

**“Impact of Farmer’s Field School Training Program on
Adoption of Integrated Pest Management practices in
Rice by the farmers of the Korba District of
Chhattisgarh”**

M.Sc. (Ag.) THESIS

by

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DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF AGRICULTURE

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**“Impact of Farmer’s Field School Training Program on
Adoption of Integrated Pest Management practices in
Rice by the farmers of the Korba District of
Chhattisgarh”**

THESIS

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CERTIFICATE – I

This is to certify that the thesis entitled “**Impact of Farmer’s Field School Training Program on Adoption of Integrated Pest Management practices in Rice by the farmers of the Korba District of Chhattisgarh**” submitted in partial fulfillment of the requirements for the degree of “**MASTER OF SCIENCE IN AGRICULTURE**” to the Indira Gandhi Krishi Vishwavidyalaya, Raipur, is a record of the bonafide research work carried out by **NEHA SARTHI** under my guidance and supervision. The subject of the thesis has been approved by Student's Advisory Committee and the Director of Instructions.

No part of the thesis has been submitted for any other degree or diploma (certificate, awarded etc.) or has been published / published part has been fully acknowledged. All the assistance and help received during the course of the investigations have been duly acknowledged by her.

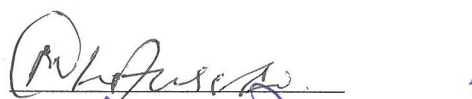
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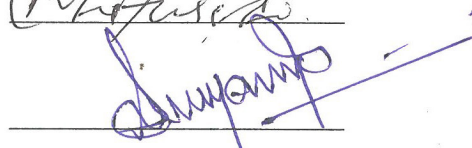
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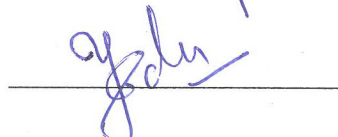
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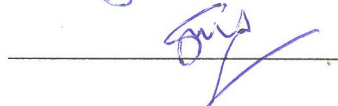
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CERTIFICATE - II

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Date: 27.8.2013



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Director of Instructions

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Introduction

CHAPTER-I

INTRODUCTION

The new conceptualization of agricultural extension services in developing countries has introduced many changes in the delivery of agricultural technologies (Qamar 2002, Suleiman & Hall 2004). The operational capacity of public extension has been dramatically reduced after following criticism for insufficient impacts and the recent wave of structural adjustment programs (Farrington 1994). New extension providers and new methods for delivering agricultural technologies have emerged, producing significant changes to the traditional means of delivering extension services. This dissertation contributes to the economic impact assessment of this “new” extension system by analyzing the delivery of integrated pest management (IPM) through the farmer field schools (FFS) extension approach that has received increasing support from development agencies as the preferred means for disseminating IPM (Feder et al 2004). IPM is a knowledge-intensive set of management practices that aim to reduce environmental and health (E & H) risks related to pesticide use by using chemical pest control methods only when strictly necessary and by offering alternative non-chemical pest control methods. FFS is an intensive IPM training program that incorporates farmers’ priorities and a “learning by doing” approach to skill development among farmers. FFS proponents expect it to increase the rate of IPM adoption compared to traditional extension approaches, notably the training and visit system. Agriculture provides the livelihoods of the majority of the population in India and plays major role in economic development. Besides technological advancement, extension plays great role in agricultural development. Farmers generally have no direct linkage with advance agricultural technology hence there is need for massive education and extension efforts to

modernize outlook of a common farmer to make them innovative and also make them willing to adopt improved and recommended technologies. The average food grain production for last fifteen years (1996-2011) comes to 200.8 million tonnes (mt.), which was precisely 227.32 million tonnes in the year 2007-08. By the year 2020 AD, when the population would reach nearly 1.32 billion mark (2026 AD population would reach 140 crore), the nation will need around 375 million tonnes of food grains. But, the share of agriculture in national income has come down. India enjoys the second position all over the world in terms of agricultural production. During the period of 2009-10, farming and associated industries such as forestry and fishing represented approximately 15.7% of the Gross Domestic Product of the country. These industries also recruited 52.1% of the overall manpower of India. India holds the second position in production of rice. Apart from that, agriculture sector at present provides livelihood to 65 to 70 per cent of the total population. The sector provides employment to 52 per cent of country's work force and at present buffer stock position of food grains as on January 1, 2008 is 19.2 million tonnes. Consumption of chemical fertilizers (in terms of nutrients) grew by 8.4 per cent to 22.04 MT during 2006-07 (Pratiyogita Darpana).

There is limited scope for expanding the area under different crops. However, it is possible to increase the production per unit area by promoting the adoption of modern agricultural technology among farmers. There are ample observations to show that not even 25 per cent of the available technology is adopted on the farmer's field. Effort has been continuously made to educate farmers on modern agricultural technology. The promotion of participatory multidisciplinary research is the need for empowerment of the farmers will be one of the important approach is Farmers Field School (FFS). The Concept of FFS emerging shingly for transfer of technology in India.

Concept of Farmer's Field School (FFS):

FFS is participatory approaches not only define the crop production technology but also helps to disseminate this technology to the target group. FFSs were conceptualized between the 1970s and 1980s and first implemented in Indonesia in 1989 to deal with the widespread pest outbreaks in rice that threatened the security of Indonesia's basic food supplies (Pontius et al., 2002). The work of some entomologists showed that the massive use of pesticides, promoted by the government to control brown plant hoppers, was the primary cause of the insect's outbreak (Kenmore et al., 1984; Settle et al., 1996). FFSs were therefore organised to educate rice farmers on the ecological relationships underlying IPM, and thereby to help them reduce their reliance on chemical pest controls (Kenmore, 1996). Because agroecological relationships are inherently place-dependent and time-specific it is ineffective to base decision making on universal dissemination of standard technologies and simple messages. The focus of FFSs was, and still is, on learning through discovery, experimentation and group or community actions. FFSs thus have social goals beyond mere changes in pest management techniques that seek to promote the empowerment of farmers by building human and social capital (Gallagher, 2000). Farmers are no longer positioned as receivers of already developed technological packages, but as field experts, who collaborate with the extension staff to find solutions relevant to the local realities. FFS programmes emphasize farmer's ownership, partnership and group collaboration. During the past two decades, FFSs have been held for a large number of crops including cotton, tea, coffee, cacao, pepper, vegetables, small grains and legumes (Pontius et al., 2002). The FFS model has been extended to several other topics such as livestock production, forestry, nutrition and health (HIV prevention) (Tripp et al., 2005). In total, thirty developing countries in the world are currently

experimenting with and implementing the FFS approach (van den Berg, 2004). This sixteen-year history of success and drawbacks is now looked upon as an invaluable ground for institutional learning, as the recent proliferation of published evaluation studies attests.

Evaluations of the accomplishments of various FFS programmes agree in their main conclusion that attending an FFS strengthens farmer's ecological knowledge on pests and predators (Thiele *et al.*, 2001; Rola *et al.*, 2002; Feder *et al.*, 2004a; Reddy and Suryamani, 2005; Tripp *et al.*, 2005). In some cases, the understanding of the crop ecosystems has induced a reduction in pesticide use, as well as higher yields and profits, for instance in sweetpotatoes, potatoes and cotton production systems (Braun *et al.*, 1995; Godtland *et al.*, 2004; Khan *et al.*, 2005). So, far, the long-term sustainability of the changes in pesticide use has been questioned only by two studies on vegetables and rice, which have drawn opposite conclusions (Khalid, 2002, Feder *et al.*, 2004).

The term FFS has its origin in Indonesia. The first FFS were designed and managed by the Food and Agriculture Organization (FAO) of the United Nations in Indonesia in 1989 to train the trainers and farmers in Integrated Pest Management (IPM) in a participatory mode.

The Extension concept has historically been based on efforts to disseminate research information to the public. Extension provides IPM educational information and expertise, while farm growers take the new found knowledge and incorporate it into their individual farming operations. The program has allowed a two-way communication tunnel that allows Cooperative Extension to disseminate program information to growers. Growers communicate back to Extension basic concerns regarding insect pests, and their experiences with IPM. Training techniques were used

to achieve learning objectives, which are not limited to those of the work domain alone, but also include interactive and empowerment domains. The approach is integrated and organized in such a way so that farmers are not the objects of training but are able to use their experience as the subject of training.

FFS is a group-based learning process that includes hands-on training methods in which farmers test management methods/production technologies for themselves and learn concepts directly. Training also includes communication skills, skills in identification and problem solving, in leadership, in interaction and discussion methods. Training in the field school follows the season long cycle and the field is the primary learning venue. Farmers learn by carrying out themselves the various activities related to the particular farming practice they want to learn/evaluate. The field school offers farmers an opportunity to learn by doing, by being involved in experimentation, discussion and decision-making. This strengthens the role of farmers in the research-extension-farmer chain. It also improves the sense of ownership of technological packages and new knowledge and skills. Other features of the FFS are:

- It is flexible, non-lecture based field study using a field that allows the “field to be the teacher”.
- It has strong emphasis on observation, analysis, discussion and debate, which allows new ecological concepts to be combined with local knowledge.
- Technically competent facilitator leads group activities, but is not seen as the “all-knowing source” of the “right information” and a focus on farmers becoming “experts” and “farmer facilitators” in their own community.

Integrated Pest Management

The IPM program was initiated in many states during the early 1970s. By 1972, Cooperative Extension had supported the implementation of 52 IPM programs across 33 states. At the state level, IPM program implementation became the responsibility of the Texas AgriLife Extension Service.

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Concept of IPM

The concept of 'pest management' was proposed in 1961 (Geier and Clark, 1961). The term Integrated Pest Management was formalized by the US Academy of Sciences in 1969. IPM drew knowledge from entomology, plant pathology, nematology, weed science and other disciplines.

IPM was a favorable alternative to the rampant overuse of chemical pesticides occurring at the time, said Dr. Tom Fuchs, coordinator of the Texas IPM program for Texas Cooperative Extension. IPM came to Texas in an organized way in 1972, when four Extension pest management agents, employed by Texas Cooperative Extension, began to work with producers year-round in cotton producing regions of the state. IPM was adopted as policy by various world governments during the 70's and 80's, including the USA (1972), Malaysia (1985), the Philippines (1986), and Indonesia

(1986). Since then, there have been numerous success stories of successful IPM programs around the world.

Definition of IPM

Wightman (1998) defined IPM as management activities carried out by farmer that maintain the intensity of potential pest levels below which they become pest without endangering the productivity and profitability of the farming system as a whole the health of the farm family, its livestock and quality of the adjacent and downstream environment.

As defined by the Structural Pest Control Act (225 ILCS 235/3.24), IPM is a pest management system that includes the following elements whenever possible:

- Identifying pests and their natural enemies;
- Establishing an ongoing monitoring and record keeping system for regular sampling and assessment of pest and natural enemy populations;
- Determining the pest population levels that can be tolerated based on aesthetic, economic and health concerns, and setting action thresholds where pest populations or environmental conditions warrant remedial action;
- Preventing pest problems through improved sanitation, management of waste, addition of physical barriers, and the modification of habitats that attract or harbour pests;
- Relying to the greatest extent possible on nontoxic, biological, cultural or mechanical pest management methods, or on the use of natural control agents;
- Using chemical pesticides, when necessary, with preference for products that are the least harmful to human health and the environment; and
- Record keeping and reporting of pest populations, surveillance techniques and remedial actions taken.

Rice production scenario in the state: Over view

About 80% kharif sown area of plains, 68% of hills and plateau region of Chhattisgarh is occupied by Rice. There is an acute need of exploring new technology for substantial growth, development and increasing of food production. Issue of protecting the different crops from the insect, pest and diseases is a major issue in India. Ecofriendly technology for plant protection is needed of the hour to avoid the environmental pollution and degradation of the soil. There is a need to validate indigenous practices and develop low cost technology which can be disseminated and diffused which could be called demand and extension in specific location region as per their demand.

Rice plays important roles in both producer's and consumer's life in rice cultivated area. In India rice is an important crop grown in nearly 44 million ha of land in the country with the productivity of 2.2 t/ha which is less than the productivity of many countries. Annual population growth rate of our country is nearly 1.8 % and if per capita consumption of rice is expected to be 400 gm of rice per day then the demand for rice in 2025 will be 130 m. tones. In Chhattisgarh, rice occupies average of 3.6 million ha. with the productivity of the state ranging between 1.2 to 1.6 t/ha depending upon the rainfall. The rainfall, which is a major factor determining rice productivity is quite high in the region and ranges between 1200-1400 mm during drought years with an irrigated area of nearly 28%. In spite of that state is well behind the average national productivity. In view of topographical structure prevailed in this part of the country, 20-30% of the rice is grown in low lying areas (Kanhari soil). Normally much irrigation is not required in this soil and one or two irrigations are sufficient to harvest a satisfactory production during normal year. This group of soil has further advantage for rice production because water which is applied to upper

situation recedes to low lying areas. The water table is also very close to the surface in many places during rice growing season. But at the same time rolling topography of the region encourages the internal drainage of water from low lying areas to the rivers, especially in Kanhar soil, creates water deficits at later growth stage of the rice crop. The long duration rice varieties are generally grown by the farmers in these lands. The upland areas where rice is grown constitute about 15-20% of the total cultivated area. Rice grown in these lands normally are not being irrigated through canal or other sources. The crops invariably suffer due to moisture stress in one stage or the other. The substitution of crops in light soil in this region becomes more difficult due to continuous rains and development of perched water table at the surface of the soil for short duration during rice growing season. Weed control and level of fertilizer use are highly correlated with production and growth. Upland rice growth is negatively correlated with slope of the land and soil depths. However, short duration moisture stress especially at tillering and dough stages, weeds and nutrient response causes reduction in upland rice production. Blast and bacterial blight diseases adversely affect seed yield in upland rice. Since last more than three decades, adoption of high yielding varieties, use of fertilizers, irrigation and agro-resources and management practices are given major emphasis. The fertilizer is a major input for rice production. Although its consumption is increased during these years but a dramatic change is still awaited in these districts. The biasi (beushening) system of rice cultivation is most widely used in the state, where optimum plant population is major constraints for achieving higher productivity. However, improved biasi i.e. maintaining plant population must be done to increase yield of rice.

Integrated Pest Management (IPM) in Rice

Rice is the staple food of at least half of the world's population and is grown in approximately 148 million ha of land globally. Nearly 90 per cent of this area falls in the Asian region. Integrated pest management (IPM) is a broad ecological approach for pest management which employs all available skills, techniques and practices such as cultural, genetic, mechanical and biological methods including application of chemical pesticides as a last resort in a harmonious and compatible manner with a view to suppress pest population below economic injury level, based on regular crop pest surveillance and monitoring. The IPM is a dynamic approach and process which varies from area to area, time to time, crop to crop and pest to pest etc., and aims at minimizing crop losses with due consideration to human and animal health besides safety to environment. Live and let live is the philosophy behind IPM. IPM approach has been globally accepted for achieving sustainability in agriculture. IPM has been enshrined as the important principal of plant protection in the overall crop protection programme under the national agricultural policy of the government of India.

All paddy growers experience pest problems from time to time, and pest management can be a real challenge. Insects, plant diseases, weeds, slugs and other animals can cause significant plant damage. How you react to a pest problem depends on the value of the affected plants, the cost of treatment and the toxicity of available controls. Many paddy growers are concerned about the use of pesticides. If not used, stored and disposed of carefully, some pesticides can harm the applicator, the environment, children, pets and other non target organisms. Rice is attacked by insect - pests, diseases, weeds, rodents and nematodes. Some of the pests are of national significance, while others are pests of regional significance. Insect pests like gallmidge (*Orseola oryzae*), white backed planthopper (*Sogatodes oryzae*), white backed

planthopper (*Sogatella furcifera*), yellow stemborer (*Sciropophaga isertalas*), leafhopper (*Cnaphalocrosis medinalis*), and brown planthopper (*Nilaparvata lugens*) and diseases like rice blast (*Pyricularia oryzae*), bacterial leaf blight (*Xanthomonas campestris* pv. *Oryzae*) and sheath blight (*Rhizoctonia solani*) and weeds like *Panicum* spp., *Cyperus* spp. and *Echinochloa* spp. and rodents such as smaller bandicoot (*Bandicota bengalensis*), field mice (*Musa* spp.) and soft furred field rat (*Millardia meltda*) are pests of national significance.

IPM Strategies for protecting the rice crops from the pest and diseases are:

Physical practices

Heat (Example: Burning surface residues, soil pasteurization.)

Cultural practices

Cultural practices are integral part of IPM. Summer ploughing, selection of healthy seeds, timely planting, raising of healthy nursery, removal of weed from field, balanced use of fertilizers as per recommendations are the important cultural practices that are followed for pest management in paddy.

Mechanical practices

Mechanical practices comprise of removal and destruction of pest infested plant parts, clipping of rice seedling tips and collection of egg masses and larvae of pest and their placement in bamboo cages for conservation of bio control agents. Pheromone traps are installed at the rate of 20 traps/ha to trap yellow stem borer at 10 days after transplanting.

Biological control practices

Bio control agents like coccinellids, spiders, damsel flies, dragonflies should be conserved. Chlorpyrifos is used for root dip treatment of rice seedlings. Egg,

masses of borers are collected and placed in a bamboo cage cum percher till flowering. It permits the escape of egg parasites and trap and kill the hatching larvae.

Chemical control measures

Chemical control measures are used under IPM as a last resort. Application of pesticides has to be need based and proper crop health monitoring, observing ETL and conservation of natural bio control agents has to be ensured before deciding in favour or use of chemical pesticides

State Profile

The Chhattisgarh, is also known as “Bowl of Rice” and is the 10th-largest state in India with an area of 52,199 sq mi (135,190 km²), It was carved out of Madhya Pradesh on November 2000. Raipur is the capital of the state. It borders the states of Madhya Pradesh on the northwest, Maharashtra on the west, Andhra Pradesh on the south, Orissa on the east, Jharkhand on the northeast and Uttar Pradesh on the north. The Northern and Southern parts of the state are hilly, while the central part is fertile plain. Chhattisgarh has a tremendous agricultural potential with a diversity of soil and climate, mountains, plateau, rivers, natural vegetation and forest. It is unique in sense in many ways. It has no seas and no connection with Himalaya and yet it has hilly and mountains with big rivers. Diversified crops and cropping systems are the typical characteristics of Chhattisgarh. The state is known for rich forest of sal and teak wood, rich in mineral wealth and having tribal dominated population. Chhattisgarh has about 35 big and small tribes inhabiting the state. The cropping system of the state is mainly rain dependent. Mahanadi is the principal river of the state. The other major rivers are – Sheonath, Hosdeo, Mand, Ebb, Pairi, Jonk, Kelo, Indrawati, Arpa and Maniyari. Korba district is situated in the northern half of the Chhattisgarh state and surrounded by the districts Korea, Surguja, Bilaspur and

Janjgir. The District's total area is 7,14,544 hectare out of which 2,83,497 hectares is forest land. Located at 22°20' North latitude and 82°42' East longitude, with a height of 304.8 meter above sea level. The district has a population density of 183 inhabitants per square kilometre (470 /sq mi) (population according to the 2011 census 1,206,563).

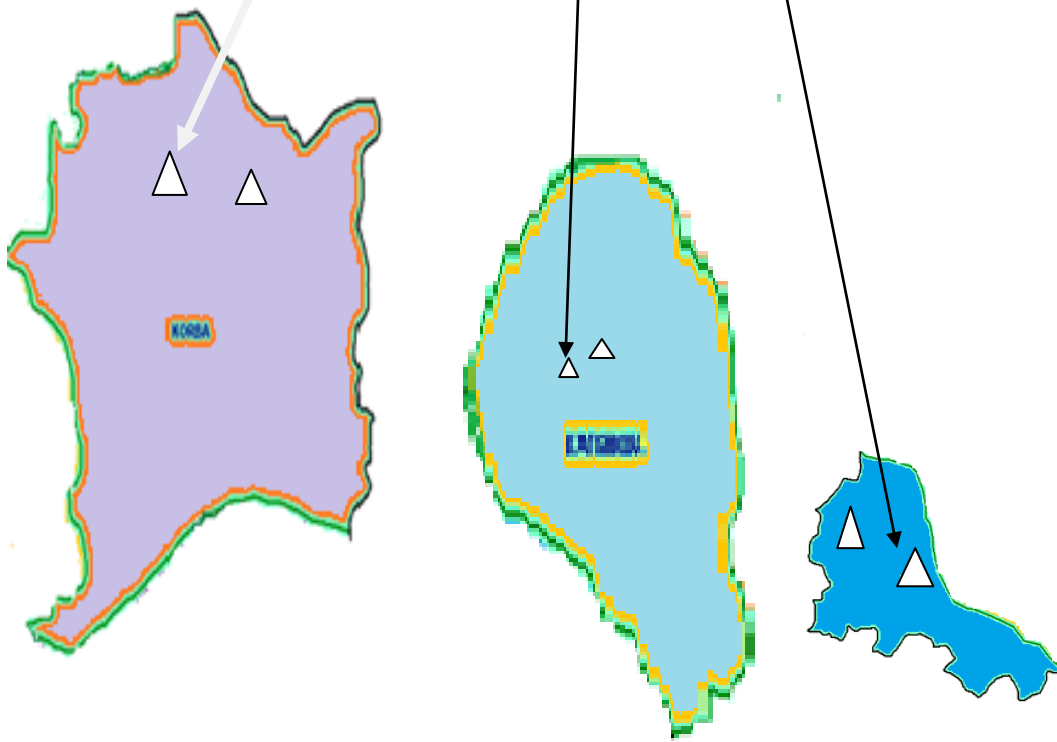
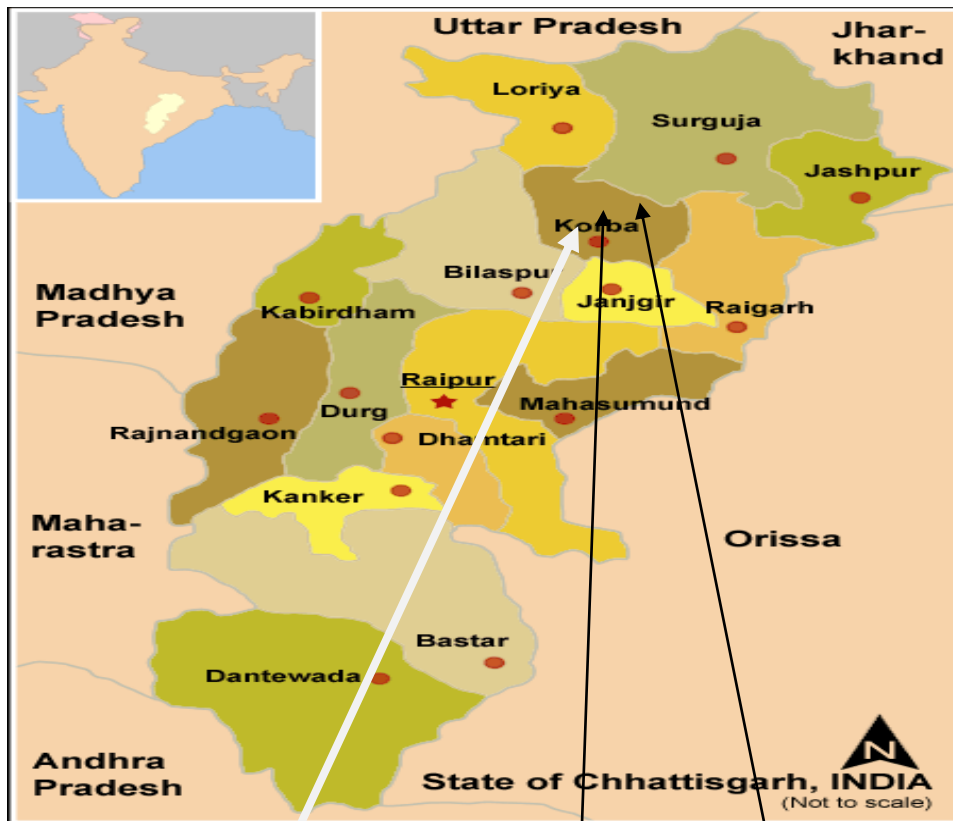
The geographical area of the state is situated between 17°04' to 24°06' N latitude and 80°15' to 84°05' E longitude. Elevations are ranging from 300 to 600 above the mean sea level. Chhattisgarh is spread in 13.51 million hectare area with a gross cropped area of 5.68 million hectare.

It comprises 27 districts and is divided into three agroclimatic zones- they are:- The districts that come in each agroclimatic zone are- Koriya, Surajpur(**new**), Sarguja (Ambikapur), Jashpur and Balrampur(**new**) in Northern hill zone. Raipur, Gariyaband(**new**), Baloda Bazar(**new**), Mungeli(**new**), Balod(**new**), Bemetara(**new**), Durg, Rajnandgaon, Bilaspur, Dhamtari, Mahasamund, Korba, Raigarh, Kawardha, Janjgir and in Chhattisgarh plain zone. Dantewada, Kondagaon(**new**), Sukma(**new**), Narayanpur, Kanker (Uttar Bastar), in Bastar plateau zone. Total forest area occupies 43.8% the net sown area to total geographical area.

