11)	9 (10.00)
2)	Concentration of insecticide	77 (85.55)	2 (02.22)	11 (12.22)
3)	Appropriate pesticide to control minor pest	80 (88.88)	1 (01.11)	9 (20.00)
4)	Concentration of insecticide	78 (86.66)	3 (3.33)	9 (10.00)
5)	Addition of sticker/spreader	71 (78.88)	-	19 (21.11)
6)	Concentration used	68 (75.55)	3 (03.33)	19 (21.11)
7)	Time interval between sprays	79 (87.77)	2 (02.22)	9 (10.00)
8)	Appropriate insecticide used on mustard	27 (30.00)	-	63 (70.00)
9)	Concentration used	27 (30.00)	-	63 (70.00)
10)	Appropriate fungicide used to control disease on mustard	23 (25.55)	-	67 (74.44)
11)	Concentration	21 (23.33)	-	69 (76.66)

Table X

Extent of adoption of tomato IPM practices by vegetable growers
(n = 90)

Sl. No.	Practices	Tomato growers		
		FA	PA	NA
I Cultural control				
1)	Covering nursery with nylon mesh	47 (52.22)	4 (04.44)	39 (43.33)
2)	Growing marigold as a trap crop	30 (33.33)	1 (01.11)	59 (65.55)
3)	Row proportion of tomato and marigold	30 (33.33)	-	60 (66.66)
4)	Inter row spacing between marigold and tomato	24 (26.66)	-	66 (73.33)
5)	Intra row spacing of tomato	80 (88.88)	1 (01.11)	9 (10.00)
6)	Intra row spacing of marigold	29 (32.22)	-	61 (67.77)
7)	Age of seedlings while transplantation			
	a) Tomato	78 (86.66)	3 (03.33)	9 (10.00)
	b) Marigold	29 (32.22)	-	61 (67.77)
8)	Simultaneous planting	30 (33.33)	-	60 (66.66)
II Biological control				
1)	Use of NPV	24 (26.66)	-	66 (73.33)
2)	Concentration	7 (07.77)	11 (12.23)	72 (80.00)

Cont.....

Cont.... Table X

Sl. No.	Practices	Tomato growers		
		FA	PA	NA
3)	Appropriate sticker used in NPV	22 (24.44)	-	68 (75.55)
4)	Concentration	20 (22.22)	2 (02.22)	68 (75.55)
III Chemical control				
1)	Appropriate insecticide used to control white fly in nursery	78 (86.66)	1 (01.11)	11 (12.22)
2)	Concentration	74 (82.22)	-	16 (17.77)
3)	Appropriate insecticide used to control Fruit borer	81 (90.00)	-	9 (10.00)
4)	Concentration	77 (85.55)	4 (04.44)	9 (10.00)
5)	Appropriate sticker used	62 (68.88)	-	28 (31.11)
6)	Concentration	49 (54.44)	13 (14.44)	28 (31.11)
7)	Appropriate sticker used on marigold	27 (30.00)	-	63 (70.00)
8)	Concentration	24 (26.66)	2 (02.22)	66 (73.33)
9)	Time interval between sprays	80 (88.88)	5 (05.55)	5 (05.55)

before spraying and used the correct concentration on cabbage crop. While 68 per cent of tomato growers adopted the addition of sticker/spreader and 54 per cent of farmers fully adopted correct concentration of sticker/spreader. The data also indicates that more than 70 per cent of farmers did not adopt practices like chemical control measures on trap crops, application of fungicide with correct concentration on mustard crop.

4.3 RELATIONSHIP BETWEEN THE SOCIO-PYCHOLOGICAL CHARACTERISTICS OF VEGETABLE GROWERS AND THEIR OVERALL KNOWLEDGE LEVEL OF IPM PRACTICES

Correlation analysis between socio-psychological characteristics of vegetable growers and their knowledge level was done and results are presented in table XI.

Among the seven selected, three socio-psychological characteristics namely land holding, extension participation and innovative proneness were positively and significantly related to knowledge level of vegetable growers. However other characters were non significantly associated to knowledge level of farmers.

Multiple regression analysis was also carried out, which revealed the relative importance of different independent variables on knowledge level of vegetable growers. The results of this analysis are presented in table XII. The data reveals that all the seven variables fitted

Table XI

Relationship between selected socio-psychological characteristics of vegetable growers and their overall knowledge level of IPM practices

(n = 90)

Sl. No.	Socio-psychological characteristics	'r' value	't' value
1.	Education	0.1234	1.19
2.	Land holding	0.2367*	2.28
3.	Mass media use	0.2026	1.94
4.	Extension contact	0.1701	1.62
5.	Extension participation	0.5671**	6.46
6.	Innovation proneness	0.2286*	2.20
7.	Scientific orientation	0.2001	1.91

* : Significant at 0.05 level

** : Significant at 0.01 level

together in the regression model explained 11 per cent of variation in the knowledge level of vegetable growers. The calculated 't'values for each of the partial 'b'values are presented in table XII . All of the partial 'b'values are nonsignificant.

4.4 RELATIONSHIP BETWEEN SELECTED SOCIO-PHYCHOLOGICAL CHARACTERISTICS OF VEGETABLE GROWERS AND THEIR OVERALL ADOPTION LEVEL OF IPM PRACTICES

Correlation analysis between socio-psychological characteristics of vegetable growers and their overall adoption level was done and the results presented in table XIII.

The characters like land holding extension participation and innovative proneness were positively and significantly related to adoption level. Where as the other characteristics namely education, mass media use, extension contact and scientific orientation , were positively and nonsignificantly related.

Multiple regression analysis revealed the relative importance of different independent variables on adoption of IPM practices by vegetables growers. The results of the analysis are presented in table XIV. The data reveals that all the seven independent variables fitted in the regression model explained 10 per cent of the variation in

Table XII

Regression analysis of selected socio-psychological characteristics of vegetables growers with their over all knowledge level

(n = 90)

Sl. No.	Socio-psychological characteristics	Knowledge level		R ²
		Regression coefficient	't' value	
1.	Education	-1.0280	-0.75503	
2.	Land holding	0.10406	1.2442	
3.	Mass media use	0.65590	0.72929	
4.	Extension contact	0.42717	0.50595	0.1068
5.	Extension participation	-0.22817	-0.22249	
6.	Innovation proneness	0.65011	1.0611	
7.	Scientific orientation	0.70903	0.91684	

the adoption level of vegetable growers. The calculated 't' value for each of the partial 'b' values are presented in table XIV and revealed that none of the variables contributed significantly to the adoption behaviour of IPM by the farmers.

4.4.1 Relationship between selected socio-psychological characteristics of cabbage growers and their knowledge level and adoption behaviour of IPM practices

Mass media use, extension participation, innovation proneness and scientific orientation of farmers were significantly related to their knowledge level of cabbage IPM practices. Other characteristics namely education, land holding and extension contact were positively and non significantly related.