Rainfed agriculture is the dominant production system and about 74% of the Chhattisgarh plains, 97% of the Bastar plateau and 95% of the Northern Hills are cultivated under rainfed conditions. The main sources of irrigation are canals, fed by major, medium, and minor irrigation projects, which are also rain dependent. Average rainfall of Chhattisgarh is about 1400 mm of average annual, traditional farming system. The productivity of rainfed rice is 10-12 q/hac where as it is 16 to 19 q/hac in irrigated area. Brown plant hopper in rice is recognized as serious problem of rice followed by stem borer by most of the farmers. Nuvacron, nuvan and phorate is the

most popular insecticides used by the majority of the farmers. New insecticides imidacloprid and chloro + cyper. Carbaryl is not liked by the farmers. Most of the farmers prefer dust and granule formation and large farmers are mostly using etc. Paddy of the paddy growers keep knapsack sprayers as insecticide application.

Full quantity of the insecticides. Applying the insecticides in morning hours. The most common drought stress period of rainfed rice in the region occurs either at the early growth stage of the crop or at the terminal stage (reproductive phase). Drought is a recurring phenomenon in the rainfed lowland ecosystems in the state and, consequently, the average productivity is low.



3.1 Location map of the study area

Statement of the problem

Adoption of high yielding varieties of paddy are more susceptible to pests and diseases and the incidence of pests and diseases are stupendous, enormous and normally beyond the reach of the farmers. 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/fungicide, any tool is good enough provided it meets the environmental safety, provides safeguard to the people and goods harvest to the farmers feed. Judicious use of chemicals as a component of integrated pest management (IPM) is the safest means of pest control among the methods available now.

The success of IPM largely depends on the proper adoption of IPM practices by the farmers. However, empirical evidences as to the impact of IPM in terms of knowledge, adoption, particularly in paddy crop is meager. Hence, a study on the knowledge and extent of adoption of IPM practices by farmers were designed which will be great use to orient extension activities to take advantage of IPM by farmers in the cultivation of paddy crop.

FFS have a profound importance for Integrated Pest Management in Chhattisgarh state, The overall objective of the study was to identify and compare FFS trained and FFS untrained farmers and to determine the profitability of IPM technology, which produces the maximum favourable impact on socio-economic condition of the farmers. Keeping this in view, the present study entitled “**Impact of Farmer’s Field School Training Program on Adoption of Integrated Pest Management practices in Rice by the farmers of the Korba District of Chhattisgarh**” was designed with the following specific objectives.

1. To determine the socio-economic profile of the selected trained and untrained farmers of Korba district.
2. To find out the level of knowledge of the respondents regarding Integrated Pest Management practices for rice.
3. To determine the extent of adoption regarding Integrated Pest Management practices in rice by the respondents.
4. To determine the relationship between selected independent variables and extent of adoption of the respondents about IPM practices in rice.
5. To identify the constraints faced by the respondents in adoption of Integrated Pest Management.
6. To obtain the suggestions from the respondents for enhancing the adoption of IPM practices in rice.

Scope of the study

The research study would attempt to assess the Impact of Farmer's Field School Training Program on adoption of IPM practices by Rice growers. The findings of this study provide valuable information to all public and private extension agents, researchers and policy makers to achieve their efforts for maximum diffusion and adoption of IPM practices on a large scale of farmer feed. The results of the study pertaining to the constraints and suggestions would help to taken out appropriate remedial measures by the extension agencies.

LIMITATION OF THE STUDY

1. The present study faced the limitations of the time and the resources to be encountered by the researcher.
2. The items included in the study for detailed investigation are also limited because it is not possible to cover all the segments in such a short time.

3. Although every efforts were made to make the best use of standardized tools and techniques of data collection, yet their accuracy may not guaranteed.
4. As present study is based upon the opinions expressed by the respondent's and individual attitude, which were perceived by them, hence biasness might had occurred as it happened in most of the cases in such type of field study.
5. All possible precautions were taken to make the study precise, valid and reliable and as the present study were restricted to vicinity of Korba district. Even though, the trend of finding may not give true picture of those areas, which had not resembled the present setting of locations.

Review of Literature

CHAPTER- II

REVIEW OF LITERATURE

One of the important aspects of research is the review of past literature. The researcher has to review the concerning literature at every stage. It is not a one shot exercise but a continuous process, while going through the literature, the researcher get acquainted with the subject-matter, techniques and materials and guide his efforts in desirable direction. Through review, researcher comes to know about the methods, procedures and techniques as well as results of past studies. It provides clues and guidance throughout the research process. Steady efforts were made to compile research findings of the research studies possessing more or less similar characteristics. Attempts have been made in this chapter to review the relevant literature available on impact assessment of various programmes for farmer's upliftment in India and abroad.

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

- 2.1 Socio-personal characteristics
- 2.2 Socio- economic characteristics
- 2.3 Communicational characteristics
- 2.4 Socio-psychological characteristics
- 2.5 The impact of FFS training on adoption of the Integrated Pest Management measures in rice.
- 2.6 Constraints
- 2.7 Suggestions

❖ INDEPENDENT VARIABLES

2.1 Socio-personal characteristics

2.1.1 Age

Karthikeyan *et al.* (1995) reported that age of the respondents had a significant and close relationship with the level of adoption of integrated pest management technology.

Adesehinma and Ogunmodele (1995) found that almost half of the respondents belonged to old age group.

Gupta (1998) stated that maximum beneficiaries (45%) belonged to less than 35 years of age, while, majority (57.50%) of non-beneficiaries were categorized between 35-50 years.

Tiwari and Lall (1998) found that age of farmers was positively and significantly related with scientific attitude of sugarcane growers.

Joshi (1998) reported that nearly half (44.00%) of the respondents were from young age group.

Shrivastava (1999) revealed that the majority of the respondents (47.2%) belonged to middle age group (36 to 50 years). About 29 per cent farmers were young, whereas 23.2 percent respondents were old, having more than 50 years of age.

Gogoi *et al.* (2000) revealed that the majority of both trained (60%) and untrained (57%) respondents were middle age group.

Nagaraj *et al.* (2000) found that age of big farmers was significantly and positively related with their adoption level.

Sharma *et al.* (2000) reported that there is no association between the extent of adoption and farmers age.

Choudhary *et al.* (2001) stated that there is a non-significant relationship between age and adoption of integrated pest management technology.

Christian (2005) concluded that majority (70.00 %) of the cotton growers were in the old age group and only 3.33 per cent were in the young age group.

Vathsala (2005) revealed that, nearly half of (48.9%) the respondents were middle aged followed by young age (26.7%) and old age (24.4%) respectively.

Mewara and Pandya (2007) reported that majority (60.00 %) of the tomato growers were in middle age group, where as old and young age group were 34.00 per cent and 6.00 per cent respectively.

Rama Rao *et al.* (2007) observed that age of the farmer influenced the adoption decision negatively whereas the other variables influenced positively and also the farmer's age increases by one year, chances of adoption will decrease by about 4 per cent the odds ratio being 0.94.

Yomota and Tan-Cruz (2007) revealed that age is positively related with the rate of adoption. The result is contrary to what roger (2003) stated that young farmers are more willing to adopt a new innovation than an elder one because they are more open.

Singh *et al.* (2008) observed that that majority of contact farmers (48.0%) belonged to middle age group between 36-50 years, followed by young age group (27.0%) and old age group (25.0%) above 50 years.

Ofuoku, *et al.* (2009), observed that most (62.81%) of the farmers were in their middle age of 31-40 years.

Banjo *et al.* (2010) observed that none of the farmers was less than 25 years old, about 9.6% were in the 26 to 35 age bracket, 34.6% were between 36 and 45 years

of age, 46.2% were between 46 and 55 years old while 9.6% of the farmer pictogram level.

Gupta *et al.* (2010) concluded that the extent of participation of young group was more than the middle and older age groups in the watershed development programmes. Majority of young and middle aged groups had medium level of participation. However the age of the respondents had non significant association with their extent of participation.

Kaushal and Singh (2010) found that age was negatively correlated with political-legal empowerment.

2.1.2 Education

Saxena *et al.* (1990) revealed that education status of a farmer and adoption were found to be positively and significantly correlated.

Patil (1991) found that there was a positive and significant relationship between adoption behaviour and education.

Dubey *et al.* (1992) investigated that the adoption behaviour of marginal and small farmers had a significant relationship with education in relation to paddy technology.

Jassi *et al.* (1998) revealed that more than half (56.00 %) of the respondents were with secondary level of education. followed by primary level of education (22.03 per cent).

Dongerdive (2002) stated that 39.33 per cent of the respondents had education up to secondary level, while 28.00 per cent and 14.00 per cent of them had higher secondary, college and primary level of education, respectively and rest of them (3.33 per cent) were illiterate.

Gokhale *et al.* (2002) observed that amongst the literate 39 per cent were educated up to primary education level, while 20 per cent were educated up to high school.

Christian (2005) revealed that majority (62.50 %) of the respondents had secondary level of education, followed by 32.50 per cent of them who had primary level of education. Only 5.00 per cent of the respondents had college level of education.

Vathsala (2005) revealed that, 38.9 per cent of the respondents were educated up to high school level and another 30.00 per cent were educated up to college level where as 13.3 per cent of the respondents were educated up to middle school level and 7.8 per cent of the respondents were educated up to primary school level, 5.6 per cent of the respondents were educated up to degree level. Only 4.4 per cent of the respondents were illiterates.

Kumar *et al.* (2007) showed that 47.33 per cent of the farmers had education below primary level while 48 per cent had upto middle and high school education. None of the farmers under rainfed agro eco-system had education above matric, while under irrigated agro eco-system 28 per cent of the farmers had education above matric; still about 13 per cent of the farmers were illiterate in the study area.

Rama Rao *et al.*, (2007) observed that an illiterate farmer has only 44 per cent chances of adoption of a literate farmer.

Singh *et al.* (2009) concluded that maximum number of respondents (25.0%) were primary level educated followed by 24 per cent having junior high school level of education, 23 per cent were intermediate and 18 per cent were high school level educated.

Ofuoku, *et al.* (2009), observed that the highest educational level attained by most of the farmers were secondary education.

Banjo *et al.* (2010) observed that more than half of the farmers have no formal education (55.8%), 40.4% of them have primary education and only a scanty 3.8% had secondary education, none had tertiary education.

Gupta *et al.* (2010) observed that the level of participation increased with the level of education and was significantly associated.

Kaushal and Singh (2010) concluded that economic empowerment was found positively correlated with education and further reveals that political-legal empowerment had significant relationship with education.

Bolarinwa and Fakoya (2011) revealed that both beneficiaries (70.4%) and non-beneficiaries (32.8%) had formal education, thus beneficiaries education accounted for their access to credit facilities.

2.1.3 Size of family

Rode (1987) noticed that the number of agricultural information sources and communicational channel used by the small farmers had positive relation with family size.

Saxena *et al.* (1990) observed that family size of the farmers had no association with adoption of innovations.

Choudhary *et al.* (2001) observed that the size of family was having non-significant but positive relation with adoption of improved rice technology.

Rao (2001) found that majority of beneficiary (60%) as well as non-beneficiary (57.78%) respondents had 5-10 members in their families, also 27.78 per cent and 12.22 per cent beneficiary farmers had small and big size families, respectively. About 40 per cent and 2 per cent farmers had small and large families, respectively in case of

non-beneficiaries.

Dongerdive (2002) concluded that majority (78.67%) of the respondents were found with large size of family, where as only 21.33 per cent of them were found with small size of family.

Sah and Chand (2002) concluded that family size was positively and significantly correlated with the adoption.

Singh *et al.* (2003) concluded that 49.57 per cent of respondents were having small size family followed by 30.43 per cent with large size family and 20.00 per cent with medium size of family.

Tadele Tafera (2007) observed that the women farmers had a mean family of member number of 6. Anonymous (2007-08a) observed that in average family size was 9 in rainfed zone and 8 in irrigated zone and of female/1000 male, were 900 in rainfed and 853 in irrigated zone. Anonymous (2007-08c) observed that the average family size is 5.12 and it is positively correlated with holding size.

Ajala *et al.* (2008) showed that 42.5 per cent of respondents were having fairly large family (6-10 person) followed by 30.8, 11.7, and 15.0 per cent respondents had small size (1-5 person), large size (11-15 person) and very large size (16-20 person) family, respectively.

Gupta *et al.* (2010) concluded that size of the family had a significant association with the level of participation.

Ogola *et al.* (2010) found that the average family size for the surveyed areas was 7.2.

2.1.4 Experience about IPM practices

Ortiz *et al.* (2004) studies of the Peruvian FPR-FFS programme indicated that participants are 48.5 per cent of respondents more experienced and that their expertise

further increases after an additional year of participation. The benefits to participants can be evaluated more directly by comparing the productivity of participants' farms compared with non-participants' farms. For the Peruvian FPR-FFS programme, participants had significantly higher average levels of productivity.

Nualnoom and Praneetvatakul (2005) analysed the impact on the environment and on farmer's knowledge of a farmer field school (FFS) project on integrated pest management in Thailand. Results revealed that the environmental risk of farmer's practices declined among those who participated in the FFS. The experience score of participant farmers significantly increased, while that of non-participant farmers remained unchanged.

2.2 Socio- economic characteristics

2.2.1 Occupation

Gaikwad and Gunjal (1989) revealed that there was no relationship between occupation of beneficiaries and knowledge gained. They also revealed that there was highly significant relationship between occupation of beneficiaries and adoption behavior.

Rahman *et al.* (1990) found that occupation was significantly related with the family who predicted agriculture as their main occupation.

Adesehinwa *et al.* (2004) revealed that 90 per cent of the respondents were involved in farming, while 4 per cent were involved in trading as primary occupation but took to farming as secondary occupation. 92 per cent of those involved in farming as primary occupation claimed that they were involved in both crop and livestock production.

Kumar *et al.* (2007) concluded that agriculture was the main occupation of majority (97.33%) of the farmers. Most of them had agriculture as their primary

occupation and dairying as the secondary occupation. Only 13.34 per cent of the IVLP farmers were engaged in other vocations such as service, business and other activities. It could be interpreted that still most of the farmers depend on agriculture and dairying for their livelihood in the villages.

Tiwari and Solanki (2007) found that agriculture was the main occupation of the SHG members (64.37%) and link workers (59.37%) however majority of them were involved in some subsidiary occupation like agricultural labour, animal husbandry, business, etc.

Odeyinka *et al.* (2007) observed that the major occupation of the respondents, 76.98 per cent indicated crop production, 35.97 per cent indicated rearing of animals and few (23.02%) others engaged in non-farming business as their major occupation.

Ajala *et al.* (2008) reported that majority (56.7%) respondents were having farmers followed by 18.3, 15.0, 5.8 and 4.2 per cent respondents had traders, civil servants, students and others, respectively.

Arya and Chander (2009) observed that the 67 per cent of the population concentrated in rural areas involved mainly with agriculture and animal husbandry.

Singh *et al.* (2009) observed that all the farmers (100.0%) have agriculture as their main occupation. Only 25.0 per cent farmers were having business (19.0%) or service (6.0%) as their subsidiary occupation. It indicates that 75.0 percent of farmers did not associate with any subsidiary occupation.

Gupta *et al.* (2010) concluded that occupation of respondents had a significant relation with the extent of participation.

Kaushal and Singh (2010) concluded that economic empowerment was found positively correlated with family occupation.

Ogola *et al.* (2010) found that the 88.9 per cent respondents had doing farming only and only 11 per cent engaged in activities other than farming (e.g., teaching, petty trading and pottery making).

Bolarinwa and Fakoya (2011) found that 84.0 per cent of the beneficiaries were engaged in non-farming income generating activities while 38.4 per cent were engaged in non-farming income generating activities.

2.2.2 Size of land holding

Subramaniam *et al.* (1978) reported that increase in farm size would follow with an increase in the extent of adoption.

Babu (1991) observed that the existing land use patterns are not even able to fulfill the basic needs of the rural people. All the socioeconomic indicators analyzed show that agro-forestry is an ideal land use method for the small and marginal farmers. It helped to get them better output for their labour and also increased in the long run.

Gogoi and Phukan (2000) revealed that a high degree association was found between size of land holding and extent of adoption in improved rice cultivation.

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

Kouch *et al.* (2003) showed that the majority (55%) of the 20 sampled households had agricultural land of less than 0.5 ha, 10 per cent had more than 0.5 ha, another 10 per cent more than 1 ha and 25 per cent had no agricultural land.

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

Deshmukh *et al.* (2007) observed that in case of land holding as the study sample was concluded on the basis of proportionate random sampling methods hence the equal number of percentage i.e. 33.33% of respondents were selected from small, medium and large category respectively.

Dwivedi *et al.* (2007) revealed that majority of the respondents (50.6%) had marginal farmers (=1 ha), followed by 25.6 per cent who belonged under small size of land holding (1 to 2 ha), whereas 23.8 per cent of the respondents were having medium / large size of land holding (> 2 ha).

Kumar *et al.* (2007) concluded that half of the farmers had less than or equal to 5 acres of land. It clearly reflected that the representation of small farmers under TAR-IVLP was more emphasized. However, 24.67 and 25.33 per cent of the beneficiaries were categorized as medium and large farmers, respectively. The involvement of small farmers (61%) was more in rainfed agro eco-system than irrigated agro eco-system (38.67%).

Rama Rao *et al.*, (2007) observed that the farm size and proportion of area under cotton influenced the adoption decision negatively.

Patel (2008) stated that most of the respondents (30.66%) had small (1 to 2 ha.) sized land holding.

Singh *et al.* (2008) revealed that majority of (50.0%) the respondents belonged to small category, followed by 48 per cent marginal farmers and only 2 per cent were big farmers.

Ofuoku, *et al.* (2009) observed that 63.73% of farm households had 6-10 members and also shows that 64.04% of the farmers had less than six household members assisting in pesticides and other agro-chemical application. Household size had positive influence.

Banjo *et al.* (2010) observed that the size of the land owned by the farmers range from as little as a plot to as much as 10ha (about 25 acres) in different farmstead and many of them had small holdings.

Gupta *et al.* (2010) concluded that Non significant relationship of extent of participation was observed with size of farm holding.

Kaushal and Singh (2010) concluded that political-legal empowerment had significant relationship with land holding.

2.2.3 Annual income

Patel *et al.* (1995) in Mehsana and Banskantha district of Gujarat found that great majority of marginal, small, big and pooled sample farmers had medium level of Techno-economic change.

Shrivastava *et al.* (1996) divulges that use of high yielding varieties of paddy depend mainly on size of land and income. Age and education has no association with adopters and non-adopters of the programme and use of fertiliser has significant association with both the adopters and non-adopters.

Shashidhara (2003) revealed that 42. 44 per cent of the respondents belonged to medium level of income (Rs. 1-2 lakh) and in low income category 30. 00 per cent of respondents were noticed, whereas 27. 70 per cent of the farmers belonged to high income group.

Reddy (2006) observed that the economic position of the respondents indicated that high income (more than Rs.59, 000) was noticed and a majority of the respondents (72.50%) were medium landholders.

Gupta *et al.* (2010) concluded that annual income had significant association with the level of participation.

Kaushal and Singh (2010) concluded that economic empowerment was found positively correlated with annual income.

Bolarinwa and Fakoya (2011) revealed that 35.0 per cent of the beneficiaries of the farm credit scheme have income level of Rs. 21,000–50,000 compared to 10.4 per cent of non-beneficiaries in the same income level. Discrepancy in income level of beneficiaries and non-beneficiaries are reflected in farmer's productivity. That is the availability of credit is required for the purchase of needed innovations and agricultural inputs which are utilized to increase income.

2.2.4 Irrigation Availability

Kalra Rajindre and Peshin Rajinder (2000) revealed that IPM villages, 17 per cent of the respondents had canal water as a source of irrigation as compared to the non-IPM village where 33 per cent of the respondents had canal water as a source of irrigation in addition to diesel or electric pumpsets or both and it is positively correlated with adoption of IPM.

Asha *et al.* 2010, concluded that irrigation was found positively correlated with annual income 35.0 per cent of the beneficiaries had rich source of irrigation whereas 22.70 per cent of the non-beneficiaries belonged to poor irrigation source.

Jai Ram *et al.*, (2011) observed that the irrigation availability of area influenced the adoption OF IPM negatively.

2.3 Communicational characteristics

2.3.1 Sources of information

Rao and Moulik (1966) pointed out that the adoption of innovations is a function of contact with the information sources.

Ramachandran (1974) revealed that progressive farmers were the most credible source followed by junior agriculture officer, farm journals and government farms in successive orders.

Gowda and Jayaramiah (1990) found that farmers were motivated to practice soil and water practices in their field through continuous supervision and encouragement by field extension workers in the watershed area.

Prabhu (1990) reported in his study that the utilization of mass media has shown positive and significant relationship with knowledge of farmers.

Singh (1990) stated that the contact with the extension agencies played a major role in influencing knowledge, attitude and adoption behaviour of farmers.

Bhople and Ekre (1991) reported that mass media exposure of the farmers significantly influence the extent of adoption.

Gangadharappa *et al.* (1991) emphasizing the necessity to develop the locally suitable technologies by the concerned personnel's. He also said that proper information management by the researchers and extension workers is need of appropriate strategy for its impact on the farmer's knowledge and adoption with respect to watershed management practices.

Rao and Rao (1996) had shown that the extent of adoption was found to be positively and significantly associated with information source utilization and its credibility.

Miah *et al.* (1998) found that the small farmers were using and preferring local sources for getting the necessary information. Factors like the availability and reliability of sources were considered by the farmers in selecting, choosing and utilizing the media for getting the information. Pal *et al.* (1999) revealed that personal localite sources were more important to the farmers than mass media.

Singh and Singh (1999) revealed that mass media exposure have a great role to play in the dissemination and adoption of improved technologies. These factors showed a positive and significant relationship with the adoption of package of practices for mustard cultivation.

Yadav and Sethi (2000) concluded that a video cassette with high communication fidelity is a strong medium for communicating various messages as respondents had gained sufficient knowledge after exposure to video cassettes.

Ghosh *et al.* (2004) revealed that all communication variables were significantly correlated with adoption of improved animal in non member milk cooperative society, whereas mass media communication personal local sources, personal cosmopolitan sources were significantly correlated with adoption of improved animal husbandry practices in member cooperative society.

Choudhary *et al.* (2001) found that information sources utilization pattern had highly significant and positive correlated with adoption of rice production technology in Faizabad district of U.P.

Gupta *et al.* (2003) indicated that electronic media, television and radio were mostly used and preferred for seeking information on agriculture and development.

Oyesola (2006) revealed that the major sources of information were radio, extension agent, friends and family members.

Deshmukh *et al.* (2007) observed that the majority of the respondents fall under medium sources of information (69.09%) regarding knowledge and adoption of agricultural technology.

Dubey (2008) showed that majority of the respondents (66.92%) were obtaining the information for dairy farming from veterinary field assistants. The study also revealed that 53.84 per cent of respondents were obtaining the information from

veterinary doctors followed by radio (51.53%), TV (44.61%), progressive dairy farmers (40.00%), friends (23.07%) and neighbors (21.53%). It was also found that 10.77, 5.38, 3.84, 3.07 and 2.30 per cent of respondents were receiving information from kisan mela, training, farmer's days, agriculture magazines and news paper. About 7.69 per cent of the respondents were also receiving information from other sources about improved dairy practices. Kumar *et al.* (2008) observed that information source influences the farmer's decision to rear livestock.

Ramesh and Santha (2008) found that higher information source utilization by the respondents would have helped them to accept the practices to higher level.

Rezvanfar and Arabi (2009) revealed that availability of communication channels of respondents about pasture conservation technologies had positive and highly significant relationship with level of adoption of pasture conservation technologies.

Singh *et al.* (2009) revealed that the majority (79.0%) of the Kisan Sahayaks frequently met farmers and radio was the next frequently used source by the farmers (63.0%), followed by input dealers and demonstration (37.0%). Extension officers, scientists, television and leaflets, folders etc. were not used as a source of information frequently. Majority of A.E.Os. (81.0%) followed by block officials (53.0%) and input dealers (48.0%) respectively were occasionally used. Other information sources were used as source of information by 35.0 per cent respondents. Only 7.0 per cent said that scientists were the source of information. While all farmers seldom used leaf let, folder, etc, followed by 93.0 per cent scientists, farmers fair / Kisan Gosthi (88.0%), news paper (82.0%), S.D.O(A.E.) (81.0%) respectively.

2.3.2 Contact with Extension Personnel

Borkar *et al.* (2000) found that extension contacts of the farmers were found significantly associated with knowledge level of bio-fertilizers.

Saxena and Singh (2000) observed that the extension contact had positive relationship with their adoption of organic farming practices.

Christian (2005) indicated that slight less than half (46.00 %) of the cotton growers had low extension contact, followed by 30.00 per cent with high and 24.00 per cent with medium extension contact.

Vathsala (2005) revealed that, 51.1 per cent of the respondents had medium level of extension contact followed by 27.8 percent had high level of extension contact and 21.1 per cent of the respondents had low extension contact category.

Reddy (2006) observed that majority of the respondents (71.67%) belonged to medium extension contact.

Deshmukh *et al.* (2007) observed that majority of respondents had medium (79.51%) extension contact.

Kaur and Gupta (2007) revealed that during pre-project situation (56.86%) sample respondents were found approaching extension functionaries for getting their problems solved which however increased to (215.68%) in the post-project period. Whereas, 23.52 per cent respondents had reported contacting block level officials for the solution of their farm related problems during pre-project situation which however increased to 80.39 per cent in the post-project era. Other functionaries who reported such an 'increase' were the field staff of Punjab agro-corporation (from 9.80 to 49.01%), district level officers (from 13.72 to 52.94%), and the scientists of KVK/ZRS/SAU (from 9.80 to 33.33%).

Maradal *et al.* (2007) found that extension contact was positively and highly significantly correlated with adoption level of sustainable sugarcane cultivation practices.

Singh *et al.* (2008) observed that an extension service has not shown statistically significant impact on adoption rates.

Ofuoku, *et al.* (2009) observed that majority (33.23%) of the farmers had contact with extension agents once in a month.

Prakash and De (2009) concluded that ATMA beneficiaries were having more net profit as compared to non beneficiaries.

2.4 Socio-psychological characteristics

2.4.1 Cosmopolitaness

Kashem and Hossain (1992) reported that majority of sugarcane growers in Bagladesh had medium level of cosmopolitaness.

Borkar *et al.* (2000) reported that cosmopolitaness characteristics of the farmers were found significantly associated with knowledge level of bio-fertilizers.

Gaikwad *et al.* (2003) revealed that cosmopolitaness exhibited positive and highly significant relationship with the adoption level of goat keepers.

Shrivastava and Lakhera (2003) observed that the variables viz. education, caste, social participation, family size, annual income, innovativeness, cosmopolitaness, opinion towards mushroom production technology, contact with agricultural scientist, contact with subject matter specialist and mass media exposure were found to be negative and significantly correlated with knowledge.

Anita (2004) indicated that more than one-fourth (28.30%) of farmwomen had high cosmopolitaness followed by medium (44.20%) category and low (27.50%) cosmopolitaness groups.

Padekar (2004) observed that cosmopolitanism characteristics of the farmers were found to be positive and highly significant at 0.01 level of probability with adoption of bio-fertilizers.

Suresh (2004) reported that 45.00 per cent of milk producers had low level of Cosmopolitanism, followed by 44.17 per cent of them had medium level and 10.83 per cent had high level of cosmopolitanism.

Chandramouli (2005) reported that among the rice growing farmers, 42.50 per cent had medium level of cosmopolitanism, and 39.17 per cent had low and remaining 18.33 per cent had high level of cosmopolitanism.

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

Pandit *et al.* (2007) revealed that cosmopolitanism was having positive and significant relationship with the adoption of mulberry cultivation and silkworm rearing.

Ajala *et al.* (2008) showed that the majority (75%) of the respondents had no visits to any veterinary contacts followed by 16.70, 5.8 and 2.5 per cent respondents had 1-3 contacts, 4-6 contacts and over 6 contacts of the veterinary, respectively. They also showed that only 25 per cent of the respondents reported utilizing the services of the veterinary officers.

2.4.2 Opinion about IPM

Chandrakant Patil (2008) opinion was gathered to know about the impact of IPM practices (Table 4.9). The higher percentage of positive opinion of IPM farmers the adoption is also higher by following IPM practices in redgram, results into positive impact on the environment (75.00%) with the reduction in the number of plant

protection chemicals sprays. As a result of this 66.66 per cent of the total IPM practicing farmers were successful in reducing the expenditure on the labour used to take up spraying of plant protection chemicals.

Suresh Saha (2008) indicated that around sixty per cent of the respondents (61.25%) had medium attitude followed by 20.42 per cent low level and 18.33 per cent high level.

2.4.3 Knowledge about IPM

Rossing *et al.* (1985) and Zadoks (1989b) reported that increase of knowledge was first reward of IPM programmes. It was a significant achievement.

Kenmore *et al.* (1987), Medina (1987) and Pincus (1991) studied IPM training programmes and indicated that farmers acquired knowledge through IPM training programmes.

Adalla and Rola (1986) found that on farm experimentation involving farmer participation in Philippines resulted in farmer's keenness on learning and gaining knowledge about various aspects of IPM.

Haque *et al.* (1988) administered a performance test following the training course. The performance test showed significant increase in the participant's knowledge of IPM principles.

Oudejans (1991) explained that small scale farmers had little knowledge either about insect and disease problems, or about selecting the right product, dosage rate and timing for controlling individual pests.

Bhuiyan *et al.* (1992) in their study on the use of ETL found that higher percentage of IPM trained farmers (100%) compared to untrained farmers (80%) were aware of the natural enemies of pests.

Van de Fliert (1993) studied the IPM-FFS programme in Indonesia and concluded that IPM-FFS trained farmers knowledge reached a satisfactory level, especially with regard to pests and natural enemies' identification, ecological functions in the rice field, and negative effects of chemical pest control to the rice ecosystem. Knowledge increase was usually mentioned as the main reward of IPM training and implementation, before economic profits, as it provided them with more expertise, responsibility and independence in their farm management. Knowledge about natural enemies viz. Spider increased from 21 per cent to 76 per cent, dragonflies from 14 per cent to 46 per cent, and beetles went up from 0 per cent to 26 per cent, while the knowledge about these three natural enemies in non-IPM farmers was 19, zero and six per cent respectively. The study further revealed that gain in knowledge about arthropod natural enemies in IPM trained farmers was as a result of IPM-FFS. Many farmers had the knowledge that ladybird beetles eat brown plant hoppers and eggs, dragonflies eat brown plant hoppers, caterpillars, moths and eggs. The gain in knowledge of respondents before and after IPM training was observed with respect to stem borer white head appearance (increased to 90% from 73%), leaf folder symptoms (increased to 43% from 16%), leaf folder appearance (increased to 31% from 10%).

Baca and Gonzalez (1994) studied an extension model and training methods based on the concept of mass education, which were used for IPM technology transfer in Nicaragua. The results showed a change in the attitude of the farmers regarding pest management and the use of pesticides.

Braun *et al.* (1995) explained the achievements of FFS in Indonesia, where farmers learnt to train other farmers to promote use of IPM to control the pests of sweet potato and other crops. They studied one pilot sweet potato FFS held in Indonesia and concluded that farmers valued gain in knowledge, mainly on the role and importance of natural enemies in the field. As the FFS progressed and the farmer's knowledge increased, more and more farmers felt confident enough to give presentation.

Meir (1995) in his two years evaluation of Zamorano's IPM programme reported that a year after training, farmers remembered key concepts, such as that insects produce sexually, that many insects are natural enemies of pests, and that insecticides kill the beneficial insects.

Winarto (1995) explained that IPM programme provided training to agricultural officers and farmers to shift their perspective in pesticide use through 'knowledge transmission' rather than transfer of 'technological packages'. IPM knowledge of and the stimulus to discover unknown phenomena on the basis of which farmers improve their knowledge and learning capacity.

Peshin *et al.* (1997) studied the impact of training under FFS and reported that the majority of the trained farmers (66%) had high knowledge about recommended IPM practices in rice crop, 80 per cent of the trained farmers had knowledge about stem borer and leaf folder, whereas only 32 per cent of the trained farmers had knowledge about blast and bacterial leaf blight.

Bhople *et al.* (2001) noticed that majority of the respondents in Akola district of Maharashtra had low level of knowledge (73.33%) about the biocontrol pest management in cotton, followed by medium (22.00%) and high level (4.67%), respectively.

Kalashkar *et al.* (2001) conducted a study in Amaravathi district of Maharashtra and revealed that 67.77 per cent of the farmers had medium level of knowledge about integrated pest management practices in cotton. Whereas, an equal percentage of respondents had low (15.76%) and high (16.97%) knowledge level.

Parthasarathi and Santha Govind (2002) in their study conducted in Thiruvannamalai district of Kerala reported that majority of rice growing farmers possessed the knowledge of IPM practices (78.6%). Among the IPM components comparatively more number of farmers have knowledge of cultural methods (42.37%), followed by chemical methods (31.24%), biological methods and physical methods (11.67%) in the cultivation of rice crop.

Venkatesh (2002) reported that in Kolar district of Karnataka state equal percentage of farmers were belonged to low (30.00%), medium (28.67%) and high (41.33%) knowledge of integrated pest management in tomato crop.

Godtland *et al.* (2003) in his study evaluated the impact of a pilot farmer-field-school (FFS) programme on farmers' knowledge of integrated pest management (IPM) practices related to potato cultivation reported that farmers who participated in the programme have significantly more knowledge about IPM practices than those in the non-participant comparison group. Furthermore, improved knowledge about IPM practices has a significant impact on productivity in potato production.

Noorjehan and Ganesan (2004) reported that majority (90.00%) on paddy growers in Trichy district of Tamil Nadu had noticed of respondents had low to medium level of knowledge on pest management practices in rice. Only 10.00 per cent of them were found to have higher-level knowledge of pest management practices.

Godtland *et al.* (2004) conducted a study on the impact of a pilot farmer field school (FFS) programme on farmers' knowledge (as measured by a knowledge test

score) and, subsequently, on the productivity levels in potato cultivation reported that FFS participation significantly enhances knowledge on pests, fungicides, and resistant varieties— all instrumental in implementing integrated pest management (IPM) practices. It also finds evidence that the FFS approach adds to the traditional transfer-of-technology approach in imparting knowledge on technical issues related to IPM to farmers. Results of a simulation exercise indicate that FFS participation would raise the average potato seed output-input ratio by 2.5, or approximately 32% of the average value in a normal year.

Ortiz *et al.* (2004) studies of the Peruvian FPR-FFS programme indicated that participants are more knowledgeable and that their expertise further increases after an additional year of participation. The benefits to participants can be evaluated more directly by comparing the productivity of participants' farms compared with non-participants' farms. For the Peruvian FPR-FFS programme, participants had significantly higher average levels of productivity.

Nualnoom and Praneetvatakul (2005) analysed the impact on the environment and on farmers' knowledge of a farmer field school (FFS) project on integrated pest management in Thailand. Results revealed that the environmental risk of farmers' practices declined among those who participated in the FFS. The knowledge score of participant farmers significantly increased, while that of non-participant farmers remained unchanged.

Reddy (2006) observed that (66.67 %) majority of respondent are having medium knowledge.

Venkatashivareddy (2006) find out that in knowledge in adoption of IPM practices among vegetable growers of gadag district in north Karnataka. Majority of

the vegetable growers possessed medium level of knowledge about IPM practices in tomato (66.70%) and cabbage (61.60%).

Bunyatta *et al.* (2006) in Kenya find out in his study that there was a significant difference in knowledge acquired in S & CM technologies by FFS compared to NFFS farmers. About 50% of FFS farmers had acquired high to very high level of the knowledge of all the eight technologies disseminated while the majority (>80%) of the NFFS farmers had acquired less than 50% of the same knowledge.

Yamini and Rajendran (2007) reported that 45 per cent of farmer gain correct knowledge towards IPM, resistant varieties (40.00%), INM (35.00%), chemical pesticides (55.00%) and biological control (50.00%) compared to non-FFS farmers (40.00%, 35.00%, 30.0%, 40.00% and 30.00%, respectively).

Sailaja and Narasimha (2008) investigate on knowledge of farm women in paddy cultivation, respondents possessed knowledge in farming system (11.00%) followed by transplanting (8.00%), water management (7.33), weed control (7.33), soil conservation and reclamation (7.67) and seed and sowing (7.20) in that order.

Rustam (2010) reported that the IPMFFS has significant effect on farmer's knowledge and the IPMFFS improves three aspects of the ability of farmer groups that is the ability to plan activity for improving agribusiness productivity, to implement and obey agreement with other institution, and to apply technology and information, and team work.

2.5 Adoption of IPM Practices

Adalla and Rolla (1986) and Kenmore et al. (1987) reported that farmers were trained in groups throughout a rice growing season in Philippines. Real plants and insects were used as training materials instead of hand outs. Lectures were avoided and technology was greatly simplified. The results were notable as the farmers were able to identify pest problem better and trusted more decision making ability. Pesticide use by trained farmers decreased, resulting in reduction of pest control costs.

Galvan and Kenmore (1991) inferred that by adopting IPM practices the use and dependence upon pesticides had dramatically reduced in areas where training in IPM had been imparted to rice farmers in Philippines.

Juliana *et al.* (1991) conducted a study on Integrated Pest Management practices on cotton crop in Vasudevanallur block of Tirunelveli district (Tamilnadu) and reported that nearly half (47.50) of small farmers and more than half (52.50) of big farmers were found to be medium adopters of IPM practices. Higher percentage (42.50%) big farmers were found to be higher adopters when compared to small and marginal farmers by 22.50 percent and 5.00 percent respectively.

Bhuiyan et al. (1992) had conducted a study to examine the adoption of ETL concept by the two groups of rice growing farmers in Philippines. One group of farmers was trained in IPM. Of trained and untrained farmers, 41 per cent and 68 per cent respectively applied insecticide following the use of fertilizers. Out of trained farmers, 44 per cent compared to 71 per cent untrained farmers based their decision to apply insecticides after fertilizer application, for offering early protection. From trained farmers, 56 per cent used the concept of ETL compared to 20 per cent untrained farmers. Out of these, 71 per cent and zero percent of trained and untrained farmers respectively determined ETL before applying insecticides.

Chin *et al.* (1992) reported on the implementation of IPM programme in rice in Malaysia, which incorporated pest surveillance, cultivating resistant varieties, cultural control, pesticide management, biological control and training. The farmers successfully adopted IPM, which was due to proper organization, well co-ordinated research based data, training and strategic campaign.

Shahid *et al.* (1992) observed that trained IPM farmers in Bangladesh had reduced pesticide use by 60-70 per cent in a single year and increased rice yields by about 10 per cent.

Thuy and Thieu (1992) analysed the initial results of IPM in rice in Vietnam at farmer's level and the results showed that yields increased by 10 per cent and plant protection costs reduced by 23 per cent.

Wiradmadya and Kusmayadi (1996) reported on the banning of broad spectrum pesticides for use on rice in Indonesia in 1986. This had resulted in increase in rice production and reduced the use of pesticides. Field schools were found to be successful in educating farmers and increasing the adoption of IPM.

Kamp *et al.* (1993) revealed that in Bangladesh IPM activities were introduced in late 1980s. Most of the farmers having less than half hectare of land were trained in rice-fish culture and IPM. A survey among these farmers revealed that during 1992-93, virtually all the farmers had stopped adopting pesticides to control insect pests. The farmers who could not cultivate fish, mainly due to lack of adequate water, poor water – holding capacity of the soil, and risk of flooding, reduced their pesticide application by 76 per cent with IPM training.

Van de Fliert (1993) in a case study of IPM-FFS in one central Javanese district of Indonesia, reported that out of the trained farmers, 29 per cent selected certified seed, compared to 20 per cent of non-IPM trained farmers. Sixty per cent of

trained farmers adopted IPM more than that of non-IPM farmers twenty per cent. Significant difference was observed in the adoption of fertilizer practices between IPM and non-IPM farmers, over the four study seasons. The results of chemical control practices, expenditure and yields of IPM and non-IPM farmers in two villages revealed significant achievement of IPM training.

Raghunathan (1995) presented the data obtained from 688 rice FFS in India, which showed an increase in yield upto 34 per cent and 50 to 100 per cent decline in the use of pesticides in IPM areas as compared to non-IPM areas. Even in case of cotton FFS, 20-26 per cent increase in yield and 30-50 per cent reduction in pesticide consumption in IPM plots was observed as compared to non-IPM plots. The productivity of these FFS villages increased from 47.27 q per ha to 53.05 q per ha.

Fernando (1996) presented the achievements of IPM-FFS programme in Srilanka, which revealed that the average number of pesticide applications ranged between three to four sprays, before IPM-FFS. After the IPM-FFS, the farmers reduced the average pesticide application to just one spray in rice crop. It resulted in reducing the cost of pesticides by 50 to 70 per cent and increasing yield by 9 to 25 per cent.

Wiradmadya and Kusmayadi (1996) revealed that IPM farmers refused to adopt new credit and input package being promoted in Indonesia, if that was obliged to be connected with pesticides. Farmers in Central Java organized themselves into block association to manage water and cultural practices more effectively in support of IPM activities. Farmers even created village news papers and other media to promote IPM adoption. IPM farmers applied pesticides on an average, 1.25 times while non-IPM farmers made an average of 3.62 applications during the season. IPM farmers adopted far fewer banned chemicals than untrained farmers.

Peshin *et al.* (1997) studied the impact of IPM training in two villages of Jammu and reported that no farmer had gone for blanket application of pesticides after being trained in IPM-FFS, 42.5 per cent of farmers monitored pest defender ratio (2:1) and 84.5 per cent of farmers who observed insect pests viz. Stem borer and leaf folder applied the concept of ETL.

Krishnamurthy (1999) observed that nearly half of the trained farmers were in high adoption category. However, only 43.00 per cent of untrained farmers were in low adoption category. Seventy per cent of trained farmers adopted recommended quality of NPK and forty per cent of trained farmers adopted chemical method as a last resort of controlling the pests.

Sumati and Alagsan (2000) highlighted that large number of groundnut growers of Salem district in Tamil Nadu adopted the IPM practices. It was observed that the big farmers had high level of adoption (38%), followed by marginal farmers (18%) and small farmers (15%).

Bhople *et al.* (2001) revealed that 81.33 per cent of cotton growers in Maharashtra state belonged to low adoption category with respect to bio- control pest management practices in cotton, followed by 16.67 and 2.00 per cent of them belonged to medium and high adoption categories, respectively.

Bhosle *et al.* (2004) conducted a study in Nanded district, Maharashtra to know the adoption of IPM practices by innovative farmers. The study revealed that majority of the farmers adopted cotton IPM practices. Out of the six independent variables, extension contact, scientific orientation, level of aspiration, risk preference had positive and significant relationship with adoption of IPM practices, but age of the farmers was negatively correlated with the adoption of the IPM practices. Socio-

economic status and scientific orientation also had significant relationship with adoption of cotton IPM practices.

Christain *et al.* (2005) reported that less percentage (37.50%) cotton growing farmers in Vadodara district of Gujarat had adopted IPM practices followed by 36.67 per cent and 25.83 per cent in medium and high category respectively.

Bunyatta *et al.* (2006) in Kenya find out in his study that there was a significant difference in knowledge acquired in S&CM technologies by FFS compared to NFFS farmers. About 45% of the FFS farmers had adopted 50% of the technology components while only 17% of NFFS farmers had adopted the same percentage of the technology components. The FFS participants were significantly ($P < 0.05$) better disseminators of S&CM technologies than the non-FFS farmers.

Venkata shiva reddy (2006) find out that in knowledge in adoption of IPM practices among vegetable growers of Gadag district in north Karnataka. Majority of the vegetable growers possessed medium level of adoption about IPM practices in Tomato (63.33%) and Cabbage (59.17%).

Rama Rao *et al.*, (2007) observed that all the variables except irrigated area included in the model significantly influenced the decision to adopt IPM technologies.

Venkatesh *et al.* (2007) the study was conducted in two taluks of Kolar district to access the adoption level of vegetable growers with respect to integrated pest management practices if tomato crop, study revealed that 42 percent of farmers were in medium adopter group of integrated pest management practices of tomato crop cultivation. The study also revealed that 34.67 per cent of farmers were in low adopter group and 23.3 per cent of farmers were in high adopter group of integrated pest management practices of tomato crop cultivation. Further, it also revealed that, relationship between socio- psychological characters of tomato growers, the variable

mass media use exhibited positive significant, other variables namely age, education, land holding, annual income, extension participation, innovative proneness and scientific orientation showed non-significant relationship with adoption level of IPM practices of tomato crop.

Rustam (2010) reported that the IPM-FFS has good influence to improve the adoption of Integrated Pest Management (IPM) by the farmers.

2.6 Constrains

Kenmore *et al.* (1995) stated that top-down approach promoted by traditional extension generated little interest in farmers and contributed to poor adoption of IPM. The lack of knowledge led farmers to follow suggestions pesticides were necessary in rice fields. The trend was changed with the introduction of non-formal approach to educating farmers in FFS.

Winarto (1995) reported that even though 1989 national IPM programme in Indonesia was a case of break through national policy to enhance the ecological balance by conserving natural enemies and diminishing the indiscriminate use of pesticides in the protection of food crops. IPM knowledge and training provided initial understanding of, and stimulus to discover unknown phenomena, but the constraints largely were due to the inflexibility of the subsidised scheme of inputs and the inadequate explanation provided to the farmers by extension services.

Bently and Andrews (1996) reflected on their experiences with promoting the use of the IPM in Latin America farming. The main obstacles to adoption of IPM were reported to be, insufficient technical knowledge, a weak public sector, inappropriate credit and subsidy schemes, influential agrochemical companies, agro-ecosystem complexity, and language barriers between farmers, scientists and extension agents. It was further reported that no quantitative strategy of sampling (ETL) would be adopted

or accepted by small holders, who lacked the arithmetic and time to count several pest species in their small fields every few days.

Iqbal *et al.* (1996) observed that lack of adequate knowledge on the natural predators and parasites, lack of adequate knowledge on the economic threshold level of different pests, inability to apply pesticides in time, excessive use of synthetic pyrethroids, non availability of NPV were the major constraints in adopting integrated pest management practices in cotton.

Shivaraj (1996) reported that non-availability of pheromone traps, green lace wing predator and NPV lack of knowledge in selecting IPM practices, lack of technical guidance and lack of printed materials were the major constraints which come in the way of adoption of IPM practices.

Sangram (1997) observed that redgram growers were facing problems of non availability of IPM materials in the market (28.24%), labour shortage (28.84%) and high wages (11.54%) per cent respectively in the adoption of IPM practices knowledge about the use of bio-agents, non-availability of recommended insecticides, lack of knowledge about preparation and use of neem seed kernel extract and non-availability of neem seed kernel were the other constraints expressed in adoption of IPM in cotton.

Shinde *et al.* (1997) revealed that cotton growers were unaware about intercropping cowpea/maize as trap crop and lacking knowledge about the use of yellow sticky pan. The inadequacy of labour and high wage rate, lack of knowledge about the use of bio-agents, nonavailability of recommended insecticides, lack of knowledge about preparation and use of neem seed kernel extract and non-availability of neem seed kernel were the other constraints expressed in adoption of IPM in cotton.

Katole *et al.* (1998) revealed that majority of respondents (80.67%) lack the knowledge about biological control. Around eighty per cent (78.67%) stated that cost of insecticide was exorbitant, followed by 69.33 per cent of the respondents faced the difficulties of lack of knowledge about plant protection measures.

Chitnis *et al.* (2000) reported the constraints of non-availability of inputs (19%), phenomena trap (14%) abiotic agents (12%) and non-availability of IPM lab at taluk level.

Krishnamurthy (1999) reported that non-availability of seeds and fertilizers (98.00%) in the cultural practices, lack of literature (98.00%) in the mechanical practices, non availability of plant products (100.00%) and lack of literature (98.00%) are the major constraints expressed by the respondents.

Sumati and Alagsan (2000) highlighted that large number of groundnut growers of Salem district in Tamil Nadu adopted the IPM practices. It was observed that the big farmers had high level of adoption (38%), followed by marginal farmers (18%) and small farmers (15%).

Venkatesh (2002) in study on constraints analysis of tomato growers in the Kolar district reported that eighty six per cent of the respondents cited the problem of susceptibility of crop to pest and disease. Labour shortage and higher wages (62.00%), high transportation cost (58.00%), non-availability of IPM material/input in the market (48.00%), lack of technical knowledge and guidance about IPM (44.67%) and non-availability of sufficient credit (40.67%) were the other problems faced by respondents in the adoption of IPM practices.

Christain *et al.* (2005), reported that cotton growing farmers in Vadodara district of Gujarat had faced the major problems of timely availability of training on IPM (100%) and lack of skilled labours (70%). Similarly the nonavailability of plant production appliances, bioagents in time (47.5%) and high cost of plant protection inputs (38.33%) were the other constraints in the adoption of IPM practices.

2.7 Suggestions

Rafee, (2008) reported that the major suggestions were suggested *viz.* irrigation facilities should be increased more, off and on campus training programmes should be organized on new agricultural technology, more subsidies should also be provided to purchase FYM/ Bio-fertilizers, Bio-pesticides etc.

Yeshwanth Kumar Naik L. G. (2008) suggested government should take appropriate measures to control the mining industry. Whereas, 82.00 per cent of paddy FFS participants suggested that FFS should continued for one mass session on the field of other participants. Majority of the paddy participants also suggested that more number of FFS session should conduct with respect to ICM practices which involve skill. From the content of Table 20, 68.00 and 84.00 per cent of the maize and paddy FFS participants expressed FFS session should continues to one more season on same village on another farmer field, it help to build confidence, 46.00 and 70.00 per cent expressed that 'more FFS session is needed' and 26.00 and 42.00 per cent were expressed we need spray to avoid odor (while preparation of neem seed kernel extract, biodigestor, panchagavya) and 'suggest the Govt. to reduce mining industry' where 78.00 and 64.00, respectively.

Gallagher, K., 2003 reported that paddy growing farmers in Vadodara district of Gujarat must have regular contact among farmers and agriculture officers & scientist (20%) and skilled labours (70%) should be their for practices.