Land holding and extension participation are positively and significantly related to their adoption of cabbage IPM practices. However the other characteristics namely education, mass media use, extension contact, innovation proneness and scientific orientation are not related to their adoption level. (Table XV).

Regression analysis of knowledge and adoption level of cabbage IPM practices with the socio-psychological characteristics of vegetable growers are presented in table XVI.

Table XIII

Relationship between selected socio-psychological characteristics of vegetable growers and their overall adoption level

(n = 90)

Sl. No.	Socio psychological characteristics	'r' Value	't' Value
1.	Education	0.1215	1.148
2.	Land holding	0.2059*	1.98
3.	Mass media use	0.1994	1.41
4.	Extension contact	0.1474	1.39
5.	Extension participation	0.6519**	8.06
6.	Innovation proneness	0.2453*	2.37
7.	Scientific orientation	0.1978	1.89

* : Significant at 0.05 level

** : Significant at 0.01 level

Table XIV

Regression analysis of overall adoption level of vegetable growers with their socio-psychological characteristics

(n = 90)

Sl. No.	Characteristics	Regression coefficient	't' value	R ²
1.	Education	-2.3125	-0.285592	
2.	Land holding	0.15589	0.93781	
3.	Mass media use	1.3352	0.74814	
4.	Extension contact	0.61598	0.36766	0.1004
5.	Extension participation	0.10389	0.51050	
6.	Innovation proneness	1.5929	1.3102	
7.	Scientific orientation	1.3741	0.89542	

Multiple regression analysis revealed that all the seven independent variables fitted in the variable model explained 11 per cent of the variation in the knowledge level of vegetable growers. The calculated 't' for each of the 'b' values shows that all the variables except education are positively related but the relationship was nonsignificant.

With respect to adoption behaviour multiple regression analysis indicated that all the seven independent variables fitted in the regression model explained only 6 percent of the variation in their adoption level. The calculated 't' values for each of the partial 'b' values calculated for the variable showed positive and nonsignificant relationship except education and extension participation (Table XVI).

4.4.2 Relationship between selected socio-psychological characteristics of tomato growers with their knowledge level and adoption behaviour of IPM practices

The characteristics like landholding, mass media use, innovation proneness and scientific orientation of tomato growing farmers were positively and significantly related with their knowledge level whereas, education, extension contact and extension participation were not related.

Table XV

Relationship between selected socio-psychological characteristics of cabbage growers and their knowledge level and adoption behaviour of IPM practices

(n = 90)

Sl. No.	Characteristics	Knowledge		Adoption	
		'r'value	't'value	'r'value	't'value
1.	Education	0.14177	1.343	0.11383	1.075
2.	Land holding	0.20471	1.962	0.21935*	2.198
3.	Mass media use	0.22799*	2.196	0.14760	1.399
4.	Extension contact	0.17826	1.699	0.11600	1.095
5.	Extension participation	0.86655**	16.286	0.59154**	6.882
6.	Innovation proneness	0.22375*	2.153	0.16416	1.561
7.	Scientific orientation	0.22938*	2.210	0.11866	1.121

* : Significant at 0.05 level

** : Significant at 0.01 level

Table XVI

Regression analysis of knowledge and adoption level of cabbage IPM practices with the socio-psychological characteristics of vegetable growers
(n = 90)

Sl. No.	Characteristics	Knowledge			Adoption		
		Regression coefficient	't' value	R ²	Regression coefficient	't' value	R ²
1.	Education	-0.78589	-0.92161		-0.78343	-0.19488	
2.	Land holding	0.14324	0.82423		0.72597	1.4291	
3.	Mass media use	0.57363	1.0184		0.17124	0.31396	
4.	Extension contact	0.25937	0.49049	0.1077	0.15794	0.11317	0.0624
5.	Extension participation	0.14456	0.16937		-0.19631	-0.15486	
6.	Innovation proneness	0.34978	0.91152		0.24083	0.64816	
7.	Scientific orientation	0.58130	1.2001		0.11298	0.24089	

Extension participation was significantly related to adoption behaviour of vegetable growers whereas, other variables were related positively and significantly (Table XVII).

Regression analysis of knowledge and adoption levels of tomato IPM practices with vegetables grower's socio psychological characteristics is presented in table XVIII.

Multiple regression analysis revealed that the seven variables fitted in the variable model explained 12 per cent of the variation in knowledge level of tomato growing farmers. The calculated 't' value for each of the partial 'b' values indicated that all the variables have positive relationship except education and extension participation.

According to 't' test criterion, these variables had contributed least for variation in the adoption behaviour (4 per cent) level of vegetable growers. (Table XVIII)

4.5 PROFILE OF VEGETABLE GROWERS

An examination of table XIX projects the profile of vegetable growers comprising of different personal and socio-psychological characteristics. This projection is only an attempt to document the background of the

Table XVII

Relationship between selected socio-psychological characteristics of tomato growers with their knowledge and adoption of IPM practices

(n = 90)

Sl. No.	Characteristics	Knowledge		Adoption	
		'r'value	't'value	'r'value	't'value
1.	Education	0.15890	1.509	0.19139	1.829
2.	Land holding	0.21088*	2.023	0.16819	1.600
3.	Mass media use	0.24077*	2.327	0.13294	1.258
4.	Extension contact	0.14908	1.414	0.11488	1.085
5.	Extension participation	0.11234	1.060	0.41568**	4.087
6.	Innovation proneness	0.25859*	2.511	0.16746	1.593
7.	Scientific orientation	0.25066*	2.429	0.19896	0.904

* : Significant at 0.05 level

** : Significant at 0.01 level

Table XVIII

Regression analysis of knowledge and adoption levels of tomato IPM practices with vegetable growers socio-psychological characteristics
(n = 90)

Sl. No.	Characteristics	Knowledge		Adoption		
		Regression coefficient	't' value	Regression coefficient	't' value	R ²
1.	Education	-1.6821	-1.0275	-0.36167	-0.23221	
2.	Land holding	0.19099	0.90338	0.18423	0.87905	
3.	Mass media use	1.1669	1.0791	0.31426	0.30546	
4.	Extension contact	0.14216	0.14529	0.39355	0.40747	0.0482
5.	Extension participation	0.50947	0.4131	-0.20958	-0.17864	
6.	Innovation proneness	0.84549	0.1477	0.64978	0.92711	
7.	Scientific orientation	1.2669	1.3624	0.83062	0.19389	

respondents which facilitates to understand and interpret the behaviour of vegetable growers with regard to their knowledge level and adoption behaviour of IPM practices.

Education

A majority of the respondent vegetable growers (60 per cent) have studied upto high school level. Very few percentage of respondents have studied behind high school level i.e., 14 per cent of the farmers have completed college education.