Research Methodology

CHAPTER - III

RESEARCH METHODOLOGY

Research methodology is a detailed action plan of investigation and the blue print of procedure for carrying out the research. This chapter narrates the methods and procedure of investigation used during the entire course of study and is presented under the following heads:

- 3.1 Location of the study
- 3.2 Sample and sampling procedure
- 3.3 Independent and dependent variables
- 3.4 Operationalization of independent variables and its measurement
- 3.5 Operationalization of dependent variable and their measurement
- 3.6 Quantification of constraints faced by the farmers in adoption of IPM practices in rice.
- 3.7 Suggestions from the respondents for enhancing the adoption of IPM practices in rice.
- 3.8 Type of data
- 3.9 Developing the interview schedule
- 3.10 Method of data collection
- 3.11 Data processing and statistical framework used for analysis of data

3.1 Location of the study area

The study was conducted in Korba district of Chhattisgarh, during the year 2011-12. The korba district is situated in the northern half of the Chhattisgarh state and surrounded by the districts Korea, Surguja, Bilaspur, Janjgir etc. The total area of the district was 7, 14,544 hectare out of which 2, 83,497 hectares was forest land. The headquarter of Korba districts was situated about 200 KM. from the capital city

Raipur. Korba was located at 22.35°N 82.68°E. It has an average elevation of 252 meters (826 feet). Located at 22*20' North latitude and 82*42' East longitude, with a height of 304.8 meter above sea level.

Chhattisgarh state has 27 districts i.e., Bilaspur, Mungeli(**new**), Korba, Janjgir-Champa, Raigarh, Dhamtari, Gariyaband(**new**), Raipur, Baloda Bazar(**new**), Mahasamund, Kawardha (Kabirdham), Rajnandgaon, Balod(**new**), Durg, Bemetara(**new**), Bijapur, Sukma(**new**), Dantewada (Dakshin Bastar), Bastar (Jagdalpur), Kondagaon(**new**), Narayanpur, Kanker (Uttar Bastar), Koriya, Surajpur(**new**), Sarguja (Ambikapur), Balrampur(**new**), Jashpur. Out of foresaid district, Korba district is purposively selected for the study.

3.2 Sample and sampling procedure

3.2.1 Selection of blocks

The korba district has five blocks i.e (Korba, Kartala, Katghora, Pali and Podi-uproda) out of these blocks only 3 blocks i.e., Korba, Katghora and Pali and blocks were selected for the study, because sizeable number of FFS trained rice growers were residing in this district.

3.2.2 Selection of villages

From each selected block, 2 villages (Total 3x2=6) were selected randomly on the basis of maximum availability of trained farmers in the villages. Village Bela and Dondro from Korba block, Arda and Ghanakachaar from Katghora block and Gopalpur and Irraf from Pali block were selected randomly.

3.2.3 Selection of respondents

From each respective village 10 trained farmers (10x6=60) were selected randomly. For comparison and to know the impact of FFS training program on adoption of IPM practices in rice 10 untrained farmers (Total 10x6=60) were also



INTERVIEW REGARDING FFS & IPM

selected from same village through simple random sampling. In this way total numbers of 120 respondents were considered for the collection of data.

Table 3.1 Details about selected study area and number of respondents

Selected districts	Selected blocks	Selected villages	Number of selected respondent	
			FFS trained	FFS untrained
Korba	1.Korba	1.Bela	10	10
		2.Dondro	10	10
	2.Khatghora	1.Arda	10	10
		2.Ghanakachaar	10	10
	3.Pali	1.Gopalpur	10	10
		2.Irraf	10	10
Total	3	6	60	60

Total sample size = 120

3.2.4 Collection of data

The data were collected through predetermined tested interview schedule.

3.2.5 Statistical methods

The obtained data were tested with suitable statistical tools.

3.3 Independent and dependent variables

3.3.1 Independent variables

1. Age
2. Education
3. Size of Family
4. Experience about IPM
5. Occupation
6. Land holding
7. Annual income
8. Irrigation availability
9. Sources of information
10. Contact with extension personnel
11. Cosmopolitaness
12. Opinion about IPM
13. Knowledge about IPM



OPINION OF RESPONDENT REGARDING IPM

3.3.2 Dependent variables

The impact of FFS training on adoption of the Integrated Pest Management measures in rice.

3.4 Operationalization of independent variables and their measurement

3.4.1 Age

The age of the FFS trained farmers and FFS untrained farmers as informed by them during personal contact was recorded. The chronological age of the FFS trained farmers and FFS untrained farmer used for analysis and the categories of farmers along with score is as follows:

Categories	Score
Young (<35 years)	1
Middle (36-50 years)	2
Old (>50 years)	3

3.4.2 Education

The reading and writing capability acquired by the farmers was considered as their education status and it was categorized as under:

Categories	Score
Illiterate	0
Primary (up to 5 th class)	1
Middle (6 th to 8 th class)	2
High school (9 th to 10 th class)	3
Higher secondary (11 th to 12 th class)	4
Above higher secondary (>12 th class)	5

3.4.3 Family size

On the basis of number of members in the family of the respondents the following categories were made on the basis of applied statistical tools:

Categories	Score
Small (up to 5 members)	1
Medium (6 to 10 members)	2
Large (>10 members)	3

3.4.4 Experience regarding IPM

The scale given below was used for analyzing the experience in terms of using IPM in Rice.

Categories	Score
Less experienced (up to 3 years)	1
Medium experienced (4 to 8 years)	2
High experienced (Above 8 years)	3

3.4.5 Occupation

The occupation was the primary source of income which contributes most towards the upkeep of the family of the respondent. The categories and scores were assigned as follows:

Categories	Score
Only Agriculture	1
Agriculture + Labor	2
Agriculture + Animal husbandry	3
Agriculture + Horticulture	4
Agriculture + Business	5
Others	6

3.4.6 Land holding

The actual land possessed by the respondents in acre was considered as such for measuring this variable and on the basis of their land holding, respondents were categorized as below:

Categories	Score
Marginal farmer (up to 2.50 acre)	1
Small farmer (2.51 to 5 acre)	2
Medium farmer (5.1 to 10 acre)	3
Large farmer (> 10 acre)	4

3.4.7 Annual income

In the study, total annual incomes from all the available sources of respondents were calculated and then the respondents were categorized in the following manner:

Annual income	Score
Low (up to Rs. 20,000)	0
Medium (Rs. 20,001 to Rs.30,000)	1
High (Rs. 30,001 to Rs. 50,000)	2
Very high (> Rs.50,000)	3

3.4.8 Irrigation availability

In the study, total irrigation from all the available sources of respondents were calculated and then categorized in the following manner:

Categories	Score
Canal	2
Tube well	1
Others	0

3.4.9 Source of information

A set of 11 information sources were identified including personal, group and mass media and each source was given equal weightage and categories were made according to the use of information sources. The respondents were grouped into three categories by using mean and S.D. for analysis purpose the scoring was made as under:

Source of information	Score
Low utilization (1-2 sources)	1
Medium utilization (3 to 4 sources)	2
High utilization (above 4 sources)	3

3.4.10 Contact with Extension personnel

This was operationally defined as the “frequency with which a respondent comes in contact with extension agents i.e. Rural Agriculture Extension Officer (RAEOs) Agriculture Development Officer (ADOs), Agricultural Scientist and Subject Matter Specialist (SMS) within a specific period of time”. The extent of contact was measured by four point continuum scale viz., never, 2-3 times a year, monthly, weekly with a score 0, 1, 2 and 3 respectively. On the basis of overall obtainable score, the respondents were grouped into four categories as following manners:

Categories	Score
Nil	0
Low level	1
Medium level	2
High level	3

3.4.11 Cosmopolitaness

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

To measure cosmopolitaness of respondents, they were asked to indicate their extent of contact with outside to their social system by their own efforts. The procedure followed by Ravishankar (1979) was used in quantification this variable. The respondents were grouped into four categories as following manners:

Categories	Score
Nil (Never)	0
Low (Once in a month)	1
Medium (Once in a weak)	2
High (Twice or more in a weak)	3

3.4.12 Opinion about IPM

The opinion of respondents was categorized on the basis of IPM. The respondents were categorized as follows:

Categories	Score
Disagreed	0
Agreed	1

3.4.13 Knowledge regarding IPM

Knowledge about innovation may be an important factor affecting the adoption behavior of farmers. Bloom (1979) defined knowledge as “those behavior and best situation which emphasized the remembering either by recognition or recall of ideas, materials on phenomenon.” Operationally knowledge was used in this study as actual knowledge of farmers regarding selected practices i.e. cultural control method in IPM programme, disease management, pest management and post harvest management.

A device was developed to measure the knowledge level of farmers regarding selected practices. To assess the knowledge of FFS trained respondents about different aspects of IPM programme a three point contenum scale was used i.e. ‘Full’, ‘Partial’ and ‘Nil’ with score of ‘2’, ‘1’ and ‘0’, respectively. A knowledge index was worked out to assess the level of knowledge of each respondent with the help of following equation:

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

Where,

KI = Knowledge index of respondent

O = Total obtained score by respondent

S = Total obtainable score

On the basis of knowledge index (KI), respondents were categorized for presentation and analysis of data in the following manner:

Categories	Score
Full	2
Partial	1
Nil	0

3.5 Operationalization of dependent variable and their measurement

3.5.1 The adoption of Integrated Pest Management practice on rice production.

In the present study, the adoption of selected practice upto any extent was considered as adoption. It was ascertained in term of adoption index based on four selected recommended IPM practices adopted by FFS trained farmers regarding selected practices i.e. Insect Management, Disease Management, Weed Management and Post Harvest management. The response of the respondents regarding adoption of selected practices, a three point contenum scale was used i.e. 'Full', 'Partial' and 'Nil' with score of '2', '1' and '0', respectively. For detailed analysis adoption index was worked out for each respondent by using the following formula:

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

Where,

AI_i = Adoption index of i^{th} respondent

O_i = Total score obtained by the i^{th} respondent

S = Total obtainable score

On the basis of adoption index, farmers were categorized as following:

Categories	Score
Full	2
Partial	1
Nil	0

3.6 Constraints faced by the farmers in adoption of IPM practices

The constraint means “confinement restriction of liberty or compulsion of circumstances or compulsion put upon the behavior” (Oxford dic.). In the context of the present investigation the constraints have been operationally defined as the problem faced by the farmers in adoption of IPM practices. For the present study the problem encountered by the farmers, were identified by taking their response to an open question. The simple ranking technique was applied to measure the constraints faced by the farmers in adoption of IPM practices. Each respondent was asked to mention his constraints in adoption of IPM practices. A list of these constraints was ranked on the basis of frequencies and percentages.

3.7 Suggestions from the respondents to overcome the constraints for effective adoption of IPM practices.

FFS trained farmers and untrained farmers were asked to give their valuable suggestions to overcome the constraints faced by them in adoption of IPM practices. The suggestions offered were summarized on the basis of number and per cent of respondents who reported for the respective suggestions.

3.8 Type of data

The data pertaining to selected characteristics about socio-personal, socio-economic, communicational, socio-psychological and constraints/problems and suggestion as perceived by respondents on relating to Adoption of of recommended IPM practices were collected as per objectives of the study as primary data. The official information and records were also consulted from the concerning departments as secondary data.

3.9 Developing the interview schedule

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

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

3.9.1 Validity

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

1. The interview schedule was thoroughly discussed with the concerned scientists and member of advisory committee and their suggestions were incorporated.
2. Pre-testing of interview schedule provided an additional check for improving the instrument.
3. The relevancy of each question in terms of objectives of study, their logical order and wordings of each question was checked carefully.

3.9.2 Reliability

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

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

3.10 Method of data collection

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

3.11 Data processing and statistical framework used for analysis

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

3.11.1 Frequency and percentage

Frequency and percentage were used for making simple comparison.

3.11.2 Mean and standard deviation

(i) Mean

Mean of sample was calculated by using the following formula:

$$\bar{x} = \frac{\sum x}{n}$$

Where, \bar{x} = Mean of the respondents

$\sum x$ = Sum of total number of respondents

n = Total number of respondents

(ii) Standard deviation

Standard deviation was calculated by using following formula:

$$SD = \sqrt{\frac{1}{(n-1)} \left[\sum x^2 - \frac{(\sum x)^2}{n} \right]}$$

Where,

SD = Standard deviation

x = Deviation obtained from mean

n = Number of observations

3.11.3 Pearson's coefficient of correlation

This technique was used to find out the relationship between two variables.

The formula used was as follows:

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{n \sum x^2 - (\sum x)^2 \cdot n \sum y^2 - (\sum y)^2}}$$

Where,

r = Correlation coefficient

x = Score of independent variable

y = Score of dependent variable

n = Number of observation

3.11.4 Multiple regression

This technique was used to know the partial and complete influence of independent variables. For the present study linear model of regression equation was used which is as follows:

$$Y_1 = a + b_1x_1 + b_2x_2 + \dots + b_nx_n$$

Where,

Y_1 = Dependent variable

$x_1 \dots x_n$ = Independent variables

a = Constant value

$b_1 \dots b_n$ = The regression coefficient for respective independent variables

3.11.5 't' test

't' test was employed to find out the significant difference, if any between the mean score of two groups (both FFS trained farmers and FFS untrained farmers) on adoption of IPM.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

Where,

\bar{X}_1 : Mean of X1 series

\bar{X}_2 : Mean of X2 series

$(\bar{X}_1) - (\bar{X}_2)$: Difference between the two means taken as positive

S_1^2 : Variance of X1 series

S_2^2 : Variance of X2 series

n_1 : Total number of observations in X1 series

n_2 : Total number of observations in X2 series

CHAPTER - IV

RESULTS AND DISCUSSION

This chapter deals with the presentation, analysis and discussion of the data. The data were collected through the pretested interview schedule keeping in view to objectives of the study. The collected data were classified, tabulated, analyzed, presented, interpreted and discussed in a systematic way in accordance with the objectives of the study.

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

4.1 Independent variables

1. Age
2. Education
3. Size of Family
4. Experience about IPM
5. Occupation
6. Land holding
7. Annual income
8. Irrigation availability
9. Sources of information
10. Contact with extension personnel
11. Cosmopolitaness
12. Opinion about IPM
13. Knowledge about IPM

4.2 Dependent variables

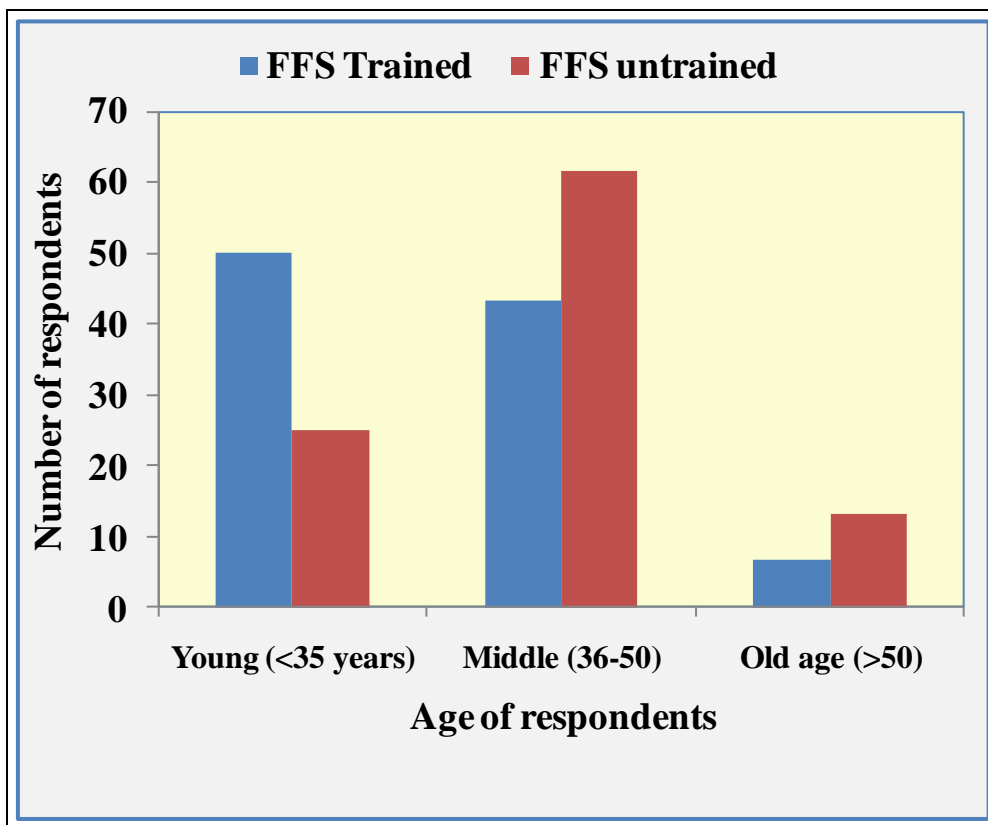
- 4.2.1** The impact of FFS training on adoption of the Integrated Pest Management measures in rice.
- 4.3** Correlation coefficient analysis of independent variables with adoption of recommended IPM practices.
- 4.4** Multiple regression analysis of independent variables with adoption of recommended IPM practices.
- 4.5** Constraints faced by the farmers in adoption of IPM.
- 4.6** Suggestions from the respondents to overcome the constraints for effective participation in adoption of IPM.

4.1 Independent variables

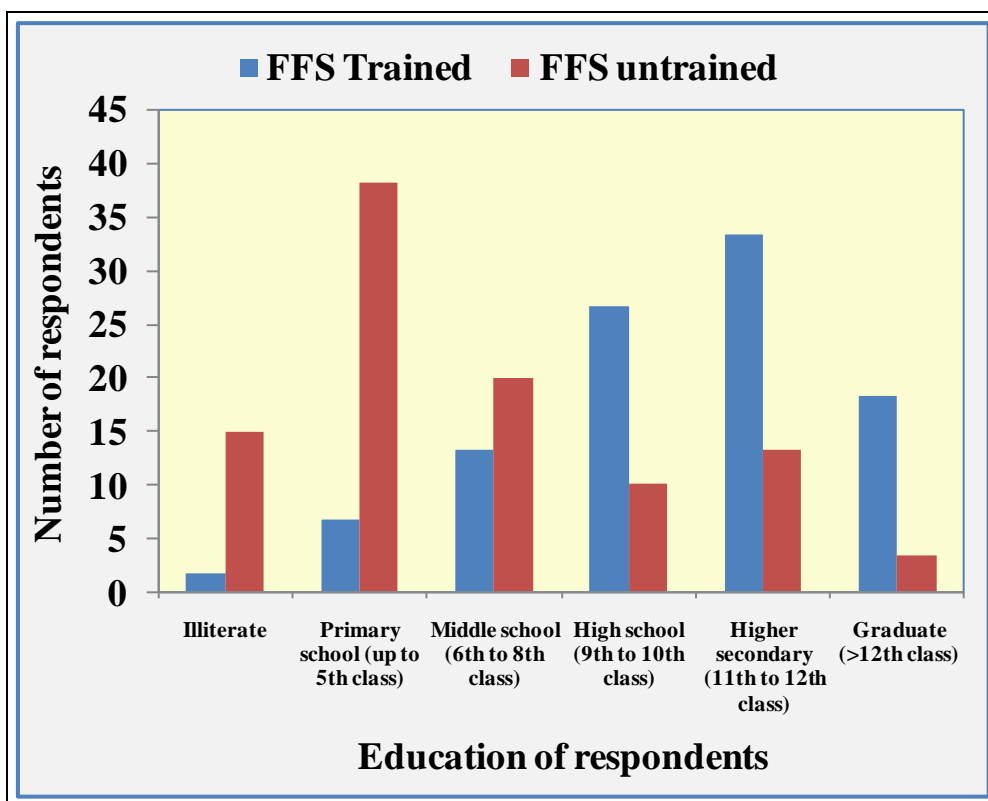
Age, education, family size and experience about IPM of FFS trained and untrained farmers were considered as socio-personal characteristics of the respondents. These characteristics were analyzed and presented in Table 4.1.

4.1.1 Age of the respondents

The findings on age of the respondents were presented in Table 4.1. and fig 4.1. The data reveals that the majority of the FFS trained farmers (50.00%) belonged to young age group (up to 35 years), followed by 43.33 per cent were under middle age group (36 to 50 years) and 6.67 per cent were of old age group (above 50 years). Whereas the majority of the FFS untrained farmers (61.66%) belonged to middle age group (36 to 50 years), followed by 25.00 per cent were belonged to young age group (up to 35 years) and 13.34 per cent were belonged to old age group (above 50 years). Thus, it may be concluded that the majority of the respondents in the study area belonged to young age group who are the trained farmers of FFS programme as compare to majority of FFS untrained farmers were belonged to middle age group.



4.1 Distribution of FFS trained and FFS untrained farmers according to their age

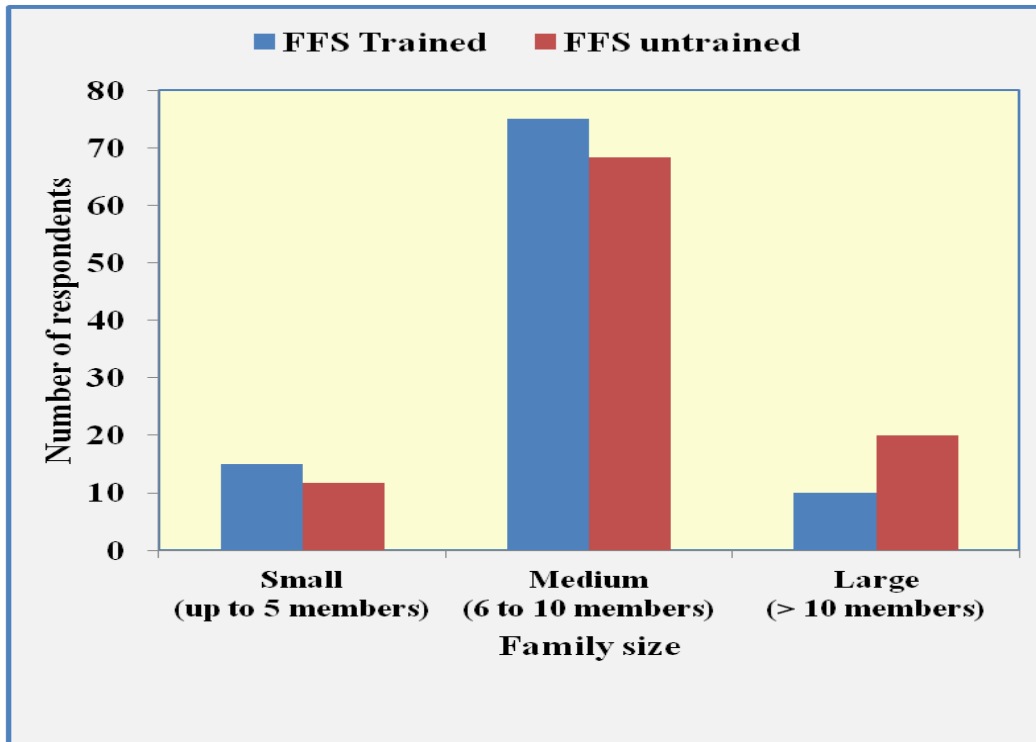


4.2 Distribution of FFS trained and FFS untrained farmers according to their education

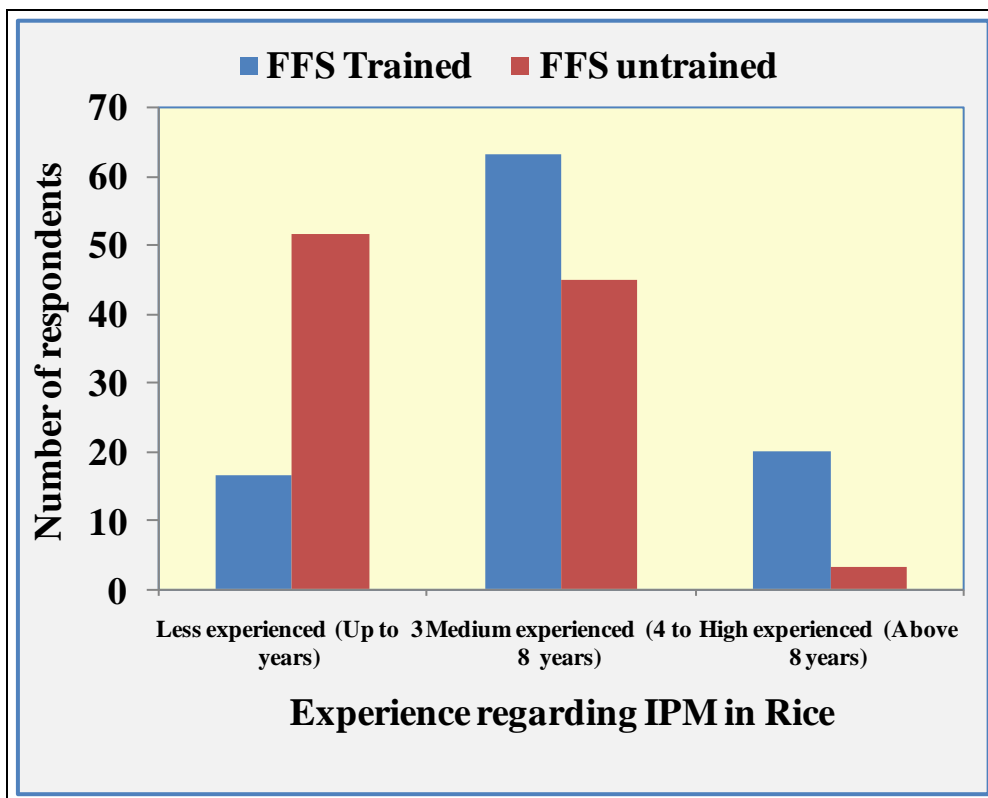
Karthikeyan *et al.* (1995), Gupta (1998), Yomota and Tan-Cruz (2007) also noted almost similar findings.