Size of holding

Only 24 per cent of the respondents were big farmers with land holdings of more than ten standard acres. Majority of the respondents were possessing land holding ranging from 5 to 10 standard acres (50 per cent) and the rest of the respondent farmers had less than 5 standard acres.

Mass media use

Majority of the vegetable growers belonged to medium mass media use category (38 per cent) followed by 36 per cent of farmers who belonged to high mass media use category while rest of the farmers belonged to low category.

Table XIX

Profile of vegetable growers following IPM practices

(n = 90)

Sl. No.	Characteristics	Category	No.	%
1.	Education	low	23	25.55
		Medium	54	60.00
		High	13	14.44
2.	Land holding	Small	23	25.55
		Medium	45	50.00
		Big	22	24.44
3.	Mass media use	Low	24	26.66
		Medium	34	37.77
		High	32	35.55
4.	Extension contact	Low	35	38.88
		Medium	32	35.55
		High	23	25.55
5.	Extension participation	Low	13	14.44
		Medium	66	73.33
		High	11	12.22
6.	Innovation proneness	Low	31	35.00
		Medium	32	35.00
		High	27	30.00
7.	Scientific orientation	Low	28	31.11
		Medium	25	27.77
		High	37	42.22

Extension contact

Nearly 39 per cent of the farmers had low extension contact and 36 per cent of the farmers had medium level of extension contact and rest had high extension contact.

Extension participation

A great majority of farmers had medium (73 per cent) extension participation while 15 per cent of farmers had low extension participation. only 12 per cent farmers had high extension participation.

Innovation proneness

Equal per centage of vegetable farmers are distributed in the low and medium innovation proneness category (36 per cent). While 30 per cent farmers were distributed in the high innovation proneness category.

Scientific orientation

A majority of vegetable growers had high (42 per cent) scientific orientation followed by 31 per cent of farmers having low scientific orientation, while 27 per cent of farmers had medium scientific orientation.

The classification of vegetable growers who were

following IPM practices are classified based on socio-psychological characteristics and the profile has come out with very interesting findings. A little over 50 per cent of the vegetable growers who were following IPM practices are possessing higher scientific orientation and medium size of land holding (5 to 10 acres). The participation in the extension activities was not encouraging as indicated in table XIX (73 per cent of the farmers). A little over 50 per cent of the vegetable growers (76 per cent) were studied upto high school. Further the vegetable grower's mass media use was satisfactory.

4.6 CONSTRAINTS IN ADOPTION OF INTEGRATED PEST MANAGEMENT PRACTICES BY VEGETABLE GROWERS

Constraints in adoption of integrated pest management practices by vegetable growers is presented in table XX. Among the different constraints, cent percent of farmers were ignorant about whom to consult if the pesticide doesn't kill the pest, and the manufacturer or seller is not ready to make up the loss incurred by the farmers if the insecticide fails to control the pest. Majority of the respondents (99 per cent) indicated that there is difficulty in using pheromone traps. Most of the farmers had not approached the consumer court (98 per cent) to make up their loss due to failure of pesticide to kill the pest. 90 per cent of the farmers found difficulty in using NPV as biological control measure.

Table XX

Constraints in adoption of IPM practices by vegetable growers

(n = 90)

Sl. No.	Constraints	No.	%
1.	Whom to approach if the insecticide doesn't kill the pest	90	100.00
2.	Seller/manf. Co. make up the loss	90	100.00
3.	Difficulty in using pheromone traps	89	98.88
4.	Difficulty in using NPV	81	90.00
5.	Difficulty in getting pheromone traps/NPV	80	88.88
6.	Awareness about consumer court	78	86.66
7.	Awareness about banned detrimental chemicals	66	73.33
8.	Difficulty in using mask	60	66.66
9.	Awareness about quality control	55	61.66
10.	Identification of mistakes in using IPM technology	25	27.77
11.	Package of practices doesn't work better in all situations	23	25.55
12.	University personnel are giving wrong advice	18	20.00
13.	Biochemical methods failed in field	12	13.33
14.	Observation on expiry date	4	04.44
15.	Use of chemicals after expiry date	4	04.44
16.	Awareness about expiry date	3	03.33

It was observed that majority of the farmers (89 per cent) found difficulty in getting NPV and pheromone traps. It is evident from the table that 87 per cent of vegetable growers were not aware about the existence of consumer court and considerable number of respondents were also not aware (73 per cent) about the banned detrimental agrochemicals. Majority of the farmers (67 per cent) expressed difficulty in using mask before spraying chemicals. Most of the respondents (61 per cent) were not aware about quality control of the product that is sold in the market. Only 28 per cent of the vegetable growers could identify their mistakes in using IPM technology.

It was also observed that vegetable growers felt that package of practices doesn't work better in all the situations (26 per cent).

Further, when farmers were asked to list the constraints as perceived by them, cent per cent of farmers expressed that lack of knowledge of farmers and lack of efforts of extension agency are the major constraints.

4.7 DOCUMENTATION OF INDIGENOUS PLANT PROTECTION MEASURES

The respondents were given an open end question of revoking their memory about the age old plant protection measures which are eco-friendly and effective control measures for most of the pests of the major crops. Some hints were given and sub questions were asked in support of

Table XXI

Documentation of Indigenous Plant protection measures

(n = 90)

Sl. No.	Indigenous PPM	No.	%
1.	Oil cake	7	07.77
2.	Neem seed Kernel extract	90	100.00
3.	Agave extract	43	47.77
4.	Application of ash	32	35.55
5.	Cow urine	40	44.44
6.	Light traps	29	32.22
7.	Panchagavya	4	04.44
8.	Eechalu mullu	3	03.33

the practice and were documented as they expressed

Cent percent of the farmers knew about the Neem leaf extract, Neem oil and Neem seed kernel extract. Apart from the utilization of Neem in agriculture they also made an attempt to explain the use of Neem in maintaining good health of human beings. Majority of the vegetable growers (48 per cent) were able to memorise the importance of 'Agave extract' in controlling pests in almost all major crops. Further, many farmers (44 per cent) expressed cow urine as a best repellent of the insects. 36 per cent of the farmers were aware about the application of ash on crops against foliage feeding caterpillars. Most of the respondents knew the technique of attracting the pests during night through light traps and this helped in controlling the pest problem to a considerable extent.

Eechalu mullu as the instrument of mechanical killing of caterpillars was expressed by few farmers and panchagavya was known to some farmers as a measure of disease control.

DISCUSSION

CHAPTER V

DISCUSSION

The results of the study are discussed in this chapter under the following headings :

- 5.1 Knowledge level of vegetable growers with respect to Integrated Pest Management practices.
- 5.2 Adoption behaviour of vegetable growers with respect to Integrated Pest Management practices.
- 5.3 Relationship between the socio-psychological characteristics of vegetable growers and their knowledge level.
- 5.4 Relationship between the socio-psychological characteristics of vegetable growers and their adoption behaviour.
- 5.5 Profile of vegetable growers following IPM practices.
- 5.6 Constraints in adoption of IPM practices by vegetable growers.
- 5.7 Documentation of indigenous plant protection measures.