4.1.2 Education of the respondents

The data in Table 4.1 and fig 4.2 described that the majority of the FFS trained farmers (33.33%) were having higher secondary level of education, followed by 26.67 per cent were found under the category of high school level of education, 18.34 per cent were above higher secondary level of education, 13.34 per cent have middle level of education, 6.66 per cent were having primary level of education and only 1.66 per cent were illiterate. Whereas, the majority of FFS untrained farmers (38.33%) were having primary school level of education, followed by 20 per cent were having middle school level of education, 15 per cent were found under the category of illiterate, 13.33 per cent were having higher secondary level of education, 10 per cent were having high school level and only 3.34 per cent were having above higher secondary level of education. Finally results clearly indicated that the majority of FFS trained farmers were having higher secondary level of education as compare to majority of FFS untrained farmers were having primary level of education (Fig 4.2). Patil (1991) and Jassi *et al.* (1998) also noted almost similar findings.



4.3 Distribution of FFS trained and FFS untrained farmers according to their family size



4.4 Distribution of FFS trained and FFS untrained farmers according to their experience regarding IPM

Table 4.1. Socio-personal characteristics of FFS trained farmers and FFS untrained farmers

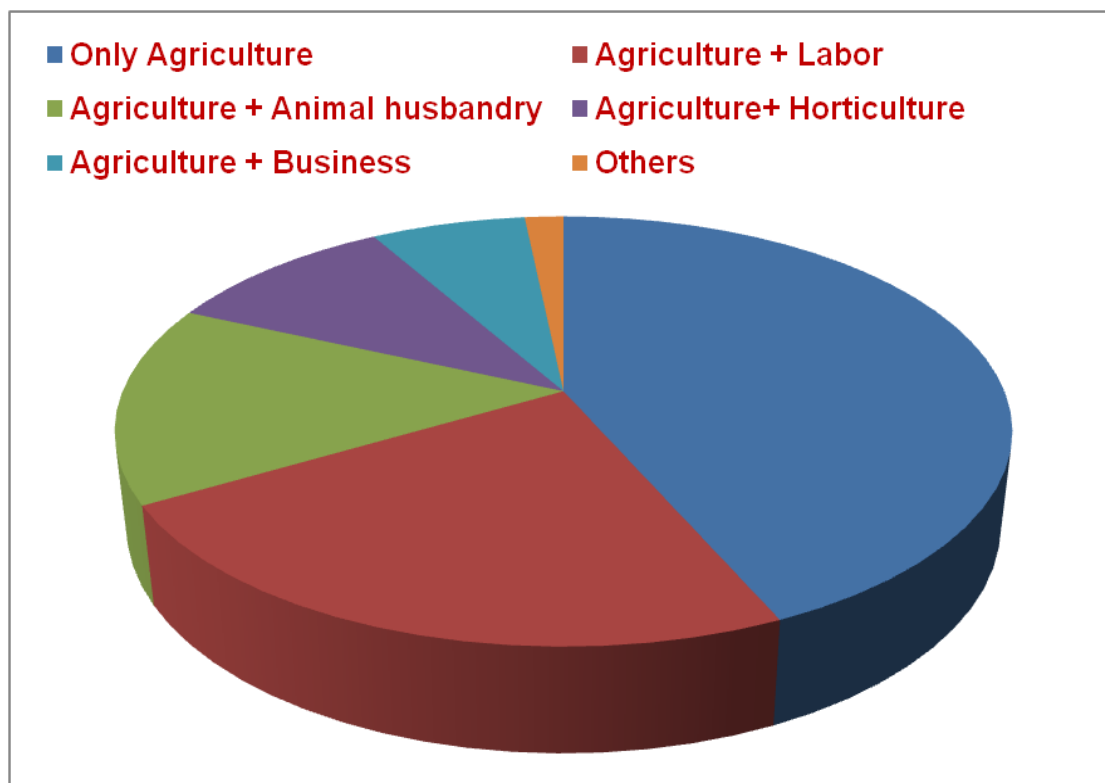
S.no	Independent Variables	FFS Trained farmers (n=60)		FFS Untrained farmer (n=60)	
		Frequency	Percentage	Frequency	Percentage
1.	Age				
i.	Young (<35 years)	30	50.00	15	25.00
ii.	Middle (36-50)	26	43.33	37	61.66
iii.	Old age (>50)	4	6.67	8	13.34
2.	Education				
i.	Illiterate	1	1.66	9	15.00
ii.	Primary school(up to 5 th class)	4	6.66	23	38.33
iii.	Middle school(6 th to 8 th class)	8	13.34	12	20.00
iv.	High school(9 th to 10 th class)	16	26.67	6	10.00
v.	Higher secondary (11 th to 12 th class)	20	33.33	8	13.33
vi.	Graduate(>12 th class)	11	18.34	2	3.34
3.	Family Size				
i.	Small (up to 5 members)	9	15.00	7	11.67
ii.	Medium (6 to 10 members)	45	75.00	41	68.33
iii.	Large (> 10 members)	6	10.00	12	20.00
4.	Experience about IPM				
i.	Less experienced(U _p to 3 years)	10	16.67	31	51.67
ii.	Medium experienced (4 to 8 years)	38	63.33	27	45.00
iii.	High experienced(Above 8 years)	12	20.00	2	3.33

4.1.3 Family size

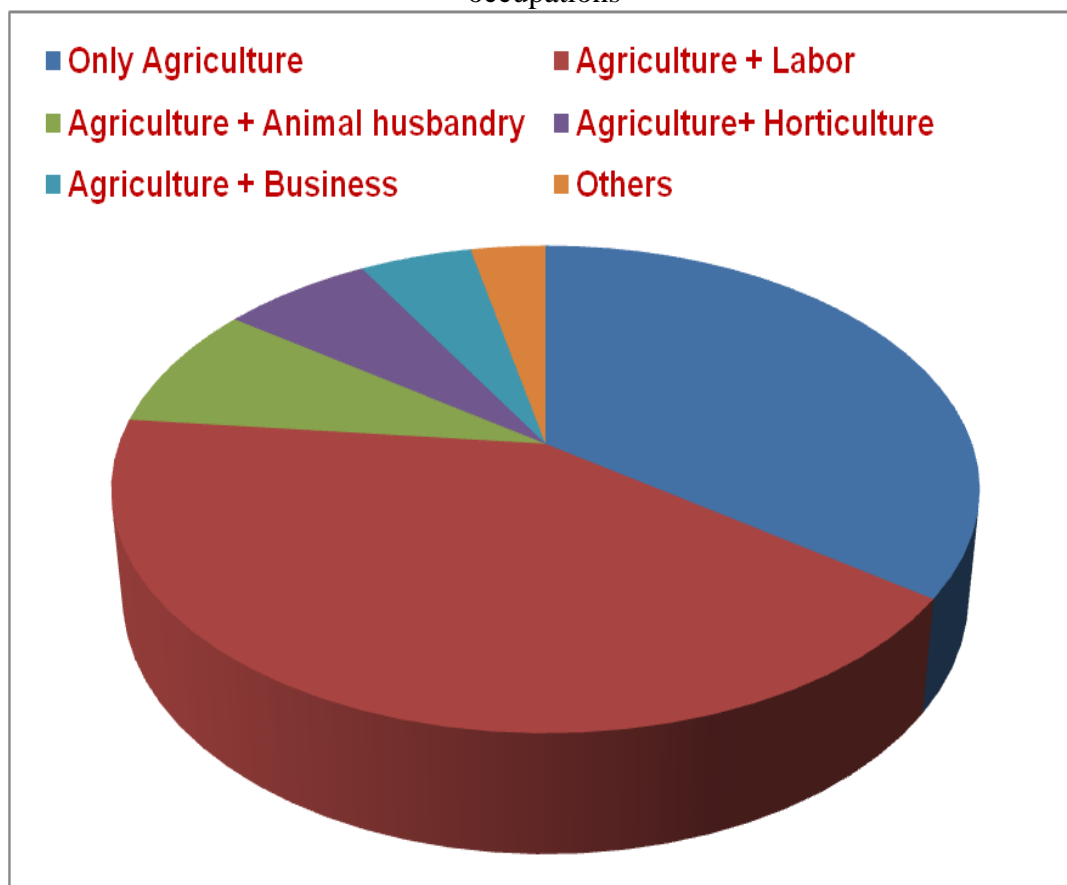
The data regarding size of family Table 4.1 and Fig 4.3 indicated that the majority (75%) of the FFS trained farmers had medium family size (6 to 10 members), followed by 15 per cent with Small family size (up to 5 members) and only 10 per cent had large family size (>10 members). The majority of the FFS untrained farmers (68.33%) had medium family size (6 to 10 members), followed by 20 per cent with large family size (> 10 members) and only 11.67 per cent had small family size (up to 5 members). Rao (2001) also noted almost similar findings.

4.1.4 Experience about IPM

The data on experience of FFS trained farmers and FFS untrained farmers are presented in Table 4.1 and fig 4.4. The findings indicated that the majority of the FFS



4.5 Distribution of the FFS trained farmers according to their involvement in various occupations



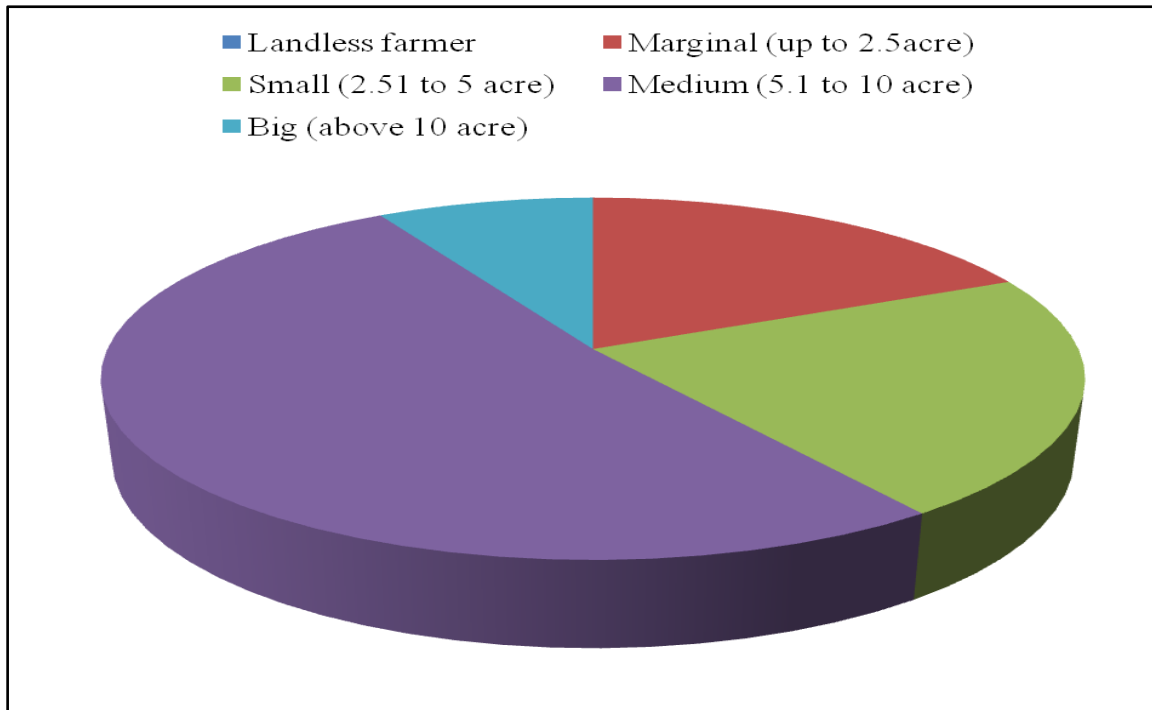
4.6 Distribution of the FFS untrained farmers according to their involvement in various occupations

trained farmers (63.33%) were having medium experience (4 to 8 years), followed by 20 per cent had high experience (above 8 years), and only 16.67 per cent were having less experience (up to 3 years) regarding IPM because the majority of the FFS trained farmers in the study area were under the young age group. The majority (51.67%) of the FFS untrained farmers had less experience (up to 3 years), followed by 45 per cent with medium experience (4 to 8 years) and only 3.33 per cent of FFS untrained were High experienced (above 8 years). Ortiz *et al.* (2004) also noted almost similar findings.

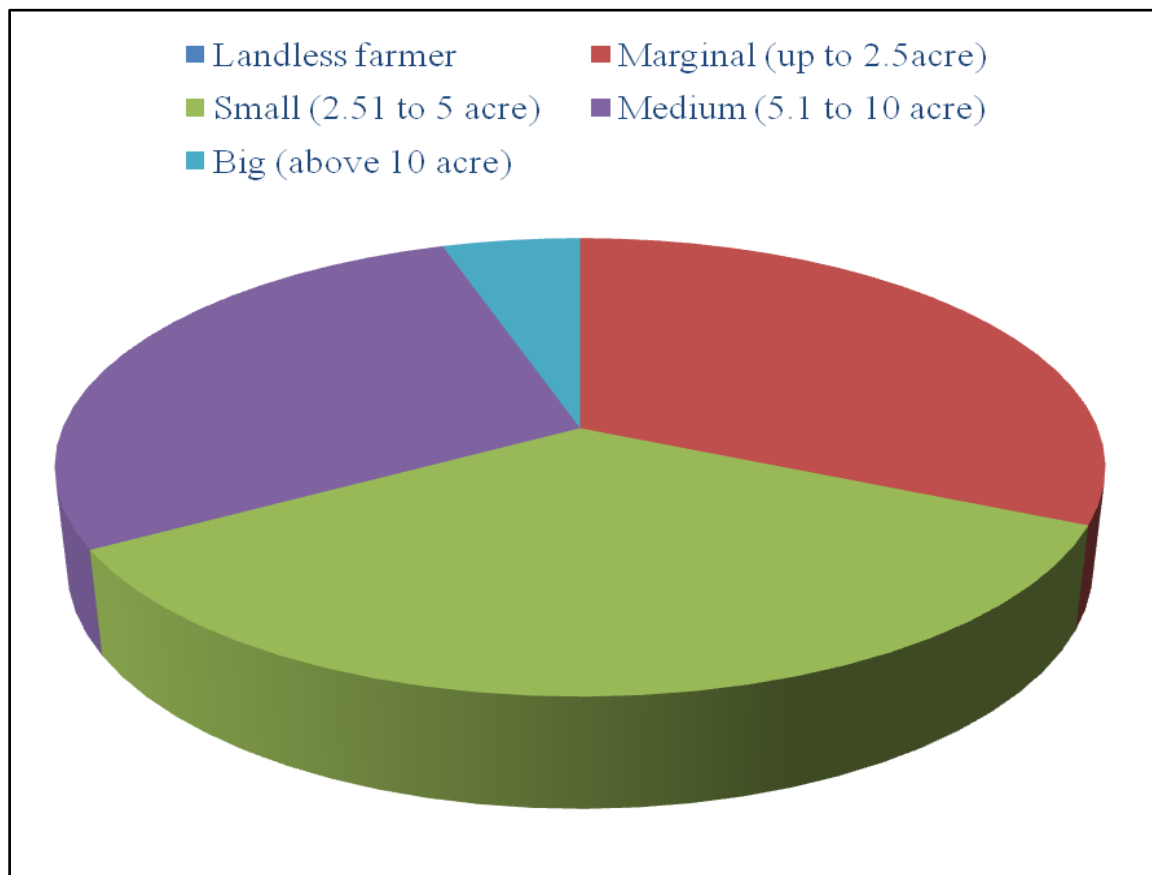
4.1.5 Occupation of respondents

Regarding involvement of respondents in various occupations, the data compiled in Table 4.2. Fig. 4.5 and Fig. 4.6 shows that that the majority (43.33%) of the FFS trained farmers were involved in agriculture, followed by 23.33 per cent were involved in agriculture and labor, while 15.00 per cent of FFS trained farmers were involved in agriculture and animal husbandry, 10 per cent had adopted agriculture and horticulture, 6.67 per cent were involved in agriculture and business and only 1.67 per cent of FFS trained farmers were involved in other occupation . Whereas, the majority (41.66) of FFS untrained farmers were involved in agriculture and labor, followed by 35 per cent were involved only in agriculture, while 8.33 per cent of FFS untrained farmers were involved in agriculture and animal husbandry, 6.67 per cent had adopted agriculture and horticulture, 5 per cent were involved in agriculture and business and only 3.34 per cent of FFS untrained farmers were involved in other occupation.

Majority of the (55%) of FFS trained farmers were involved in 2 to 3 occupations including agriculture, followed by 41.66 per cent were involved in one occupation with rice cultivation and only 3.34 per cent of FFS trained farmers were involved in more than 3 occupation, whereas majority (61.66%) of FFS untrained



4.7 Distribution of FFS trained farmers according to their land holding



4.8 Distribution of FFS untrained farmers according to their land holding

farmers were involved in 2 to 3 occupations including agriculture, followed by 33.34 per cent were involved in one occupation with rice cultivation and only 5 per cent of FFS untrained farmers were involved in more than 3 occupation. It clearly indicates that due to lack of sufficient earnings from a single source such as agriculture, the FFS untrained farmers were engaged in other allied activities labor, animal husbandry, horticulture etc. This finding is strongly supported by Rahman *et al.* (1990).

Table 4.2 Distribution of the FFS untrained respondents according to their involvement in various occupations

S no.	Independent Variables	FFS Trained farmers (n=60)		FFS Untrained farmers (n=60)	
		Frequency	Percentage	Frequency	Percentage
1.	Occupation				
i.	Only Agriculture	26	43.33	21	35.00
ii.	Agriculture + Labor	14	23.33	25	41.66
iii.	Agriculture + Animal husbandry	9	15.00	5	8.33
iv.	Agriculture + Horticulture	6	10.00	4	6.67
v.	Agriculture + Business	4	6.67	3	5.00
vi.	Others	1	1.67	2	3.34
2.	Number of occupation				
i.	Involved in one occupation	25	41.66	20	33.34
ii.	Involved in 2 to 3 occupation	33	55.00	37	61.66
iii.	Involved in more than 3 occupation	2	3.34	3	5.00

4.1.6 Land holding of respondents

The distribution of the respondents according to their land holdings are presented in the Table 4.3, Fig 4.7 and 4.8. The majority of the FFS trained farmers (51.66%) were having medium size of land holding (5.1 to 10 acre), followed by 21.66 per cent who belonged under small size of land holding (having 2.51 to 5 acre), 18.34 per cent had marginal category of FFS trained farmers (having up to 2.50 acre land

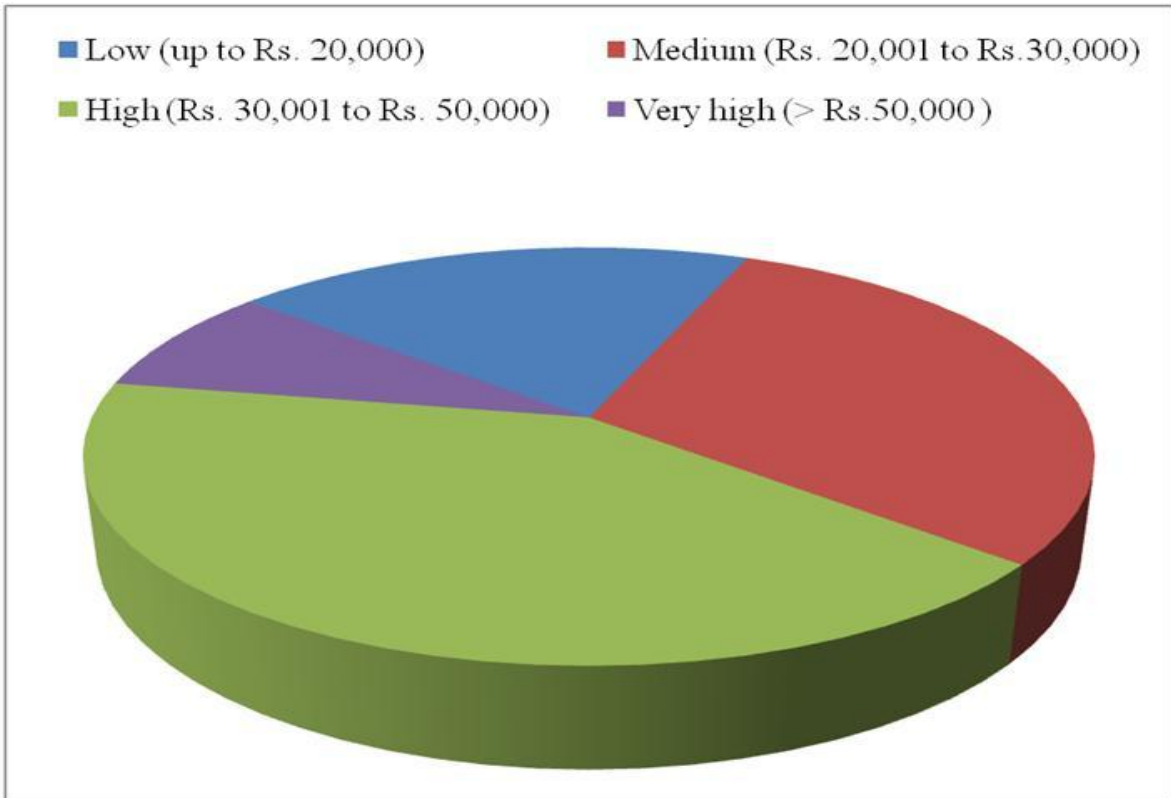
holdings), 8.34 per cent were big farmers (above 10 acre) and no FFS trained farmers were under the land less category. Whereas the majority of the FFS untrained farmers (35%) came under small size of land holding (having 2.51 to 5 acre), followed by 31.66 per cent had marginal category of farmers (having up to 2.50 acre land holdings), 28.34 per cent had medium category of FFS untrained farmers (having 5.1 to 10 acre), 5 per cent came under the big farmers (having above 10 acre) and here also no FFS untrained farmers were under the land less category. This finding was strongly supported by Subramaniam *et al.* (1978), Gogoi and Phukan (2000).

Table 4.3: Distribution of the respondents according to their size of land holding

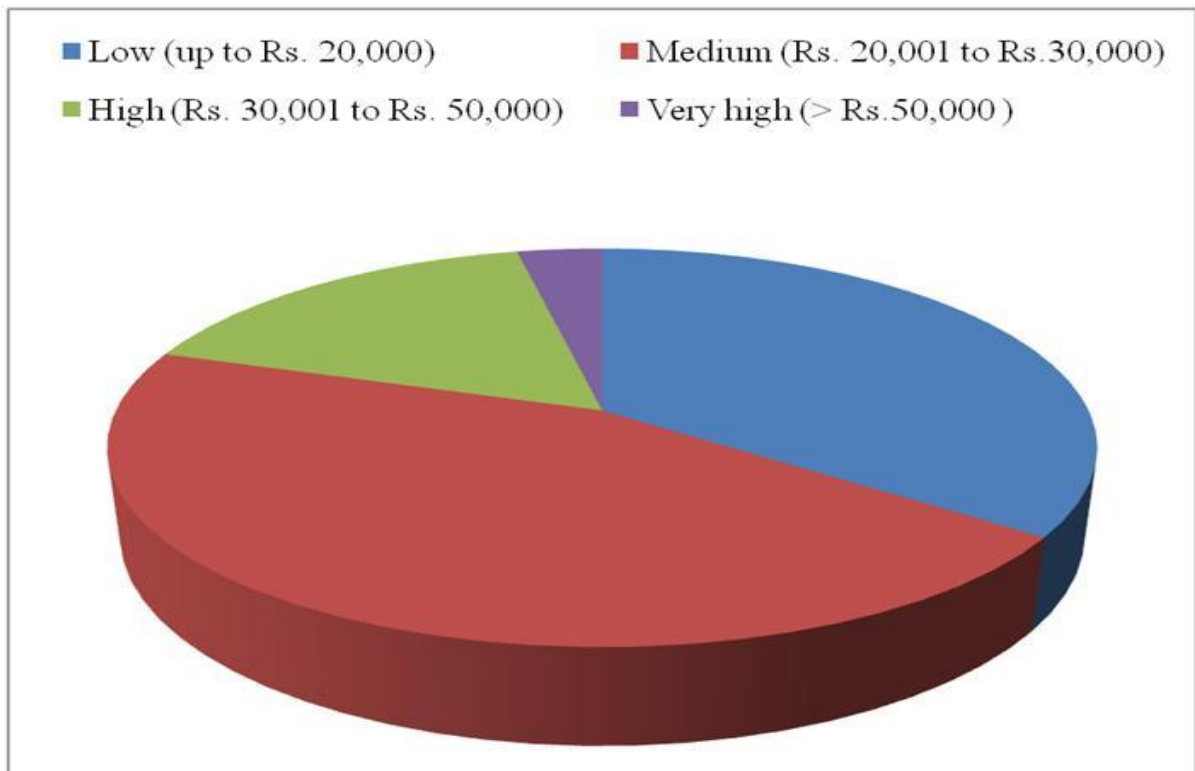
Size of land holding	FFS Trained farmers (n=60)		FFS Untrained farmers (n=60)	
	Frequency	Percentage	Frequency	Percentage
Land less farmer	0	0	0	0
Marginal (up to 2.50 acre)	11	18.34	19	31.66
Small (2.51 to 5 acre)	13	21.66	21	35.00
Medium (5.1 to 10 acre)	31	51.66	17	28.34
Big (above 10 acre)	5	8.34	3	5.00

4.1.7 Annual income of respondents

It is very difficult to assess the average annual income of each individual, as they are not maintaining any records. The attempt was made to collect the annual income of the respondents through discussion and interpretation from different angles. The distribution of the respondents according to their annual income is presented in Table 4.4, fig 4.9 and 4.10. As regard to annual income the majority of the FFS trained farmers (41.66%) were having their income ranging from Rs. 30,001 to Rs.50, 0000 (High category) per annum, followed by 30 per cent of FFS trained farmers earned above Rs. 20,001 to 30,000 (medium category) per annum, 20 per cent FFS trained farmers had their annual income less than Rs. 20,000 (Low category) and 8.34 per cent



4.9 Distribution of FFS trained farmers according to their annual income



4.10 Distribution of FFS untrained farmers according to their annual income

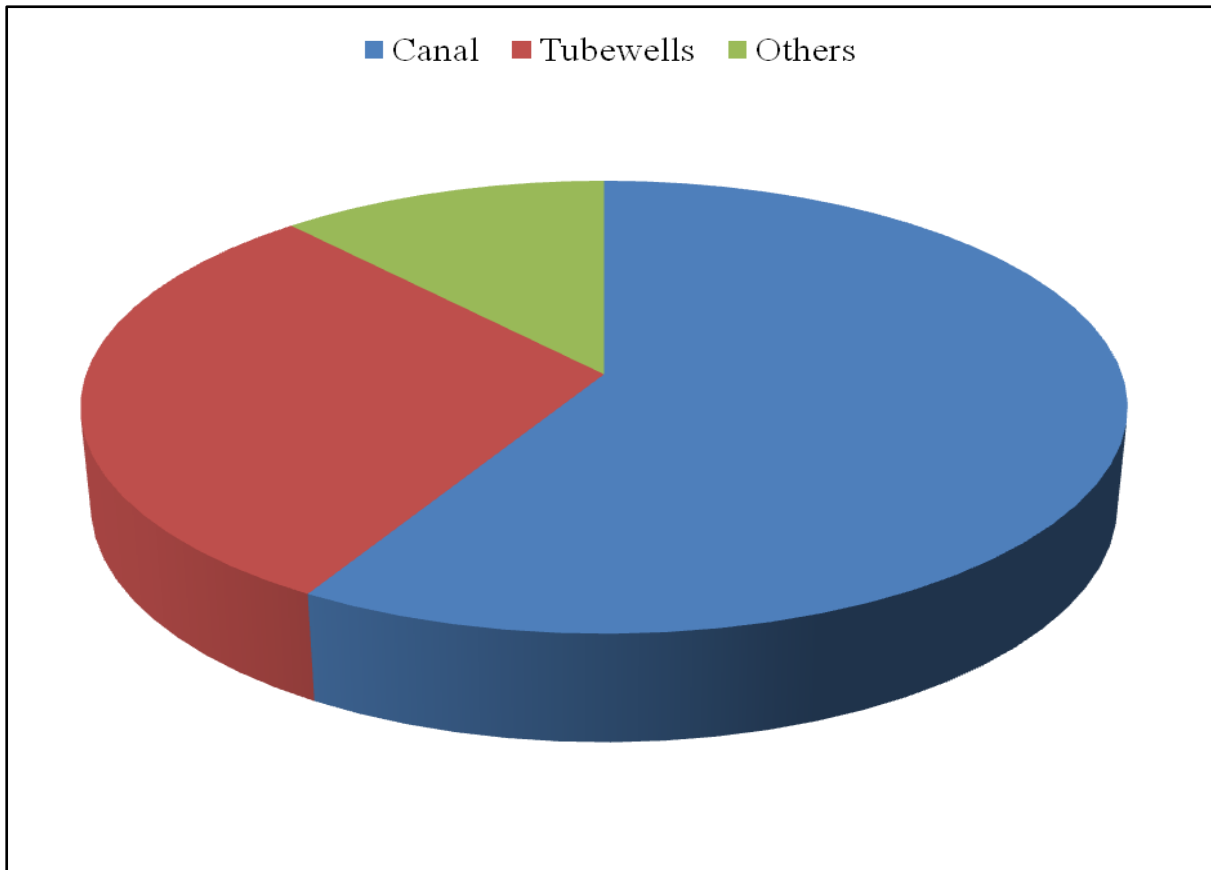
of FFS trained farmers had obtained annual income above Rs. 50,000 (Very high category).

Whereas, the majority of (45%) FFS untrained farmers earned Rs. 20,001 to Rs. 30, 0000 (Medium category) per annum, followed by 35 per cent FFS untrained farmers had obtained income less than Rs. 20,000 (Low category) per annum, 16.66 per cent had their annual income in the range between Rs. 30,001 to Rs. 50,000 (High category) and only 3.34 per cent FFS untrained farmers had obtained annual income above Rs. 50,000 (Very high category).

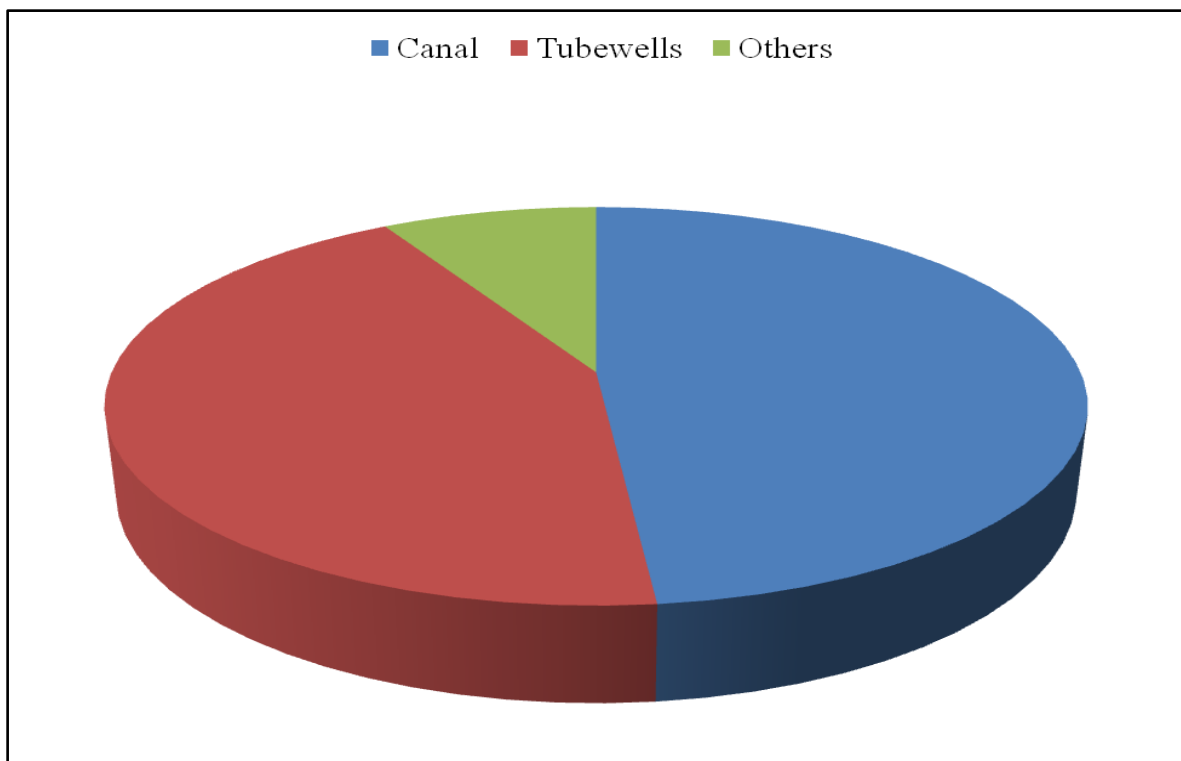
The results clearly indicated that the majority of the FFS trained farmers belonged to Rs. 30,001 to Rs. 50,000 (High category) annual income group as compare to FFS untrained farmers earned Rs. 20,001 to Rs. 30,000 (Medium category) (Fig 4.8 and Fig. 4.9). This finding is supported by Patel *et al.* (1995), Bolarinwa and Fakoya (2011).

Table 4.4: Distribution of the respondents according to their annual income

Annul income	FFS Trained farmers (n=60)		FFS Untrained farmer (n=60)	
	Frequency	Percentage	Frequency	Percentage
Low (up to Rs. 20,000)	21	20.00	21	35.00
Medium (Rs. 20,001 to Rs. 30,000)	18	30.00	27	45.00
High (Rs. 30,001 to Rs. 50,000)	25	41.66	10	16.66
Very high (above Rs. 50,000)	5	8.34	2	3.34



4.11 Distribution of FFS trained farmers according to irrigation availability



4.12 Distribution of FFS untrained farmers according to irrigation availability

4.1.8 Irrigation availability

The distribution of the respondents according to irrigation availability are presented in the Table 4.5, Fig 4.11 and 4.12 reveals the majority of the FFS trained farmers (58.33%) were having irrigation through canal, followed by 30 per cent who had irrigation through tube wells and only 11.67 per cent of the FFS trained farmers were using other sources for irrigation. Whereas the majority of the FFS untrained farmers (48.33%) were also having irrigation through canal, followed by 43.33 per cent who had irrigation through tube wells and only 8.34 per cent of the FFS untrained farmers were using other sources for irrigation.

Table 4.5: Distribution of respondents according to Irrigation availability

S.no	Irrigation availability	FFS Trained (n=60)		FFS Untrained (n=60)	
		Frequency	Percentage	Frequency	Percentage
i.	Canal	35	58.33	29	48.33
ii.	Tube well	18	30.00	26	43.33
iii.	Others	7	11.67	5	8.34

4.1.9 Sources of information

Distribution of the respondents according to utilization of the information sources about integrated pest management are presented in the Table 4.6 and fig 4.13. It revealed that amongst the information sources, majority of FFS trained farmers (53.33%) preferred to get the IPM information regularly from the Farmer Field School, followed by 50 per cent made regular contact with neighbors/friends, 48.33 per cent of the FFS trained farmers had regularly watched T.V. programmes for information regarding IPM, 26.66 per cent of the FFS trained farmers read the news paper/leaflet/pamphlet(written material) regularly for information regarding IPM, 25 per cent of the FFS trained farmers regularly listen radio for information regarding

IPM, 18.33 per cent FFS trained made regular contact with R.A.E.Os for information regarding IPM, 6.66 per cent made regular contact with KVK for information regarding IPM, 5 per cent FFS trained farmers were regularly using others sources for information regarding IPM like co-operative society, visit, village leaders, 3.33 per cent FFS trained farmers were regularly using KCC for information seeking, 1.66 per cent FFS trained farmers got the information from kisan mela regularly and there were no FFS trained farmers who were regularly contacting the agricultural college for information regarding IPM.

Whereas, the majority of the FFS untrained farmers (28.34%) had made regular contact with neighbors/friends for obtaining information regarding IPM , followed by 23.33 per cent of the FFS untrained farmers who had contact regularly with R.A.E.Os for information regarding IPM, 20 per cent of the FFS untrained farmers had regularly listen radio for information regarding IPM, 16.66 per cent were regular watched T.V. programmes related to IPM, 10 per cent of the FFS untrained farmers read the news paper/leaflet/pamphlet(written material) regularly for information regarding IPM, 3.33 got information regularly through KVK, 1.66 per cent FFS untrained farmers contact regularly with KCC and others like co-operative society, visit, village leaders there were no FFS untrained farmers who were regularly got information from FFS training program, kisan mela or agricultural college regarding IPM.

While, the majority of the FFS trained farmers (45%) made partial contact with FFS for information regarding IPM, followed by 46.66 per cent of the FFS trained farmers contact with neighbors/friends for information regarding IPM, 41.67 per cent of the FFS trained farmers had partially watched T.V programmes related to IPM, 38.33 per cent of the FFS trained farmers partially read the news

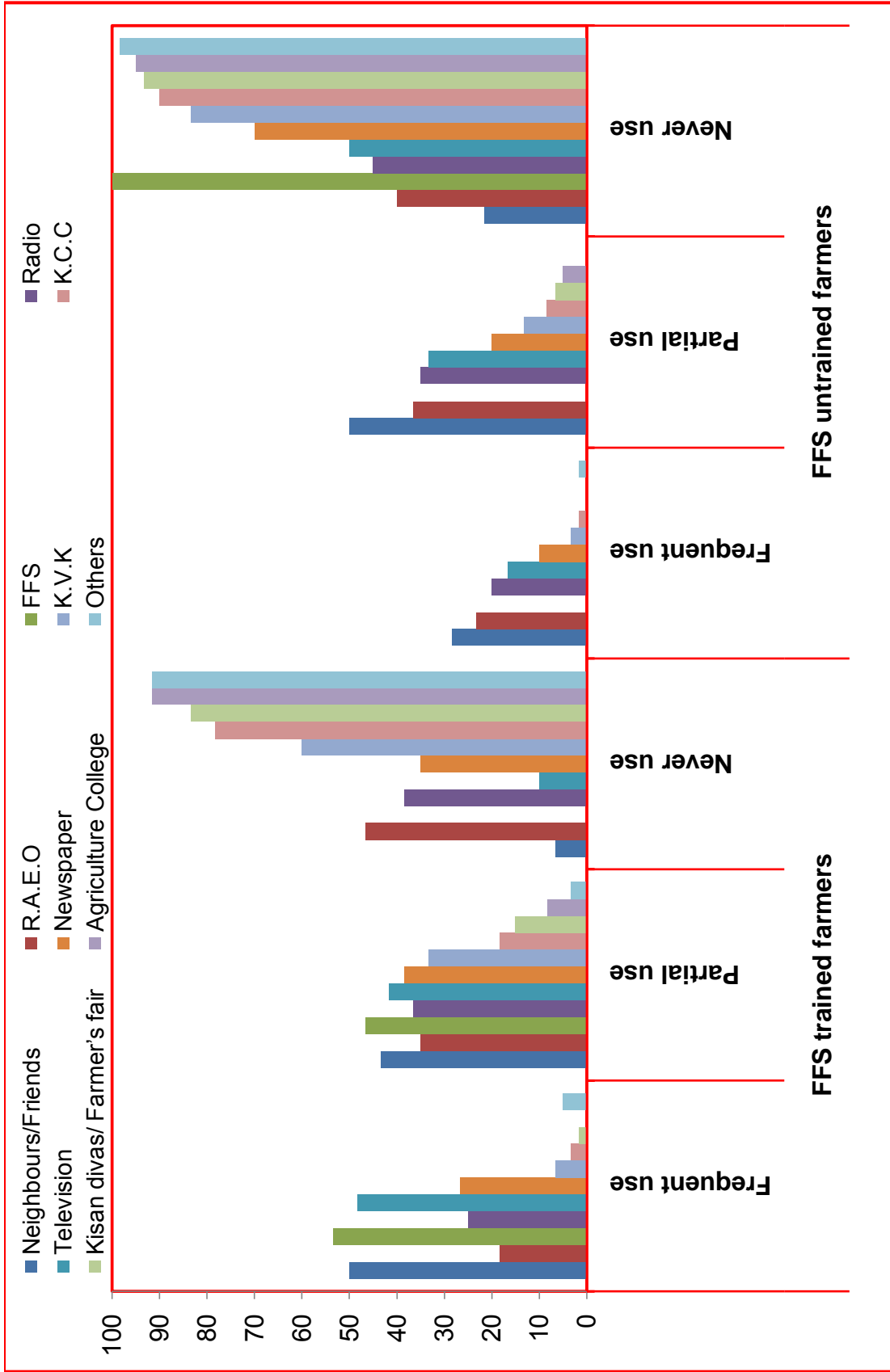


Fig 4.13. Distribution of the FFS trained and FFS untrained farmers according to their use of information sources

paper/leaflet/pamphlet(written material) for information regarding IPM, 36.66 per cent of FFS trained farmers partially listen radio for information regarding IPM, 35 per cent of the FFS trained farmers had contact partially with R.A.E.Os for information regarding IPM, 33.34 per cent of the FFS trained farmers got information partially through KVK, 18.33 per cent of the FFS trained farmers contact partially with KCC, 15 per cent of the FFS trained farmers get information through kisan mela, 8.33 per cent of the FFS trained farmers get information through agricultural college regarding IPM, 3.33 per cent FFS trained farmers were getting information through others sources viz. village leaders, co-operative society, visit. Whereas, the majority 50 per cent of FFS untrained farmers made partial contact with neighbours/friends followed by 36.67 per cent of the FFS untrained farmers made partial contact with R.A.E.Os for information regarding IPM, 35 per cent of the FFS untrained farmers partial used radio for obtaining information, 33.34 per cent of the FFS untrained farmers had partially watched television, 20 per cent of the FFS untrained farmers partially read the news paper/leaflet/pamphlet(written material), 13.33 per cent of the FFS untrained farmers got information partially through KVK, 8.34 per cent of the FFS untrained farmers contact partially with KCC, 6.66 per cent of the FFS untrained farmers get information through kisan mela, 5 per cent of the FFS untrained farmers get information through college and no FFS untrained farmers were using FFS training program or other source for information regarding IPM.

Similarly, majority (91.67%) of FFS trained farmers never used agriculture college and other sources of information regarding IPM, followed by 83.34 per cent of the FFS trained farmers never used kisan divas/kisan mela for obtaining information regarding IPM, 78.34 per cent never used KCC for information regarding IPM, 60 per cent of FFS trained farmers never used KVK for information regarding IPM, 46.67 per cent of FFS trained farmers never used R.A.E.Os as a source of information regarding

IPM, 38.33 of FFS trained farmers never got information through radio regarding IPM, 35 per cent of FFS trained farmers never got information through news paper regarding IPM, 10 per cent of FFS trained farmers never got information through television regarding IPM, 6.67 per cent of the FFS trained farmers never got information through neighbors/friends regarding IPM.

Whereas, cent per cent of FFS untrained farmers never used FFS training program as a sources of information regarding IPM, followed by 98.34 per cent of the FFS untrained farmers never used other sources, 95 per cent of the FFS untrained farmers never used agriculture college, 93.34 per cent of the FFS untrained farmers were never used kisan divas/kisan mela for information, 90 per cent of the FFS untrained farmers never used KCC, 83.34 per cent of the FFS untrained farmers never used KVK, 70 per cent of the FFS untrained farmers never read news paper, 50 per cent of the FFS untrained farmers never watch television, 45 per cent of the FFS untrained farmers never listen radio, 40 per cent of the FFS untrained farmers never contact R.A.E.Os and 21.66 per cent of the FFS untrained farmers never contact neighbors/friends as a source of information regarding IPM.

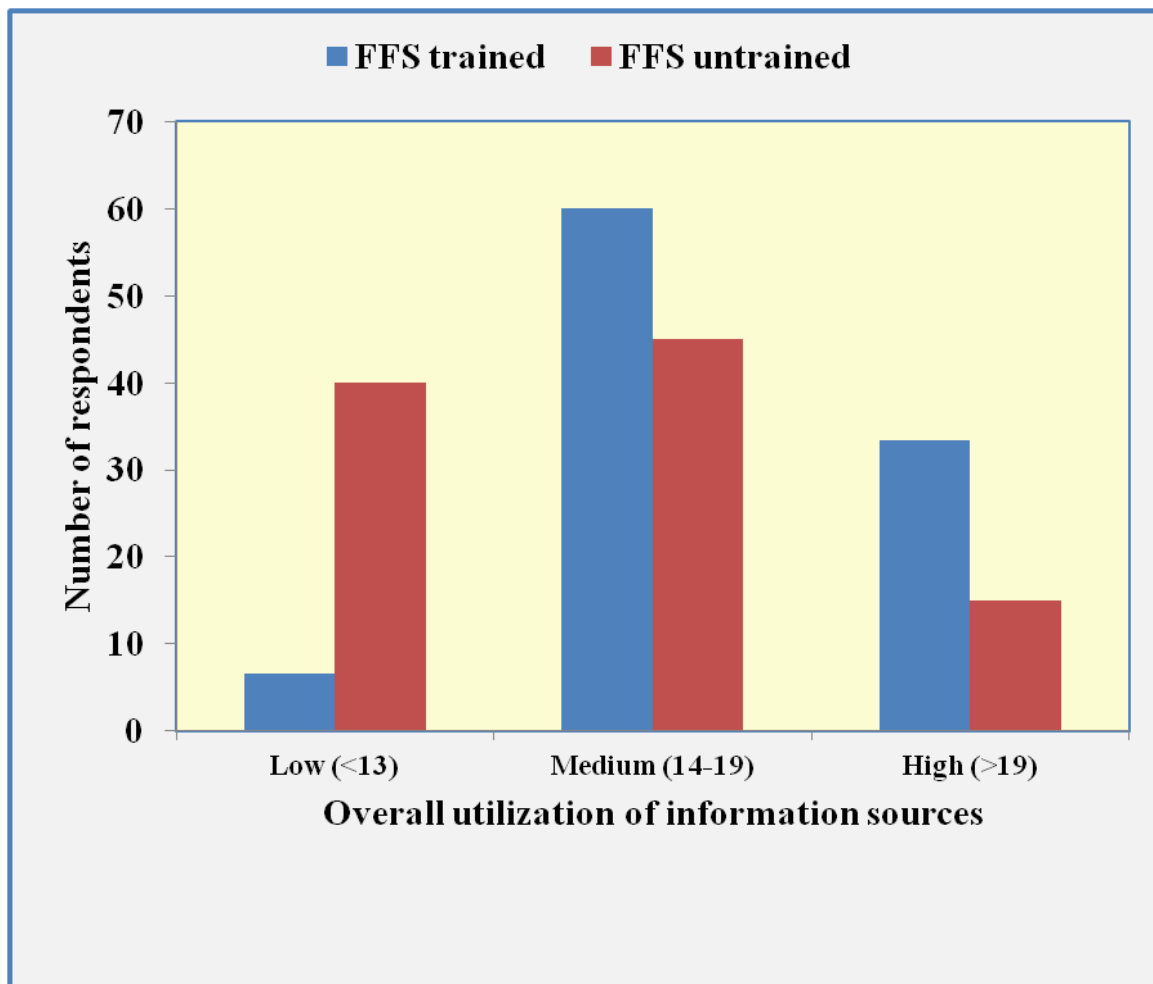
It could be concluded that majority of the FFS trained farmers (53.34%) were using FFS training program for obtaining information regarding IPM and majority of FFS untrained farmers (28.34%) had made regular contact with neighbors/friends regularly for obtaining information regarding IPM. Whereas, the majority 46.66 per cent of the FFS trained farmers made partial contact with FFS training program for obtaining information regarding IPM. Majority 50 per cent of the FFS untrained farmers made partial contact with neighbors/friends for obtaining information. However, majority (91.67%) of the FFS trained farmers and (90%) FFS untrained farmers (98.34) never used other sources for obtaining information regarding IPM.

Table 4.6: Distribution of the respondents according to their use of information sources

Source of information	FFS trained farmers (n=60)			FFS untrained farmers (n=60)		
	Frequent use F/ (%)	Partial use F/ (%)	Never use F/ (%)	Frequent use F/ (%)	Partial use F/ (%)	Never use F/ (%)
Neighbours/Friends	30 (50%)	26 (43.33%)	4 (6.67%)	17 (28.34%)	30 (50%)	13 (21.66%)
R.A.E.O	11 (18.33%)	21 (35%)	28 (46.67%)	14 (23.33%)	22 (36.67%)	24 (40%)
FFS	32 (53.34%)	28 (46.66%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
Radio	15 (25%)	22 (36.66%)	23 (38.33%)	12 (20%)	21 (35%)	27 (45%)
Television	29 (48.33%)	25 (41.67%)	6 (10%)	10 (16.66%)	20 (33.34%)	30 (50%)
Newspaper	16 (26.67%)	23 (38.33%)	21 (35%)	6 (10%)	12 (20%)	42 (70%)
K.V.K	4 (6.66%)	20 (33.34%)	36 (60%)	2 (3.33%)	8 (13.33%)	50 (83.34%)
K.C.C	2 (3.33%)	11 (18.33%)	47 (78.34%)	1 (1.66%)	5 (8.34%)	54 (90%)
Kisan divas/kisan mela	1 (1.66%)	9 (15%)	50 (83.34%)	0 (0%)	4 (6.66%)	56 (93.34%)
Agriculture College	0 (0%)	5 (8.33%)	55 (91.67%)	0 (0%)	3 (5%)	57 (95%)
Others	3 (5%)	2 (3.33%)	55 (91.67%)	1 (1.66%)	0 (0%)	59 (98.34%)

*Data are based on multiple responses

It could be concluded that FFS trained farmers were utilized news paper/leaflet/pamphlet, training and visit etc. for obtaining information as compared to FFS untrained farmers were utilized traditional type of information sources. This study is strongly supported from the findings of Rao and Moulik (1966).