5.1 KNOWLEDGE LEVEL OF VEGETABLE GROWERS WITH RESPECT TO INTEGRATED PEST MANAGEMENT PRACTICES

Knowledge level of vegetable growers on Integrated Pest Management practices as seen from Table I indicates that 31 per cent of vegetable growers had high knowledge,

44 per cent of them had medium knowledge and only 24 per cent of vegetable growers had low knowledge level with respect to Integrated Pest Management practices. An attempt was also made to find out the vegetable growers component wise knowledge level with respect to Integrated Pest Management practices, of cabbage and tomato, namely cultural, biological, insecticide of plant origin, mechanical and chemical, and the data are presented in Table II and III. It is clear from the table that almost equal per centages of (31 and 33 per cent) cabbage and tomato growers respectively had high knowledge with regard to cultural practices of IPM, 21 per cent of cabbage and 30 per cent of tomato growers had high knowledge of chemical control packages of IPM. Majority of the respondents (59 to 94 per cent) knew about the mechanical control measures and insecticides of plant origin respectively that were used on cabbage crop. Majority of tomato growers (64 per cent) had low knowledge of biological control measures, nearly 50 per cent of the respondents had medium knowledge of cultural control measures and 60 per cent of respondents had medium knowledge of chemical control measures. The difference in the knowledge level of different components of Integrated Pest Management practices that can be used on cabbage crop were seen in mechanical control, insecticide of plant origin, cultural control, biological control and chemical control.

This trend evidently shows that the components which are age old, less cost involved and easy to practice are known to all farmers while the components which are technical, cost is involved and needs skill to practice are known to few per cent of respondents.

Further probe was made to assess the knowledge level of vegetable growers on different items of specific practices of integrated pest management and data are presented in table IV and V. Deep summer ploughing, a cultural control measure was known to all the farmers. Most of the vegetable growers had correct knowledge of age of seedling while transplanting, critical stage for protecting the crop from pest, intra row spacing, names of insecticides, concentration of insecticides and time interval between sprays. The practice of components which are technical and skill oriented are less known to farmers namely biological control, which consists of use of NPV, its concentration, sticker to be used, growing trap crop, plant protection on trap crop, row proportion of trap and main crops.

It is logical to derive from the above discussion that the practices which are complex and difficult to remember are least known to farmers, on the other hand the practices which are simple and are being practiced by fore fathers are known to most of the farmers.

Findings of the study are in confirmity with

findings of Aswathiah and Krishna (1973), Govindappa (1974), Gangadharappa (1979), Sinha (1981), Patil et al. (1987).

5.2 ADOPTION BEHAVIOUR OF VEGETABLE GROWERS WITH RESPECT TO INTEGRATED PEST MANAGEMENT PRACTICES

Table VI reveals the adoption behaviour of vegetable growers with respect to integrated pest management practices. Majority of the farmers (47 per cent) are medium adopters and 30 per cent of farmers are low adopters, while only 22 per cent of the farmers are high adopters of IPM practices.

An examination of Table VII and VIII indicates almost equal per centage of vegetable growers (31 to 28 per cent) were high adopters of cultural and chemical control practices respectively. Majority of the farmers were high adopters of mechanical control measures (64 per cent) and insecticide of plant origin (59 per cent) on cabbage crop. While majority of the farmers (74 per cent) were non adopters on biological control measures on tomato crop. The differences in adoption of different practices of integrated pest management by farmers is presented in table IX and X. It is evident from the table that cent percent of farmers had adopted deep summer ploughing which is an important method of exposing the early stages of pest to sun for natural destruction. More than 80 per cent of vegetable growers adopted very important cultural control methods

namely intra row spacing, age of seedling while transplanting, adoption of appropriate plant protection measures during critical stages. Though it is the most important methods of IPM more than 50 per cent of the farmers did not grow any trap crop in tomato crop. Row proportion between tomato crops and trap crops, appropriate time of sowing and simultaneous planting of main and trap crop were not adopted by the majority of the farmers who grew tomato. Majority of the farmers had adopted mechanical control packages and most of the farmers had adopted Neem seed kernel extract, concentration and frequency of spraying NSKE. It is evident from table X that more than 75 per cent of the farmers had not adopted biological control methods.

It is seen from the tables that more than 80 per cent of the farmers did not adopt appropriate insecticide for major and minor pests, its concentration and time interval between sprays. More than 55 per cent of the farmers had used appropriate stickers to insecticides and maintained its concentration while mixing. Interestingly, on the other hand most of the farmers (more than 70 per cent) had not adopted appropriate insecticides and its concentration on trap crops.

The reasons for this kind of observation might be that the farmers are more tuned to control / prevent the pest incidence by chemical control measures only. The other

reasons could be the extension agency might not educated the farmers on suitable control measures and this agency might have neglected the eco-friendly non pollutant control measures of pests. Even though the chemical control measures are costly, farmers might have resorted to use them as chemical control measures are still cost effective and remunerative.

Considerable number of farmers had adopted mechanical, biological methods and insecticide of plant origin which certainly indicates gradual change in the affective domain of the farmer towards chemical control packages. Growing of trap crops as a biological control measure was given due consideration by the farmers. The findings were in agreement with the studies reported by Raodeo (1983), Sundarmurthy (1987), Petrov et al. (1988), Butter et al. (1989), Kantaraju (1989), Hanchinal (1991), Sharma et al. (1992), Gopikrishna (1993) and Manjula (1993).

5.3 RELATIONSHIP BETWEEN THE SOCIO-PSYCHOLOGICAL CHARACTERISTICS OF FARMERS WITH THEIR KNOWLEDGE LEVEL

A critical appraisal of table XI reveals that the characteristic like land holding, extension participation and innovation proneness of vegetable farmers were positively and significantly related to their knowledge level. However the other characteristics were found to be positive but do not have relation ship with the knowledge

level of vegetable growers.

The possible reasons for significant relationship between knowledge level and land holding might be that, when the individual possess larger holding, he will be having more opportunities to gather more information from outside sources which makes him a successful farmer. Shoemaker (1964) and others revealed that innovators as early adopters, will have larger holdings and these farmers will have better extension contact, mass media participation. Hence this findings confirm the above trend.

The finding of positive and significant relationship of knowledge with land holding is in conformity with the studies reported by Kantaraj (1980), Veeraraghava Reddy and Venkata Reddy (1988), Raghupathi (1989), Sateesh (1990) and Venkatesh (1995).