4.14 Distribution of the FFS trained and FFS untrained farmers according to their overall use of information sources

4.1.9.1 Distribution of the respondents according to their overall utilization of information sources

The data regarding overall use of information sources has been presented in Table 4.7 and Fig4.14. The data reveals that the majority of the FFS trained farmers (60%) had medium level of exposure to various sources of information for getting the information regarding IPM, followed by 33.34 per cent of the FFS trained farmers were found to have high level of exposure to various sources of information and 6.66 per cent of the FFS trained farmers were found to have low level use of information sources category.

Table 4.7: Distribution of the respondents according to their overall utilization of information sources

Overall utilization	FFS Trained farmers (n=60)		Overall utilization	FFS Untrained farmers (n=60)	
	Frequency	Percentage		Frequency	Percentage
Low (<13)	4	6.66	Low (<5)	24	40.00
Medium (14-19)	36	60.00	Medium (6-13)	27	45.00
High (>19)	20	33.34	High (>13)	9	15.00

\bar{x} = T6.31, SD= 2.86

\bar{x} = 9.05, SD= 3.80

The data indicate that the majority of FFS untrained farmers (45%) had medium level of exposure to various sources of information for getting the information regarding IPM, followed by 40 per cent of the FFS untrained farmers were found to have low level of exposure to various sources of information and 15 per cent of the FFS untrained farmers were found to have high level use of information sources category. The majority of the FFS trained farmers and FFS untrained farmers were found to be contacting various sources of information regarding IPM, to medium extent. Ramachandran (1974) also observed similar findings in their study.

4.1.10 Contact with extension personnel

The data presented in Table 4.8 and Fig 4.15 reveals that the contact of FFS trained farmers and FFS untrained farmers with the extension personnel. The table shows that the majority of the FFS trained farmers (40%) had made contact with Rural Agricultural Extension Officers (RAEOs) once a week, 36.66 per cent had made contact once a month, 15 per cent 2-3 times in a year and 8.34 had never contacted with Rural Agricultural Extension Officers (RAEOs). Whereas, the majority of the FFS untrained farmers (40%) had never made contact with Rural Agricultural Extension Officers (RAEOs), followed by 26.6 per cent had contact 2-3 times in a year and 23.33 per cent FFS untrained farmers had contacted once in a month with Rural Agricultural Extension Officers (RAEOs) for information regarding IPM.

With regards to Agricultural Development Officers (ADOs), the study shows that maximum (46.66%) of the FFS trained farmers had contact with them once a month, followed by 40 per cent of the FFS trained farmers had never contacted with Agricultural Development Officers (ADO). 8.34 per cent 2-3 times in a year, 5 per cent once a week. The majority (50%) of the FFS untrained farmers had never contacted with Agricultural Development Officers (ADOs), followed by 28.34 per cent of the FFS untrained farmers contacted 2-3 times in year, 20 per cent FFS untrained farmers had contact with Agricultural Development Officers (ADOs) once a month. 1.66 per cent had contacted once a week with Agricultural Development Officers (ADOs) for information regarding IPM.

With respect to contact with Agriculture Scientist, it was found that a majority (36.67%) of the FFS trained farmers had never contact with Agriculture Scientist, followed 33.34 per cent 2-3 times in a year, 26.66 per cent once a month, 3.33 once a week had contacted with agriculture scientist. However, the majority of the FFS

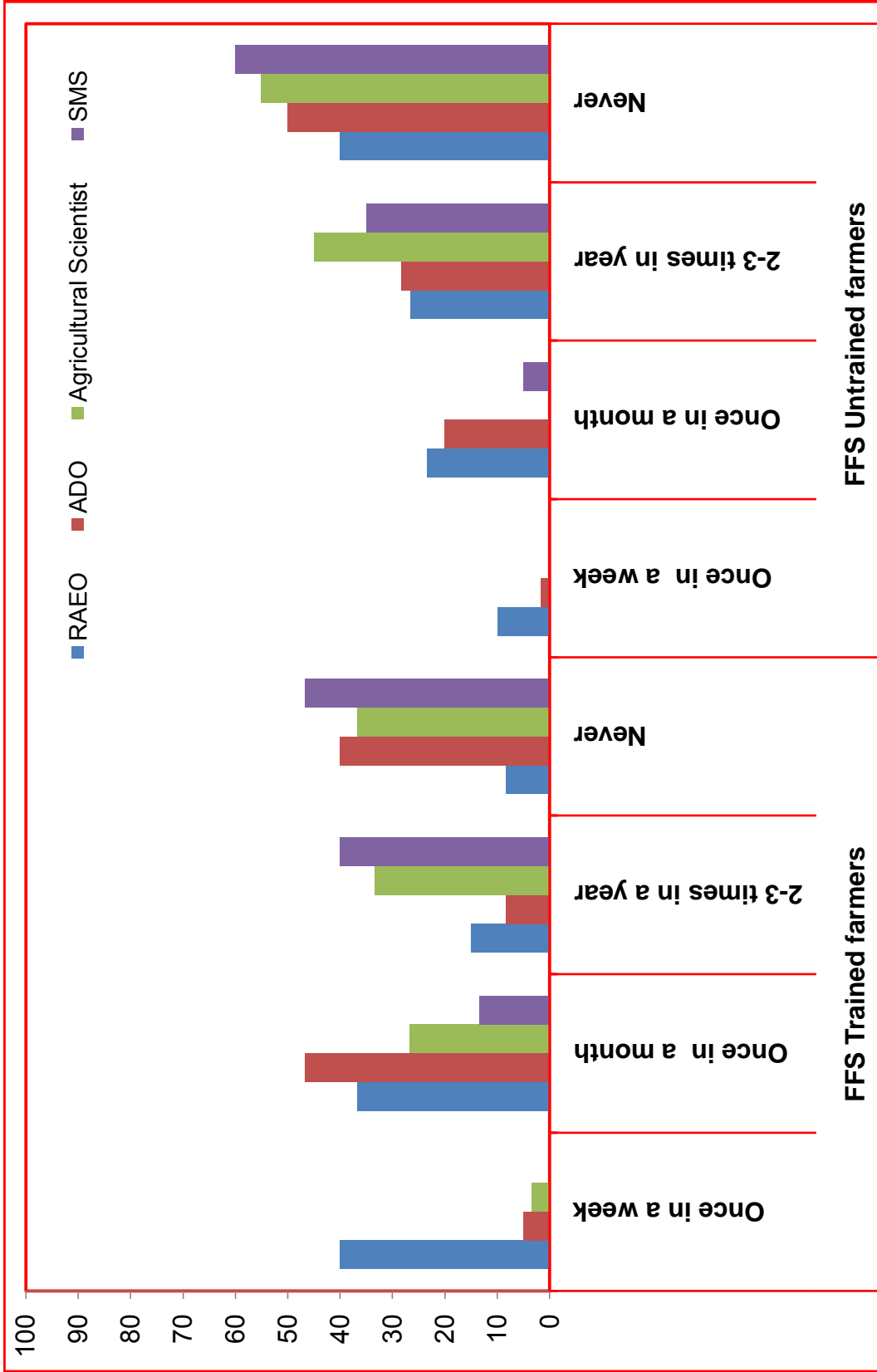


Fig 4.15 : Distribution of respondents according to contact with extension personnel

untrained farmers (55%) had never contacted with agriculture scientist, 45 per cent 2-3 times in a year and no farmers had made contact with agriculture scientist once a month or once a week for information regarding IPM.

Regarding contact with Subject Matter Specialist (SMS), it was found that majority (46.66%) of the FFS trained farmers had never with Subject Matter Specialist (SMS), followed by 40 per cent of the FFS trained farmers had contact 2-3 times in a year with Subject Matter Specialist (SMS). 13.33 per cent FFS trained farmers made contact once a month. Whereas, the maximum (48.34%) of the FFS untrained farmers had never contact with Subject Matter Specialist (SMS) and 46.66 per cent of the FFS untrained farmers had contacted with 2-3 times in a year with Subject Matter Specialist (SMS), 5 per cent once a month and None of both the category FFS trained farmers and FFS untrained were contacted once a week with Subject Matter Specialist (SMS) for information regarding IPM.

It could be concluded that Rural Agricultural Extension Officers (RAEOs) and Agricultural Development Officers (ADOs) were the most frequently visiting in the village from which the respondents were obtained latest information. Majority of 46.66 per cent FFS trained farmers and 60 per cent FFS untrained farmers had never contact with Subject Matter Specialist (SMS) for information regarding IPM. Reddy *et al.* (1998) also observed similar findings in his study.

Table 4.8: Distribution of the respondents according to their extent of contact with extension personnel

Extension personnel	FFS Trained farmers (n=60)				FFS Untrained farmers (n=60)			
	Once a week	Once a month	2-3 times in a year	Never	Once a week	Once a month	2-3 times in a year	Never
	Freq. (%)	Freq. (%)	Freq. (%)	Freq. (%)	Freq. (%)	Freq. (%)	Freq. (%)	Freq. (%)
RAEO	24 (40%)	22 (36.66%)	9 (15%)	5 (8.34%)	6 (10%)	14 (23.33%)	16 (26.6%)	24 (40%)
ADO	3 (5.00%)	28 (46.66%)	5 (8.34%)	24 (40%)	1 (1.66%)	12 (20%)	17 (28.34%)	30 (50%)
Agricultural scientist	2 (3.33%)	16 (26.66%)	20 (33.34%)	22 (36.67%)	0 (0.00%)	0 (0.00%)	27 (45%)	33 (55%)
SMS	0 (0.00%)	8 (13.33%)	24 (40%)	28 (46.67%)	0 (0.00%)	3 (5.00%)	21 (35%)	36 (60%)

It could be concluded that Rural Agricultural Extension Officers (RAEOs) and Agricultural Development Officers (ADOs) were the most frequently visiting in the village from which the respondents were obtained latest information. Majority of 91 per cent FFS trained and 98 per cent Untrained had never contact with Subject Matter Specialist (SMS) for information regarding IPM.

Table 4.9: Distribution of the respondents according to their overall extent of contact with extension personnel

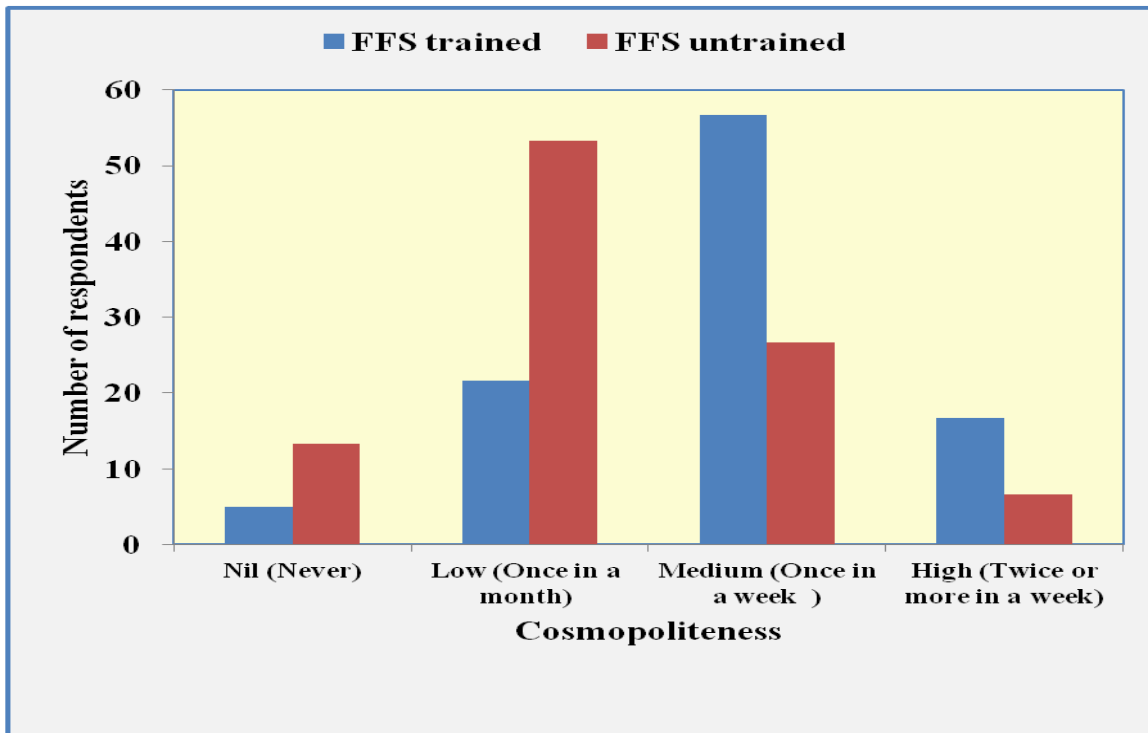
Extent of contact with extension personnel	FFS Trained farmers (n=60)		FFS untrained farmers (n=60)	
	Frequency	Percentage	Frequency	Percentage
Nil	0	0.00	0	0.00
Low (1- 4)	17	28.34	29	48.33
Medium (5-8)	31	51.66	23	38.33
High (>8)	12	20.00	8	13.34

The result in Table 4.9 shows that majority (51.66%) of the FFS trained farmers had medium contact with extension personnel; followed by 28.34 per cent

FFS trained farmers who had low contact with extension personnel, 20 per cent of FFS trained farmers had high contact with extension personnel and there were no FFS trained farmers who had nil contact with extension personnel. Whereas the majority (48.33%) of the FFS untrained farmers had low contact with extension personnel, followed by 38.33 per cent FFS untrained farmers who had medium contact with extension personnel while only 13.34 per cent FFS untrained farmers had high contact with extension personnel for information regarding IPM and there were no FFS untrained farmers who had nil contact with extension personnel. This study is strongly supported from the findings of Gupta (1998).

4.1.11 Cosmopolitaness

The data regarding cosmopolitaness are presented in the Table 4.10 and fig 4.17. The data revealed that the majority of the FFS trained farmers (56.66%) had medium cosmopolitaness, followed by 21.67 per cent had reported low cosmopolitaness and 16.67 per cent had reported high cosmopolitaness, and only 5 per cent of the FFS trained farmers had nil cosmopolitaness. Whereas majority of 53.33 per cent of the FFS untrained farmers reported low cosmopolitaness, followed by 26.67 per cent of the FFS untrained farmers were reported medium cosmopolitaness, 13.34 per cent had reported cosmopolitaness and only 6.66 per cent of the FFS untrained farmers were found in the high cosmopolitaness category with regard to IPM. This study is strongly supported from the findings of Chandramouli (2005).



4.16 Distribution of the FFS trained and FFS untrained farmers according to their Cosmopolitanism

Table 4.10: Distribution of respondents according their cosmopoliteness

Cosmopoliteness	FFS trained farmers (n=60)		FFS untrained farmers (n=60)	
	Frequency	Percentage	Frequency	Percentage
Nil (Never)	03	5.00	08	13.34
Low (Once in a month)	13	21.67	32	53.33
Medium (Once in a weak)	34	56.66	16	26.67
High (Twice or more in a weak)	10	16.67	04	6.66

It could be concluded that the low cosmopoliteness of the FFS untrained farmers was mainly due to less utilization of information sources and poor socio-economic status (Fig. 4.10). This study strongly support from the findings of Gaikwad *et al.* (2003), Padekar (2004), Chandramouli (2005) and Rajni (2006).

4.1.12 Opinion about IPM

The data of Opinion about IPM are presented in the Table 4.11. The data revealed that the opinion of majority (90.00%) of the FFS trained farmers were agreed regarding IPM and only 10 per cent were not fully agreed or disagreed with IPM. Whereas opinion of majority (53.33) of the FFS untrained farmers were disagreed regarding IPM and 46.66 per cent were agreed regarding IPM.

Table 4.11: Distribution of respondents according to their opinion about IPM

Opinion about IPM	FFS trained farmers (n=60)		FFS untrained farmers (n=60)	
	Frequency	Percentage	Frequency	Percentage
Disagreed	6	10.00	32	53.34
Agreed	54	90.00	28	46.66

It could be concluded that the FFS trained farmers were aware of the IPM practices and their opinion is positive towards the program.



DEMONSTRATION BY FFS ON TEST PLOT



NURSERY PREPARATION

4.1.13 Knowledge about IPM

The findings on extent of knowledge regarding IPM and others are presented in Table 4.12. The data revealed that majority (91.66%) of the FFS trained farmers had full knowledge about recommended soil treatment/summer ploughing, followed by 90 per cent had full knowledge about weed management and 88.34 per cent had full knowledge about recommended seed treatment of rice, 86.66 per cent had full knowledge about neem based/neem extract, 85 per cent had full knowledge about the use of recommended resistance variety/tolerant varieties, 83.34 per cent of FFS trained farmers had full knowledge about micronutrient Zn, 81.66 per cent had full knowledge about recommended fertilizer doses, 80 per cent had full knowledge about the disease management, 78.34 per cent had full knowledge about recommended seedling treatment, 75 per cent of FFS trained farmers had full knowledge about biofertilizer and Pests of stored rice, 73.34 per cent had full knowledge about the water management, 71.66 per cent had full knowledge about recommended seed rate, 66.66 per cent had correct knowledge about the soil testing, 63.34 per cent had full knowledge about use of NPV// *Beauveria bassiana*, 60 per cent had full knowledge about use of pheromones/light traps respectively. Whereas majority (70%) of the FFS untrained farmers had full knowledge about recommended soil treatment/summer ploughing, followed by 65 per cent had full knowledge about weed management, 63.34 per cent had full knowledge about recommended seed treatment, 61.66 per cent had full knowledge about micronutrient Zn, 60 per cent had full knowledge about the use of recommended resistance variety/tolerant varieties, 56.66 per cent had full knowledge about disease management, 51.66 per cent had full knowledge about water management, 50 per cent had full knowledge about pests of stored rice, 48.34 per cent had full knowledge about the recommended seedling treatment, 45 per cent had full knowledge about recommended fertilizer doses, 43.34 per cent had full knowledge

about neem based/neem extract, 38.34 per cent had full knowledge about recommended seed rate, 36.66 per cent had full knowledge about use of pheromones/light traps, 35 per cent had full knowledge about soil testing, 30 per cent use of NPV/ beauveria bassiana and about 26.66 per cent had full knowledge about the biofertilizer respectively.

The data also revealed that majority (36.66%) of the FFS trained farmers had partial knowledge about use of pheromones/light traps, 35.00 per cent had partial knowledge about use of NPV/ beauveria bassiana, 30.00 per cent had partial knowledge about soil testing, 28.34 per cent had partial knowledge about recommended seed rate, 20.00 per cent had partial knowledge about Pests of stored rice and water management, 18.34 per cent had partial knowledge about recommended fertilizer doses, 18.33 per cent had partial knowledge about disease management, 16.66 per cent had partial knowledge about recommended seedling treatment and Biofertilizer, 13.34 per cent had partial knowledge about neem based/neem extract, 13.33 per cent had partial knowledge about the use of recommended resistance variety/tolerant varieties, 11.66 per cent had partial knowledge about micronutrient Zn, 10 per cent had partial knowledge about weed management, 8.34 per cent had partial knowledge about recommended soil treatment/summer ploughing, 6.66 per cent had partial knowledge about recommended seed treatment respectively. Whereas majority (71.66%) of the FFS untrained farmers had partial knowledge about the biofertilizer, 65 per cent had partial knowledge about use of NPV/ beauveria bassiana, 58.33 per cent had partial knowledge about soil testing, 56.67 per cent had partial knowledge about use of pheromones/light traps, 56.66 per cent had partial knowledge about the neem based/neem extract, 55 per cent had partial knowledge about the recommended fertilizer doses, 50 per cent had partial knowledge about the recommended seed rate, 45 per cent had partial knowledge about the recommended seedling treatment and water management, 36.67 per cent had partial knowledge about

the disease management, 36.66 per cent had partial knowledge about the recommended seed treatment, 35 per cent had partial knowledge about the use of recommended resistance variety/tolerant varieties, Micronutrient Zn and Weed management, 26.66 per cent had partial knowledge about the recommended soil treatment/summer ploughing and about 23.33 per cent had partial knowledge about pests of stored rice, respectively.

The data also revealed that majority (8.34%) of the FFS trained farmers had nil knowledge about Biofertilizer, 6.66 per cent had nil knowledge about water management, 5 per cent had nil knowledge about recommended seed treatment, recommended seedling treatment and micronutrient Zn, 3.34 per cent had nil knowledge about the soil testing and use of pheromones/light traps, 1.67 per cent had nil knowledge about disease management and pests of stored rice, 1.66 per cent had nil knowledge about the use of recommended resistance variety/tolerant varieties and use of NPV/ *beauveria bassiana*, 0.00 per cent had nil knowledge about recommended soil treatment/summer ploughing, recommended seed rate, neem based/neem extract, recommended fertilizer doses and weed management, respectively. Whereas majority (11.66%) of the FFS untrained farmers had nil knowledge about the recommended seed rate, 6.67 per cent had nil knowledge about soil testing and use of pheromones/light traps, 6.66 per cent had nil knowledge about the recommended seedling treatment and disease management, 5.00 per cent had nil knowledge about the use of NPV/ *beauveria bassiana*, 3.34 per cent had nil knowledge about the recommended soil treatment/summer ploughing, micronutrient Zn and water management, 1.67 per cent had nil knowledge about the biofertilizer, 1.66 pests of stored rice and about 0.00 per cent had nil knowledge about had nil knowledge about the recommended seed treatment, neem based/neem extract, recommended fertilizer doses and weed management, respectively. This study strongly support from the findings of Sangram, R., (1997), Sailaja, A. and Narasimha Reddy, 2008.

Table 4.12: Distribution of FFS trained and FFS untrained farmers according to their extent of knowledge regarding Integrated Pest Management

Management practices in rice	FFS trained farmers n=60			FFS untrained farmers n=60		
	Full	Partial	Nil	Full	Partial	Nil
Soil testing	40 (66.66)	18 (30.00)	2 (3.34)	21 (35.00)	35 (58.33)	4 (6.67)
Recommended Soil treatment/ Summer ploughing	55 (91.66)	5 (8.34)	0 (0.00)	42 (70.00)	16 (26.66)	2 (3.34)
Use of recommended resistance variety/tolerant varieties	51 (85.00)	8 (13.33)	1 (1.66)	36 (60.00)	21 (35.00)	3 (5.00)
Recommended Seed rate	43 (71.66)	17 (28.34)	0 (0.00)	23 (38.34)	30 (50.00)	7 (11.66)
Recommended Seed treatment	53 (88.34)	4 (6.66)	3 (5.00)	38 (63.34)	22 (36.66)	0 (0.00)
Recommended Seedling treatment	47 (78.34)	10 (16.66)	3 (5.00)	29 (48.34)	27 (45.00)	4 (6.66)
Biofertilizer	45 (75.00)	10 (16.66)	5 (8.34)	16 (26.67)	43 (71.66)	1 (1.67)
Micronutrient Zn	50 (83.34)	7 (11.66)	3 (5.00)	37 (61.66)	21 (35.00)	2 (3.34)
Neem based/neem extract	52 (86.66)	8 (13.34)	0 (0.00)	26 (43.34)	34 (56.66)	0 (0.00)
Use of NPV/ Beauveria bassiana	38 (63.34)	21 (35.00)	1 (1.66)	18 (30.00)	39 (65.00)	3 (5.00)
Use of pheromones/light traps	36 (60.00)	22 (36.66)	2 (3.34)	22 (36.66)	34 (56.67)	4 (6.67)
Recommended fertilizer doses	49 (81.66)	11 (18.34)	0 (0.00)	27 (45.00)	33 (55.00)	0 (0.00)
Water management	44 (73.34)	12 (20.00)	4 (6.66)	31 (51.66)	27 (45.00)	2 (3.34)
Weed management	54 (90.00)	6 (10.00)	0 (0.00)	39 (65.00)	21 (35.00)	0 (0.00)
Disease management	48 (80.00)	11 (18.33)	1 (1.67)	34 (56.66)	22 (36.67)	4 (6.66)
Pests of stored rice	45 (75.00)	14 (23.33)	1 (1.67)	30 (50.00)	29 (48.34)	1 (1.66)

It could be concluded that majority 91.66 per cent of FFS trained farmers had full knowledge about the recommended soil treatment/summer ploughing and majority 70.00 per cent of FFS untrained farmers had full knowledge about the recommended soil treatment/summer ploughing in Integrated Pest Management.

- **Distribution of FFS trained and FFS untrained farmers according to their overall level of knowledge regarding Integrated Pest Management**

The overall extents of knowledge regarding Integrated Pest Management are present in Table 4.13, The data reveals that the majority (78.34%) of the FFS trained farmers had full knowledge followed by 18.33 per cent had partial knowledge and 3.33 per cent had nil knowledge about Integrated Pest Management in comparison to FFS untrained farmers which is (48.34%) having full knowledge followed by 43.33 per cent had partial knowledge and 8.33 per cent had nil knowledge about Integrated Pest Management.

Table 4.13: Distribution of FFS trained and FFS untrained farmers according to their overall level of knowledge regarding Integrated Pest Management

Extent of knowledge	FFS trained farmers (n=60)		FFS untrained farmers (n=60)	
	Frequency	Percentage	Frequency	Percentage
Full	47	78.34	29	48.34
Partial	11	18.33	26	43.33
Nil	2	3.33	5	8.33

This shows that FFS helps to sensitize the trained farmers in new ways of thinking and problem solving. This study is strongly supported from the findings of Ortiz *et al.* (2004) and Bunyatta *et al.* (2006).