Extension participation of the vegetable growers was significantly related with their knowledge level. It may be explained by the fact that participation in extension activities might have provided an opportunity for condried experiences and perhaps helped them in reinforcement of gained knowledge about IPM packages. The findings of the study are in agreement with the related studies conducted by Ravindra (1980), Lalitha (1985), Aswathanarayan (1989), Sateesh (1990) and Yoganand (1992).

Innovation proneness was positively and significantly related with their knowledge level. This may be explained by the fact that the farmers who are prone to innovations will naturally exert more pressure and try to acquire more information to satisfy their psychological needs.

This findings of the study are in agreement with the related findings reported by Raghupathi (1989), Kher and Halyal (1988).

Further the data in the table XII reveals that the seven independent variables selected for the study explained about 11 per cent of variability in the knowledge level of vegetable growers. It is further clear from the results that size of holding, extension participation and innovation proneness contributed significantly towards the variation in the IPM knowledge level of vegetable growers.

5.4 RELATIONSHIP BETWEEN THE SOCIO-PSYCHOLOGICAL CHARACTERISTICS OF VEGETABLE GROWERS AND THEIR ADOPTION BEHAVIOUR

A perusal of table XIII indicates that characteristics like land holding, extension participation and innovation proneness had positive and significant relationship with their adoption behaviour. However other characteristics did not possess significant relationship

with the adoption behaviour of IPM practices of vegetable growers.

Size of holding of vegetable growers has positive and significant relationship with adoption behaviour. To have accessibility of innovations and adopting them requires strong financial position of the farmer, which is directly linked to the size of holding of farmer. Normally the farmer with larger holdings have high income and intends to adopt innovations. The findings of the study are in conformity with the findings of Sainath (1982), Pallavan (1985), Choudhary et al. (1988), Aswathnarayan (1989), Sateesh (1990) and Manjula (1994).

Extension participation of vegetable growers has significant relationship with their adoption behaviour. To have accessibility of new knowledge, discussion about new knowledge and its possibility of including in their farms is necessary. Further the group force operate on the individual farmers to change their attitude and beliefs in favour of new practices. Participation in the extension activities by the farmers will certainly enhance the mental horizon and create a sort of dissonance among the farmers. To tide over the dissonance stages, farmers should adopt certain practices which are suitable to him and finally solves the problem. The results of this study are similar to the findings reported by other researchers like Pallavan (1985), Aswathanarayan (1989), Sateesh (1990) and Yoganand (1992).

Innovation proneness of vegetable growers was positively and significantly related with their adoption behaviour. This might be due to the fact that vegetable growers with high innovation proneness are prone to try anything that is new which is economically feasible. Such dispositions might have influenced them to adopt the IPM practices. The results of the study are in consistency with Venkatesh (1995).

As indicated in table XIV all the seven independent variable selected for the study explained 10 per cent of the variability in the adoption behaviour of vegetable growers. It is further clear from the result that size of holding, extension participation and innovation proneness contributed significantly towards the adoption behaviour of vegetable growers.

5.4.1 Relationship between the socio-psychological characteristics of cabbage growers and their knowledge level and adoption behaviour of IPM practices

An appraisal of table XV indicates the characteristics like mass media use, extension participation, innovation proneness and scientific orientation of vegetable growers had positive and significant relationship with their knowledge level of cabbage IPM practices. However other characteristics were

found to have no relationship with the knowledge level of cabbage IPM practices.

The possible reasons for significant relationship between knowledge level and mass media use of vegetable growers is that mass media like news paper, radio and television provides variety of information related to specific topics of varied fields. Farmers have the choice of accepting the required and ignoring what they don't want. Probably vegetable growers, since their profit depends on latest knowhow on plant protection measures, whatever information related to cabbage IPM would have picked by the farmers. Now a days mass media give much importance and emphasize on eco-friendly practices. The repeated orientation by the mass media on the IPM might have also contributed to greater knowledge of farmers on the IPM practices. The findings of the study are in agreement with the findings of Kantaraj (1980), Ravindra (1980), Dayanand Patel (1985), Lalitha (1985), Aswathanarayana (1989), Prem Kumar (1989), Uma and Sethu Rao (1989), Sateesh (1990) and Yogananda (1992).

Extension participation of cabbage growers has positive and significant relationship with their knowledge level of IPM practices. The possible reason for significant relationship between knowledge level and extension participation is that more extension participation enhances the knowledge level of participants and might have convinced

the farmers about advantage and disadvantages of any technologies. The findings of the study are in conformity with Ravindra (1980), Lalitha (1985), Aswathanarayan (1989), Sateesh (1990) and Yogananda (1992).

The findings also reveals that the innovation proneness of cabbage growing farmers was positively and significantly related to their knowledge level of IPM practices. The mind which is prone to innovations provides avenues to bring in dynamic ideas. The individual who drives/strives for innovations, leads him to excel his performance will have the determination to search his goal with concredited effort. This might be the reason for establishing positive and significant relationship between the above said two variables and the findings coincides with Kher and Halyal (1988) and Raghupathi (1989).

Scientific orientation was significantly related to knowledge level of vegetable growers (Table XV). Scientific orientation refers to the extent of use of scientific methods in each of his actions. It is the logical thinking, foresight and rationality which helps the individual to understand the object. It might be due to this reason that those who had higher scientific orientation, had higher knowledge about IPM practices. The above finding is supported by the findings of Reddy and Reddy (1985), but the same is contradicting with the finding

of Balavatti and Sundarswamy (1991).

✓ As indicated in table XVI, the seven independent variables selected for the study explained about 11 per cent of variability in knowledge level of cabbage IPM practices. It is further clear from the table that mass media use, extension participation, innovation proneness and scientific orientation contributed significantly towards the variability of knowledge level of cabbage IPM practices.

A perusal of table XV also reveals that characteristic like land holding and extension participation of vegetable growers had positive and significant relationship with the adoption of cabbage IPM practices. However, other characteristics were found to have no relationship with adoption behaviour of cabbage IPM practices.

Size of holding had significant relationship with adoption behaviour. Farmers with large (big) holdings normally have high income, which makes them to adopt the innovations with confidence than others. The farmers with large land holdings cannot go only for chemical measures to control pest and diseases as they worked out to very costly and hence these farmers will search out and opt for innovations which are cost effective. This kind of thinking might have contributed for the positive and significant relationship between land holding and adoption behaviour. Similar finding was also reported by the previous

researchers like Sainath (1982), Pallavan (1985), Sateesh (1990) and Manjula (1994).

Extension participation of vegetable growers has significant relationship with their adoption level of cabbage IPM practices by the farmers. Extension participation brings confidence among farmers wherein they see, practice and believe in the activities like training, demonstrations, krishimela etc and this kind of process helps the farmers to develop favorable attitude towards the technologies and certainly it might lead to adoption of such packages which are beneficial to them. Pallavan (1985), Aswathanarayan (1989), Sateesh (1990), Yogananda (1992) also confirms this kind of findings.

Table XVI also reveals that the seven independent variables selected for the study explained 6 percent of variability in adoption behaviour of cabbage IPM practices. It is clear from the table that land holding and extension participation contributed significantly towards adoption of cabbage IPM practices.

5.4.2 Relationship between the socio-psychological characteristics of tomato growers with their knowledge level and adoption behaviour of IPM practices

An examination of Table XVII indicates

characteristics like land holding, mass media use, innovation proneness and scientific orientation had positive and significant relationship with their knowledge level of IPM practices. Nevertheless, the other characteristics were found to have no relationship with the knowledge level of IPM practices.

The probable reasons for significant relationship between knowledge level and land holding is that, higher land holding leads to higher income of the farmers which in turn facilitates to contribute more for acquiring knowledge. The findings are in conformity with the findings of Kantaraj (1980), Raghupathi (1989) and Sateesh (1990).

The likely reasons for significant relationship between knowledge level and mass media use is that mass media provides the day to day information to the farmers in varied fields and about innovations. Then the farmers can have the choice of their own to accept and acquire the knowledge. Lalitha (1985), Aswathanarayan(1989), Prem Kumar (1989) Sateesh (1990) and Yoganand (1992) reported similar kind of results.

Innovation proneness is significantly related to knowledge level of the IPM practices by the farmers. The farmers who are prone to innovations generally will have higher orientation towards risks, scientific technology and competition. These factors do naturally influence ones knowledge level, and hence these factors might have

established a significant association with the knowledge level of tomato IPM practices. The findings are in agreement with Kher and Halyal (1988) and Raghupathi (1989).

Scientific orientation is positively and significantly related with the knowledge level of IPM practices. Farmers who uses the scientific methods in each of their practices decides their scientific orientation. Involvement in the scientific methods makes the concept clear and brings clarity to the problem and its possible solutions. Now, it is evident that those who have higher scientific orientation has higher knowledge level. Reddy and Reddy (1988) also reports the similar kind of results.

A perusal of table XVII indicates that the character extension participation had positive and significant relationship with adoption of tomato IPM practices. However other characteristics were found to have no relationship with adoption of cabbage IPM practices.

Extension participation had significant relationship with the adoption behaviour of tomato IPM practices by the farmers. It is quite natural that the participation of farmers in the activities will certainly broaden the knowledge level of farmers because extension activities would provide all possible opportunities to learn i.e., seeing, hearing and doing. This might have lead to

yield positive and significant relationship between extension participation and adoption behaviour of farmers. The finding is in conformity with the findings of Pallavan (1985), Sateesh (1990) and Yoganand (1992).

As indicated in table XVIII the seven independent variables selected for the study explained 4 percent of variability in adoption behaviour of tomato IPM practices. It is clear from the table that extension participation contributed significantly towards adoption of tomato IPM practices.

5.5 PROFILE OF VEGETABLE GROWERS FOLLOWING IPM PRACTICES

An appraisal of the table XIX in relation to profile, comprising of personnel socio-psychological characteristics, of vegetable growers reveals that majority of the vegetable growers had medium and low education. Similarly no difference was observed in the case of size of holding of vegetable growers. Most of the vegetable growers belonged to medium and high category of mass media utilization, and thus the respondents were fairly good in utilizing mass media. In case of extension contact, majority of the farmers had low to medium extension contact. With regard to extension participation, majority of the vegetable growers had medium extension participation. In case of innovation proneness majority of the vegetable growers had medium and high innovative

proneness while most of the farmers had high scientific orientation.

5.6 CONSTRAINTS IN ADOPTION OF IPM PRACTICES BY VEGETABLE GROWERS

The close observation of table XX indicates the constraints in the adoption of integrated pest management technologies. It is obvious from the table that, none of the respondents knew as to whom to approach if the insecticide fails to control the pest. When the respondents were asked whom did they approach when insecticide failed, the majority of the farmers did not give proper answer/answers. Many a times, when the insecticide fails in controlling pests, none of them approached the seller or informed to the manufacture about the failure of insecticide and tried to make up the loss. Almost all of the respondents expressed difficulty in using pheromone traps and Nuclear Polyhydral Virus (NPV). In case of pheromone traps the lures have to be changed again and again and they are crop specific. In case of NPV, the proper concentration to be used and the addition of sticker/spreader is most important in controlling the pest effectively. Farmers failure in reaping the fruit of there two technologies is mainly due to the lack of knowledge. About 90 percent of the farmers expressed difficulty in getting pheromone traps and NPV. Since they

are not very popular as the insecticides, the seller hesitates to bring pheromone traps and NPV. Another reason might be, that since pheromone traps and NPV are cheaper, the seller might not get maximum profit as in case of insecticides and this might have acted as another reason for not popularising the pheromone traps and NPV. Majority of the farmers were not aware about the consumer courts to be approached if the insecticide or any other agricultural chemical is found to be ineffective or illicit. Majority of the respondents were also not aware about the agricultural chemical which are abandoned from using in pest control processes and 67 per cent of the farmers expressed difficulty in wearing mask while taking up sprays to the crops. Majority of the respondents were not aware about the pesticide quality control procedure of the Government. An interesting point was observed while conducting research was that the farmers did not use the vegetables they grew, which are heavily sprayed. Instead, they used the vegetables which are not sprayed. 28 per cent of the respondents were able to identify their mistakes in using IPM technology, and it is the same percentage of farmers who adopted IPM technology.

Considerable number of farmers expressed that the package of practices doesn't work better in all the situations and hence University personnel are giving wrong advice. Some times biocontrol methods failed to the extent

of 50 per cent in the adopters field. This may be due to the lack of proper knowledge, non availability of inputs and lack of proper guidance to the interested adopters of IPM technology.

Very few farmers (4 per cent) were not aware about expiry date written on the box of chemicals, and did not observe the expiry date. Few farmers (4 per cent) used the chemicals even after the expiry date.

Thus lack of knowledge and proper guidance was the major constraint as perceived by the vegetable growers in the adoption of IPM practices.

5.7 DOCUMENTATION OF INDIGENOUS PLANT PROTECTION MEASURES

A perusal of table XXI reveals that all the respondents knew and practiced the insecticide of plant origin, 'Neem seed kernel extract' in their own way. Majority of them also followed the recent appropriate methodology of using Neem seed kernel extract (4 per cent) as it doesn't have any side effects on plant or on insects or on environment. It acts as a repellent for many insects and stomach poison for few of harmful insects. Except the problem of availability of seeds in a particular season, it is the safe insecticide of wide range. Cow urine if applied fresh acts as hormone and if applied after storage for a week acts as a strong repellent of insects. Majority of

the farmers (45 per cent) informed about their knowledge of cow urine as an insecticide. The dilemma in using cow urine among the farmers as insecticides is that it will not give sudden or immediate effect as chemical insecticides. Majority of the farmers revealed their memory of application of ash to the crops as antefeedents of insects, mainly to control aphid problem. About 33 per cent of the respondents expressed the advantages of using light trap, which attract adult males and helps in controlling the pests.

Majority of the farmers were aware about Agave extract and its repellent action against wide range of pests. Also farmers registered the other plant protection measures like use of oil cake, panchagavya and Eechalumullu.

SUMMARY

CHAPTER VI

SUMMARY

Indian subcontinent is endowed with salubrious climate which permits growing of vegetables throughout the year. Vegetables play an important role in balanced nutrition of man. Vegetables not only provide maximum output but also give more income per unit area of land to the farmers. During recent past efforts have been made to increase the vegetable production by developing technologies like high yielding and pest and disease resistant varieties/hybrids etc.. These high yielding varieties and hybrids are more input responsive, which makes the plant more succulent and susceptible to pest and disease for which farmers feel that there are no alternatives other than spraying chemical pesticides to minimise the crop loss. When these chemicals are used indiscriminately, the problems of resurgence of pest, destruction of natural enemy, destruction of beneficial insects, in toto, imbalances in crop ecology.

Realising the threat to the environment and ecology Indian Institute of Horticultural Research, Hesaraghatta and University of Agricultural Sciences, Bangalore have come out with the alternative technologies which are non pollutant, eco-friendly and cost effective pest management practices and have taken up extension

education activities in different villages. An attempt was made to assess the farmers reaction towards IPM technology with the following objectives.

- a) To find out knowledge level of vegetable grower with respect to Integrate Pest Management practices.
- b) To study the adoption behavior with respect to integrated pest management practices.
- c) To understand the relationship, if any, between socio-psychological characteristics of vegetable growers and their knowledge level and adoption behaviour.
- d) To study the constraints faced by vegetable growers in adopting Integrated Pest Management practices.
- e) To document indigenous plant protection measures practiced by farmers.

METHODOLOGY

The study was conducted in Malur of Kolar dist. and Bangalore North of Bangalore urban dist. Based on the maximum area under vegetable cultivation and suggestions of ADH of respective talukas, eight villages were selected for the study at the rate of four villages from each taluka . 45 vegetable growers were randomly selected from each taluk and thus 90 vegetable growers constituted the sample of study. The dependent variables selected for

the study are knowledge level and adoption behaviour. The seven independent variables along with the variables like constraints in adoption of IPM and documentation of indigenous plant protection measures are put into test in the study. To measure these dependent and independent variables appropriate measuring devices were used to quantify them which are included in the study.

The data collected from these respondents through interview technique was analysed by frequencies, simple per centages, mean, standard deviation, simple correlation, multiple linear regression and 't'test of significance.

FINDINGS

The important findings of the study are presented here, which are as follows :

1. Majority of the vegetable growers had medium to high level of knowledge with respect to Integrated Pest Management practices.
2. All the vegetable growers have knowledge of deep ploughing during summer as a cultural control measure. More than 90 per cent of the farmers have correct knowledge about intra row spacing, age of seedlings while transplanting and identification of major and minor pests. However, they lack knowledge on growing of trap crops, row proportion of main crops and trap crop.

3. Majority (95%) of the farmers have correct knowledge of mechanical control and insecticide of plant origin. However, farmers lack knowledge of biological control measures.
4. More than 87 per cent of the growers had correct knowledge of name of the insecticide to be used against major and minor pests, concentrations and time interval between sprays. Majority of the farmers knew about addition of sticker and its concentration. However, they lack knowledge about plant protection measures to be taken up on trap crops.
5. Majority of the farmers were high and medium adopters of IPM practices.
6. All the farmers adopted summer deep ploughing as a measure of cultural control method. Nearly cent percent of the farmers have adopted intra row spacing, PPM at critical stages and transplanted seedlings at correct age. Majority of them did not follow growing of trap crop, row proportion of trap crop and main crop.
7. More than 78 per cent of farmers adopted mechanical control and insecticide of plant origin.
8. All the vegetable growers adopted appropriate insecticides to control major and minor pests, its concentration and also maintained time interval between

sprays. Majority of the farmers followed addition of sticker and its concentration.

9. Among the selected socio-psychological characteristics, only land holding, extension participation and innovation proneness were significantly related to overall knowledge level of vegetable growers.

10. Characters like mass media use, extension participation, innovation proneness and scientific orientation were positively and significantly related to knowledge level of cabbage IPM practices, while characters namely land holding, mass media use, innovation proneness and scientific orientation were significantly related to knowledge level of tomato IPM practices.

11. Socio-psychological characteristics namely, land holding, extension participation and innovation proneness of farmers were significantly related with overall adoption level of IPM practices.

12. Characters namely land holding and extension participation had positive and significant relationship with adoption behaviour of cabbage IPM practices. Extension participation had significant relationship with adoption level of tomato IPM practices.

13. 'Lack of knowledge and guidance' as to whom to be consulted in case of failure of insecticide to

kill the pest, difficulty in using pheromone traps and NPV, concentration of NPV to be used, addition of sticker, difficulty in getting NPV and pheromone traps, lack of knowledge of banned detrimental chemicals were the major constraints expressed by the farmers. Majority of the farmers felt that package of practices doesn't work better in all situations, University personnel are giving wrong advice and bio control methods failed in 50 percent of the adopters field. These are some of the major constraints which come in the way of adoption of IPM practices.

14. All the farmers knew and followed the use of insecticide of plant origin like, 'Neem seed Kernel extract'. Majority of the farmers were aware about other insecticides of plant origin 'Agave extract' and was used against major sucking pests. Other indigenous plant protectants like Cow urine, Ash, Oil cakes, Panchagavya and Eechalumullu were adopted by vegetable growers.

IMPLICATIONS OF THE STUDY AND SUGGESTIONS

The findings of the study have following implications for extension work.

1. The findings of the study showed that there were only 31 per cent of farmers had high level of knowledge of IPM practices. Therefore it is not a matter of

satisfaction because there are still 69 per cent of the farmers with medium and low level of knowledge. Hence it is an immediate necessity to be considered first on priority to awaken the farming community towards non polluting plant protection measures like IPM which stresses on minimum and judicious use of chemicals.

2. It is also a matter of serious concern that there are only 22 per cent of farmers who had adopted IPM practices. It is very much important to disseminate the innovation and it has to become the movement of adoption of non pollutant measures not only in vegetables but also in other Agricultural crops.
3. It is a naked truth that seller or manufacturer will not take the risk of making up the loss incurred by the farmers due to failure of chemical produced / sold by him. Farmers are also equally responsible for the same. They have to approach the consumer court to make up loss or abandon the use of ineffective chemical on mass basis so that company will become aware of the facts. Non availability of bio control equipments, lack of guidance and knowledge are the other serious constraints faced by farmers in adoption of an innovation. Immediate steps may be taken by Government developmental departments and Agricultural University to train and educate farmers in a proper way.

4. A farmer is a treasure of knowledge, due to his accumulated experience and the experiences of his fore fathers, farmers have simple excellent solutions to the existing complex problems in Agriculture. An urgent action may be taken to find out the indigenous methods and the research should be taken up on the methods and the successful ones may be disseminated among the farming community.

FUTURE LINE OF WORK

1. Similar study could be taken up in predominantly vegetable growing districts like Belgaum, Hassan, Dharwad etc. and the districts which consume maximum quantity of chemicals on commercial crops like Cotton and Pulses like Redgram.
2. A research study could be taken up to document indigenous plant protection measures and other technologies with respect to agriculture and allied sciences.
3. Proper training could be given to agrarian community on the alternatives in plant protection and other aspects of agriculture and to awaken the farmers about the increasing environmental pollution due to indiscriminate use of chemicals.

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CHAPTER VII

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APPENDICES

APPENDIX - I

**KNOWLEDGE LEVEL ADOPTATION BEHAVIOUR OF VEGETABLES GROWTHS
WITH RESPECT TO INTEGRATED PEST MANAGEMENT**

Name of the Researcher : Basavaprabhu. V. jirli

Assisted by :

INTERVIEW SCHEDULE

PART - I

1. Name of the respondent :
2. Village :
3. Taluk / District :
4. Educational level : Illiterate/Can read and write / primary school / Middle school/High school/PUC/Degree/P.G.
5. Size of holding :

Type of land	Area Ac.	Guntas	Source of irrigation
Dry			
Wet			
Garden			
Total			

6. Mass media use :

Indicate the extent to which you use the following:

Statement	Regular	Occasional	Never
6.1 Do you read newspaper			
6.2 Do you listen to radio programmes on Agriculture			
6.3 Do you read farm magazines			
6.4 Do you watch agricultural programmes on T.V			

7. Extension contact :

Indicate the extent of contact you had with the following extension workers.

Extension workers	Frequency of contact			
	Once in a week	Once in 15 days	Once in a month	Never
1. A.H.O.				
2. A.D.H.				
3. Agril. Assistant				
4. A.A.O.				
5. A.D.A.				
6. Extension guide				
7. University staff/ Researcher				
8. Others (Specify)				

8. Extension participation :

Indicate the extent to which you participate in the following activities.

Extension activity	Regular	Ocassional	Never
1. Training programme			
2. Group meeting/Discussion			
3. Exhibition/Krishimela			
4. Demonstration			
5. Field days			
6. Field visit/tour			

9. Innovation proneness :

Here are 8 statements, you may please go through each statements and indicate your response:

Statements	Yes	No	Undecided
a. Do you want to learn new ways of farming			
b. If Agril. extension worker gives a talk on improved cultivation aspect, would you attend			
c. If the Government would help you to establish a farm else where, would you move			
d. Do you want to change your way of life			
e. A farmer should try to farm the way his parents did			
f. Do you want your sons to be a farmer			

PART - II

KNOWLEDGE AND ADOPTION OF INTEGRATED PEST MANAGEMENT
PRACTICES

I. CABBAGE

Knowledge Adoption
Full Partial No

I Cultural control

- 1) Identification of pests
 - a) Major pest
 - b) Minor pest
- 2) Growing mustard as trap crop
- 3) Time of sowing of mustard
- 4) Row proportion of cabbage and mustard
- 5) Inter row spacing between mustard and cabbage
- 6) Intra row spacing of cabbage
- 7) Intra row spacing of mustard
- 8) Age of cabbage seedling while transplantation
- 9) Critical stage for protecting the crop from pest
- 10) Summer deep ploughing

II Mechanical control

- 1) Hand picking of larva

III Insecticide of plant origin

- 1) Knowledge about Neem seed Kernel extract
- 2) Preparation of Neem seed Kernel extract
- 3) Concentration of Neem seed Kernel extract
- 4) Frequency of spraying Neem seed extract

IV Chemical control

- 1) Name of the insecticide sprayed to control major pest

- 2) Concentration of pesticide
- 3) Name of the insecticide used to control minor pest
- 4) Concentration of pesticide
- 5) Addition of sticker/spreader
- 6) Concentration used
- 7) Time interval between sprays
- 8) Name of insecticide used on mustard
- 9) Concentration used
- 10) Fungicide used to control white rust on mustard
- 11) Concentration

II TOMATO

I Cultural control

- 1) Identification of pests
 - a) Major pests
 - b) Minor pests
- 2) Covering nursery with nylon mesh
- 3) Growing marigold as a trap crop
- 4) Row preparation of Marigold and tomato
- 5) Inter row spacing between marigold and tomato
- 6) Intra row spacing of tomato
- 7) Intra row spacing of marigold
- 8) Age of seedlings while transplantation
 - a) Tomato
 - b) Marigold
- 9) Simultaneous planting

II Biological control

- 1) Use of NPV
- 2) Concentration of NPV
- 3) Name of sticker used in NPV
- 4) Concentration of sticker used

III Chemical control

- 1) Insecticide used to control white fly in nursery
- 2) Concentration
- 3) Insecticide used to control

- fruit boner
- 4) Concentration used
 - 5) Name of the sticker used
 - 6) Concentration
 - 7) Insecticide used on marigold
 - 8) Concentration
 - 9) Time interval between sprays
-

PART - III

CONSTRAINTS IN ADOPTION OF IPM PRACTICES

1. Whether the package of practices which are recommended work better in all situations.
2. Are you aware of expiry date which is printed on the pesticide/fungicide/weedicide box.
3. While purchasing, do you observe them.
4. Do you use the chemical after expiry date.
5. If the pesticide doesn't kill the pest whome do you approach.
6. Will the seller/manf. company make up your loss.
7. Are you aware of consumer court.
8. Are you aware of banned detrimental chemicals, DDT, BHC, synthetic pyrethroids etc.
9. Do you know about quality control before the produce is sold in the market.
10. Do you face any problems in using masks to be worn before spraying the chemicals to the fields.
11. Do you face any difficulty in using biological control methods.
 - i) NPV
 - ii) Pheromone traps
12. Whether these biological control methods failed in your field.
13. Can you identify your mistakes in using IPM practices.

14. Do you find any difficulty in getting NPV/pheromone traps.
15. Do you feel that University personnel are giving wrong advice.

PART - IV

DOCUMENTATION OF INDEGENEOUS PLANT PROTECTION MEASURES

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ವಿಶ್ವವಿದ್ಯಾನಿಲಯ ಕ್ರೀಡಾಂಗಣ
ಗಾ.ಕೃ.ವಿ.ಶಿ., ಮೈಸೂರು-65.
8 MAR 1996
ಅನುಷ್ಠಾನ ಸಂ. 4058
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