4.2 Dependent variable

4.2.1 The adoption of Integrated Pest Management practice on rice production.

The findings on adoption of IPM are presented in Table 4.14. In insect management, the data revealed that majority (81.66%) of the FFS trained farmers had fully adopted the IPM practices to control the stem borer, followed by 70 per cent had fully adopted IPM practices for plant hopper, 61.67 per cent had fully adopted IPM practices for gall midge and 55 per cent of the FFS trained farmers had fully adopted IPM practices for nematodes. In Disease management majority (86.66%) of the FFS



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trained farmers had fully adopted IPM measures for brown spot, followed by 76.66 per cent had fully adopted IPM measures for blast, 65 per cent had fully adopted IPM measures for leaf blight and 55 per cent of the FFS trained farmers had fully adopted IPM measures for sheath blight disease. In weed management the majority (83.33%) of the FFS trained farmers had fully adopted IPM measures for *Panicum* spp., followed by 63.34 per cent had fully adopted IPM measures for *Cyperus* spp., 56.67 per cent had fully adopted IPM measures for *Echinochloa* spp, and 45 per cent of the FFS trained farmers had fully adopted IPM measures *cynodon* spp. In Post harvest management majority (86.66%) of the FFS trained farmers had fully adopted IPM measures for the control of Rice weevil, followed by 78.33 per cent had fully adopted IPM measures for saw toothed grain beetle, 56.67 per cent had fully adopted IPM measures for lesser grain moth and 38.34 per cent of the FFS trained farmers had fully adopted IPM measures for rust red beetle. Where as the majority (53.33%) of the FFS untrained farmers had fully adopted the IPM practices Stem borer, 48.34 per cent had fully adopted IPM practices for plant hopper, 43.34 per cent had fully adopted the IPM practices for gall midge and only 30 per cent of the FFS untrained farmers had fully adopted the IPM practices for nematodes. In Disease management majority (65%) of the FFS untrained farmers had fully adopted IPM measures for brown spot, followed by 46.67 per cent had fully adopted the IPM practices for blast, 31.66 per cent had fully adopted the IPM practices for leaf blight and 16.67 per cent of the FFS untrained farmers had adopted the IPM practices for sheath blight disease. In weed management the majority (56.67%) of the FFS untrained farmers had fully adopted IPM practices for *Panicum* spp., followed by 41.66 per cent had adopted IPM practices for *Cyperus* spp., 33.34 per cent had fully adopted IPM practices for *Echinochloa* spp, and only 23.34 per cent of the FFS untrained farmers had fully adopted IPM practices for

cynodon spp. In Post harvest management majority (68.33%) of the FFS untrained farmers had fully adopted IPM measures for the control of Rice weevil, followed by 48.34 per cent had fully adopted IPM measures for saw toothed grain beetle, 31.67 per cent had fully adopted IPM measures for Lesser grain moth and only 18.33 per cent of the FFS untrained farmers had fully adopted IPM measures for Rust red beetle.

Table 4.14: Distribution of FFS trained and FFS untrained farmers according to their adoption regarding Integrated Pest Management

Use of IPM in managing following pests/component	FFS trained farmers n=60			FFS untrained farmers n=60		
	Full	Partial	Nil	Full	Partial	Nil
Insect management						
Stem borer	49 (81.66)	11 (18.34)	0 (0.00)	32 (53.33)	28 (46.67)	0 (0.00)
Gall midge	37 (61.67)	23 (38.33)	0 (0.00)	26 (43.34)	34 (56.66)	0 (0.00)
Plant hopper	42 (70)	18 (30)	0 (0.00)	29 (48.34)	31 (51.66)	0 (0.00)
Nematodes	33 (55)	26 (43.33)	1 (1.66)	18 (30)	39 (65.00)	3 (5.00)
Disease management						
Brown spot	52 (86.66)	8 (13.34)	0 (0.00)	39 (65)	21 (35)	0 (0.00)
Blast	46 (76.66)	14 (23.34)	0 (0.00)	28 (46.67)	32 (53.33)	0 (0.00)
Leaf blight	39 (65)	21 (35)	0 (0.00)	19 (31.66)	41 (68.34)	0 (0.00)
Sheath blight	33 (55)	25 (41.66)	2 (3.33)	10 (16.67)	47 (78.33)	3 (5.00)
Weed management						
Panicum spp.	50 (83.33)	10 (16.67)	0 (0.00)	34 (56.67)	26 (43.33)	0 (0.00)
Cyperus spp.	38 (63.34)	22 (36.66)	0 (0.00)	25 (41.66)	35 (58.34)	0 (0.00)
Echinochloa spp	34 (56.67)	26 (43.33)	0 (0.00)	20 (33.34)	38 (63.33)	2 (3.33)
Cynodon spp.	27 (45)	33 (55)	0 (0.00)	14 (23.34)	46 (76.66)	0 (0.00)
Post harvest management						
Rice weevil	52 (86.66)	6 (10.00)	2 (3.33)	41 (68.33)	16 (31.67)	3 (5.00)
Saw toothed grain beetle	47 (78.33)	13 (21.67)	0 (0.00)	29 (48.34)	30 (50.00)	1 (1.66)
Lesser grain moth	34 (56.67)	26 (43.33)	0 (0.00)	19 (31.67)	41 (68.33)	0 (0.00)
Rust red beetle	23 (38.34)	36 (60.00)	1 (1.66)	11 (18.33)	46 (76.67)	3 (5.00)



USE OF LIGHT TRAPS IN RICE

The data also revealed that majority (43.33%) of the FFS trained farmers had partially adopted IPM practices for nematodes, followed by 38.33 per cent had partially adopted IPM practices for gall midge, 30 per cent had partially adopted IPM practices for plant hopper and only 18.34 per cent of the FFS trained farmers had partially adopted IPM practices for stem borer, In disease management majority (41.66%) of the FFS trained farmers had partially adopted IPM measures for sheath blight, followed by 35 per cent had partially adopted IPM for leaf blight, 23.34 had partially adopted IPM practices for blast and 13.34 per cent of the FFS trained farmers had partially adopted IPM practices for stem borer. In weed management the majority (55.00%) of the FFS trained farmers had partially adopted IPM practices for cynodon spp., 43.33 per cent had partially adopted IPM practices for Echinochloa spp, 36.66 per cent had partially adopted IPM practices for Cyperus spp and only 16.67 per cent of the FFS trained farmers had partially adopted IPM practices for panicum spp. In Post harvest management majority (60.00%) of the FFS trained farmers had partially adopted IPM measures for the control of rust red beetle, followed by 43.33 per cent had partially adopted IPM practices for Lesser grain moth, 21.67 per cent had partially adopted IPM practices for Saw toothed grain beetle, and only 10.00 per cent of the FFS trained farmers had partially adopted IPM practices for Rice weevil. Whereas in FFS untrained farmers the majority (43.33%) of the FFS untrained farmers had partially adopted IPM practices for nematodes, followed by 56.66 per cent had partially adopted IPM practices for gall midge, 51.66 per cent had partially adopted IPM practices for plant hopper and only 46.67 per cent of FFS untrained farmers had partially adopted IPM practices for stem borer, In Disease management majority (78.33%) of the FFS untrained farmers had partially adopted IPM measures for sheath blight, followed by 68.34 per cent had partially adopted IPM for leaf blight, 53.33 had



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partially adopted IPM practices for blast and only 35 per cent of the FFS untrained farmers had partially adopted IPM practices for Brown spot. In weed management the majority (76.66%) of the FFS untrained farmers had partially adopted IPM practices for cynodon spp. 66.66 per cent had partially adopted IPM practices for Echinochloa spp, 58.34 per cent had partially adopted IPM practices for Cyperus spp and only 43.33 per cent of the FFS untrained farmers had partially adopted IPM practices for panicum spp. In Post harvest management majority (81.67%) of the FFS untrained farmers had partially adopted IPM measures for the control of rust red beetle, followed by 68.33 per cent had partially adopted for lesser grain moth, 51.66 per cent had partially adopted IPM practices for Saw toothed grain beetle and only 31.67 per cent of the FFS untrained farmers had partially adopted IPM practices for Rice weevil.

The data also revealed that majority (1.66%) of the FFS trained farmers had not adopted IPM practices for nematodes, followed by 0.00 per cent had not adopted IPM practices for stem borer, gall midge and plant hopper, In disease management majority (3.33%) of the FFS trained farmers had not adopted IPM measures for sheath blight, followed by 0.00 per cent had not adopted IPM for brown spot, blast and leaf blight. In weed management the majority (55%) of the FFS trained farmers had not adopted IPM practices for cynodon spp. followed by 43.33 per cent had not adopted IPM practices for Echinochloa spp, 36.66 per cent had not adopted IPM practices for Cyperus spp and only 16.67 per cent of the FFS trained farmers had not adopted IPM practices for panicum spp. In Post harvest management majority (3.33%) of the FFS trained farmers had not adopted IPM measures for the control of Rice weevil, followed by 1.66 per cent had not adopted IPM for rust red beetle, 0.00 per cent had not adopted IPM practices for for Saw toothed grain beetle and Lesser grain moth. Whereas in FFS untrained farmers the majority (5.00%) of the FFS untrained farmers had not adopted

IPM practices for nematodes, followed by 0.00 per cent had not adopted IPM practices for stem borer, plant hopper and gall midge. In Disease management majority (5.00%) of the FFS untrained farmers had not adopted IPM measures for sheath blight, followed by 0.00 per cent had not adopted IPM for brown spot, blast and leaf blight. In weed management the majority (3.33%) per cent had not adopted IPM practices for *Echinochloa* spp, followed by 0.00 per cent had not adopted IPM practices for *pannicum* spp, *Cyperus* spp and *cynodon* spp. In Post harvest management majority (5.00%) of the FFS untrained farmers had not adopted IPM measures for the control of rice weevil and rust red beetle, 1.66 per cent had not adopted IPM practices for Saw toothed grain beetle and 0.00 per cent of the FFS untrained farmers had not adopted IPM practices for lesser grain moth.

It could be concluded that majority (86.66) of the FFS trained farmers had adopted IPM practices for for brown spot and rice weevil. Whereas only (68.33%) of the FFS untrained farmers had adopted the various IPM practices for rice weevil due to lack of awareness regarding IPM. This study is strongly supported from the findings of Chin *et al.* (1992) and Wiradmadya (1996).

- **The overall extents of adoption about Integrated Pest Management**

The overall extents of adoption regarding Integrated Pest Management are present in Table 4.15. The data reveals that the majority (75%) of the FFS trained farmers had fully adopted Integrated Pest Management in comparison to FFS untrained farmers (38.34%). It was also found that 5.00 per cent of FFS trained farmers and 8.33 per cent of FFS untrained farmers had no adoption about recommended Integrated Pest Management practices.



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Table 4.15: Distribution of FFS trained and FFS untrained farmers according to their overall adoption of Integrated Pest Management

Adoption of IPM practices	FFS trained farmers (n=60)		FFS untrained farmers (n=60)	
	Frequency	Percentage	Frequency	Percentage
Full	45	75.00	23	38.34
Partial	12	20.00	32	53.33
Nil	3	5.00	5	8.33

This indicates that FFS has good influence on the adoption of IPM and also empower the trained farmers on decision making due to training programme and FFS untrained farmers did not aware of the significance of the practices so they less adopt the Integrated Pest Management.

Table 4.16 Adoption degree of biological control measures used by the respondents

Adoption degree	FFS trained farmers (n=60)			FFS untrained farmers (n=60)		
	Frequency	Percentage	Cumulative frequency	Frequency	Percentage	Cumulative frequency
Very low (0-8)	3	5.00	3	18	30.00	18
Low (9-16)	5	8.33	8	23	38.33	41
Average (17-24)	21	35.00	29	11	18.33	52
High (25-32)	31	51.66	60	8	13.33	60

4.2.2 Adoption degree of biological control measures used by the respondents

In table 4.16 the majority of the FFS trained farmers (51.66%) were belong to high degree of adoption of the biological control for pest management and about 38 per cent of the FFS untrained farmers were belonged to low adoption degree of biological control measures. The major difference in degree of adoption between FFS trained farmers and FFS untrained farmers is quite high. The farmers who participated

in FFS training were adopting biological control more than those who are not participated in FFS training.

It is evident from the data that majority of FFS trained farmers (51.66%) were using biological control for pest management (high degree of adoption) in comparison to FFS untrained farmers (38.33%) (low degree of adoption). This results in reduction of environmental pollution due to less use of hazardous pesticides and conservation of natural enemies.

4.2.3 Impact of FFS programme on productivity of rice

To determine the level of difference between the FFS trained farmers and FFS untrained farmers related to their adoption, 't' test was applied and results are summarized in Table 4.17. It reveals that FFS trained farmers had significantly higher adoption as compared to FFS untrained farmers because the 't' value is 17.41** and was found highly significant. This indicated that Farmer Field School training programme played important role in increasing the rate of adoption of FFS trained farmers through proper training.

Table 4.17: Difference between FFS trained farmers and FFS untrained farmers with respect to their productivity of rice

Particular	FFS trained farmers	FFS untrained farmers
Frequency	60	60
Mean	22.28	11.01
S.D.	4.08	2.69
't' value	17.41**	

**Significant at 0.01 level of probability

Table 4.18: Correlation coefficient analysis of independent variables with socio-economic status of the respondent

S. no.	Independent variables	Correlation coefficient (r)	
		FFS trained farmers	FFS untrained farmers
1.	Age	0.375**	0.127
2.	Education	0.349**	0.158
3.	Family size	-0.279	-0.202
4.	Experience regarding IPM	0.152	0.068
5.	Occupation	0.218	0.031
6.	Land holding	0.254*	0.106
7.	Annual income	0.252*	0.158
8.	Irrigation availability	0.163	0.036
9.	Source of information	0.337**	0.253*
10.	Contact with extension personnel	0.291*	0.251*
11.	Cosmopolitaness	0.250*	0.169
12.	Opinion regarding IPM	0.326**	0.124
13.	Knowledge regarding IPM	0.852**	0.249

** Significant at 0.01 level of probability

* Significant at 0.05 level of probability

4.3 Correlation coefficient analysis of independent variables with adoption of IPM

To determine the relationship of selected independent variables with the adoption of IPM, the correlation analysis was worked out and results are present in Table 4.18. The finding revealed that out of 13 independent variables, 5 variables i.e. age, education, Source of information, opinion about IPM and knowledge about IPM were found to be positive and highly significantly correlated at 0.01 level of probability, and 4 variables i.e. land holding, annual income, contact with extension personnel and cosmopolitaness were found to be positive and significantly correlated at 0.05 level of probability with the adoption of Integrated Pest Management. The other variables like experience about IPM, occupation and irrigation availability showed statistically non significant relationship and only 1 variable i.e. family size is negatively correlated with the adoption of Integrated Pest Management.

In case of FFS untrained farmers out of 13 independent variables only 2 variables i.e. sources of information and contact with extension personnel were found to be positive significantly correlated at 0.05 level of probability and family size is negatively correlated with the adoption of Integrated Pest Management. However, remaining 10 independent variables i.e. age, education, experience about IPM, occupation, land holding, annual income, irrigation availability, cosmopolitaness, opinion about IPM and knowledge about IPM could not indicated any significant relationship with the adoption of Integrated Pest Management.

4.4 Multiple regression analysis of independent variables with adoption of IPM

The result of multiple regression analysis is presented in Table 4.20. The data reveals that out of 13 independent variables, the 3 variables *viz.* source of information, contact with extension personnel and knowledge about IPM contributed positively and

highly significantly toward adoption of IPM at 0.01 per cent level of probability in FFS trained farmers. The 5 variables age, education, land holding annual income and opinion about IPM contributed positively and significantly at 0.05 per cent level of probability toward FFS trained farmers and 1 variable family size is negatively contributed with the adoption. The other variables i.e. experience about IPM occupation, irrigation availability and cosmopolitaness had significant contribution in adoption of IPM of the FFS trained farmers.

In case of FFS untrained farmers, out of 13 independent variables, the 2 variables *viz.* source of information, contact with extension personnel showed the positive and significant contribution at 0.05 per cent level of probability and only 1 variable i.e. family size showed the negative contribution towards adoption of IPM. Remaining 10 variables age, education, experience about IPM, occupation, land holding, annual income, irrigation availability, cosmopolitaness, opinion about IPM and knowledge about IPM had no significant contribution in adoption of IPM of the FFS untrained farmers.

All the selected 13 variables which were fitted in regression model explained the 51.13 and 32.21 per cent of the total contribution were explained in the adoption of IPM of FFS trained farmers and FFS untrained farmers, respectively. The corresponding F value was found significant (at 13,59 *d.f.*) (at 13, 59 *d.f.*)

Table 4.19 Multiple regression analysis of the independent variables with the adoption of IPM of the FFS trained farmers and FFS untrained farmers

Independent variables	Partial regression coefficient			
	FFS trained farmers		FFS untrained farmers	
	'b' value	't' value	'b' value	't' value
X ₁ Age	0.5246*	1.262	0.042	0.508
X ₂ Education	0.850*	0.445	0.133	0.340
X ₃ Family size	-0.085	0.167	-0.162	-0.124
X ₄ Experience about IPM	0.022	0.323	0.106	0.398
X ₅ Occupation	0.209	0.243	0.168	0.980
X ₆ Land holding	0.348*	0.163	0.122	1.161
X ₇ Annual income	2.674*	1.412	1.87	0.369
X ₈ Irrigation availability	0.516	1.360	0.207	0.126
X ₉ Source of information	0.421**	1.358	0.344*	0.202
X ₁₀ Contact with extension personnel	0.379**	0.772	0.327*	0.262
X ₁₁ Cosmopolitaness	0.209	0.594	0.773	0.463
X ₁₂ Opinion about IPM	0.342*	1.393	0.014	0.063
X ₁₃ Knowledge about IPM	0.938**	1.225	0.181	0.198

** Significant at 0.01 level of probability

Multiple R² 0.7967 0.6804

* Significant at 0.05 level of probability

Intercept constant (a) 0.581 1.113

F value 12.867 7.534

(at 13,59 *d.f.*) (at 13, 59 *d.f.*)

It indicated that, increase in age, education, land holding, annual income, sources of information, extension contact with extension personnel, opinion and knowledge about IPM leads to increase adoption of IPM of FFS trained farmers. Similarly, education, land holding, annual income, opinion and knowledge about IPM of FFS untrained farmers are to be increased for enhance their rate of adoption of IPM. Rao (2001) noted almost similar findings in his study.

4.5 Constraints faced by the farmers in adoption of Integrated Pest Management

Multiple responses were taken to ascertain the problems faced by the FFS trained farmers in adoption of IPM, those are given as shown in Table 4.21. Among several constraints, the highest percentage of respondents (85%) were of the opinion that Lack of technical knowledge regarding IPM practices was the major constraints ranked 1st, followed by lack of co-operation among farmers for adopting IPM (81.66) IInd, lack of proper training conducted for adopting improved IPM practices (60.00%) IIIrd in ranked, scarcity of labour in peak period of operation (60%) IVth in ranked, higher cost of pheromone traps Vth in ranked.

Table 4.20: Constraints perceived by the FFS trained and untrained farmers in adoption of IPM n=60

Constraints	Frequency	Percentage	Rank
• Lack of technical knowledge regarding IPM practices.	51	85.00	I
• Lack of proper training conducted for adopting improved IPM practices.	36	60.00	III
• Poor support for adopting IPM practices.	23	38.33	VI
• Lack of co-operation among farmers for adopting IPM.	49	81.66	II
• Higher cost of pheromone traps.	25	41.66	V
• Scarcity of labour in peak period of operation.	29	48.33	IV
• Lack of subsidy to purchase FYM/ bio-fertilizers, bio-pesticides etc. IPM material.	21	35.00	VII
• Poor extension reach of agencies.	18	30.00	VIII

*Data are based on multiple responses

The other constraints were 38.33 per cent of the FFS trained farmers were of the opinion that poor support for adopting IPM practices was sixth ranked, lack of subsidy to purchase FYM/ bio-fertilizers, bio-pesticides etc. IPM material was



IDENTIFICATION OF INSECTS



IDENTIFICATION OF SHEATH BLIGHT DISEASES

seventh ranked and poor extension reach of agencies was eighth in rank were reported as the major constraints in adoption of Integrated pest management. Ignorance is a seed of quackery so this clearly indicates that FFS trained farmers were aware of FFS and IPM. This study is strongly supported from the findings of Kenmore *et al.* (1995).

4.6 Suggestions to overcome the constraints faced by the the FFS trained farmers

As regard to suggestion given by the FFS trained farmers to overcome the constraints in adoption of IPM, the findings are presented in the Table 4.22. The data revealed that the majority of the FFS trained farmers (83.33%) were suggested that extension agent or agency should convey right information at right time and technical knowledge regarding use of IPM material like Neem Seed Kernal Extract (NSKE) and pheromone traps etc.

Table 4.21: Suggestions given by FFS trained farmers to overcome the constraints for adoption of IPM

(n=60)

Suggestions	Frequency	Percentage*
• Extension agent or agency should convey right information at right time and technical knowledge regarding use of IPM material like NSKE and pheromone traps etc.	50	83.33
• Regular publicity of IPM on TV, radio and newspaper should be provided.	47	78.33
• Proper FFS training should be conducted for adopting improved IPM practices.	35	58.33
• Labor should be easily available at the time of important operation.	29	48.33
• The Pheromone/ light traps should be available at reasonable price or in subsidy so that more farmers can afford it.	24	40.00
• Better organizational and extension support should be provided for adopting IPM practices.	23	38.33
• More subsidies should be provided to purchase FYM/ bio-fertilizers, bio-pesticides etc.	12	20.00
• There is an urgent need to intensify the IPM extension services in major rice growing areas.	11	18.34

*Data are based on multiple responses

The other suggestions were 78.33 per cent of the FFS trained farmers were suggested that Regular publicity of IPM on TV, radio and newspaper should be provided, 58.33 per cent of the FFS trained farmers were suggested that proper FFS training should be conducted for adopting improved IPM practices, 48.33 per cent of the FFS trained farmers were suggested that labour should be easily available at the time of important operation. Whereas, 40 per cent of FFS trained farmers were suggested that the pheromone/ light traps should be available at reasonable price or in subsidy so that more farmers can afford it, followed by 38.33 per cent of the FFS trained farmers were suggested that better organizational and extension support should be provided for adopting IPM practices, 20 per cent of the FFS trained farmers were suggested that more subsidies should be provided to purchase FYM/ bio-fertilizers, bio-pesticides etc. 18.34 per cent of FFS trained farmers were suggested that there is an urgent need to intensify the IPM extension services in major rice growing areas. This study is strongly supported with the findings of Rafee(2003).

*Summary, Conclusion &
Suggestions for Future Research
Work*

CHAPTER – V

SUMMARY, CONCLUSION AND SUGGESTION FOR FUTURE RESEARCH WORKS

The challenges posed by agricultural globalization revolution in information and communication technology rising population and the consequent demand for sustainability have prompted to have a re-look on the existing extension system in India and re-orient it with proper direction. The new conceptualization of agricultural extension services in developing countries has introduced many changes in the delivery of agricultural technologies. One of the main components of this project is to focus directly on agricultural diversification and increasing farm income and rural employment and pilot testing innovation to improve management of technological dissemination with greater accountability to stake holders and participation by the farming community to fulfill the requirement of this component.

The term FFS has its origin in Indonesia. The first FFS were designed and managed by the Food and Agriculture Organization (FAO) of the United Nations in Indonesia in 1989 to train the trainers and farmers in Integrated Pest Management (IPM) in a participatory mode. The IPM program was initiated in many states during the early 1970s. By 1972, Cooperative Extension had supported the implementation of 52 IPM programs across 33 states. At the state level, IPM program implementation became the responsibility of the Texas AgriLife Extension Service.

FFS is a group-based learning process that includes hands-on training methods in which farmers test management methods/production technologies for themselves and learn concepts directly. Training also includes communication skills, skills in identification and problem solving, in leadership, in interaction and discussion

methods. Training in the field school follows the season long cycle and the field is the primary learning venue. Farmers learn by carrying out themselves the various activities related to the particular farming practice they want to learn/evaluate. The field school offers farmers an opportunity to learn by doing, by being involved in experimentation, discussion and decision-making. This strengthens the role of farmers in the research-extension-farmer chain. It also improves the sense of ownership of technological packages and new knowledge and skills. Keeping in view to profound importance of Integrated Pest Management programme for sustainable development of farmers of Chhattisgarh, this research work “Impact of Farmer’s Field School Training Program on Adoption of Integrated Pest Management practices in Rice by the farmers of the Korba District of Chhattisgarh” was undertaken to assess the impact of the programme on improving annual income, farm power and home assets of the implemented programme area, because it ensures the efficiency of extension services, enable Govt. of Chhattisgarh to take necessary action regarding short comings in extension and provide appropriate information to policy makers. The study should not be treated as fault finding mechanism but it should be a positive means to suggest areas requiring attention that may not be readily apparent through regular field review of extension activities. The study was fully based on the farmer’s perception and findings should be considered as the views of the farmers.

Keeping the above objectives in view, it was thought to take up the present study with following specific objectives:-

1. To determine the socio-economic profile of the selected trained and untrained farmers of Korba district.
2. To find out the level of knowledge of the respondents regarding Integrated Pest Management practices for rice.

3. To determine the extent of adoption regarding Integrated Pest Management practices in rice by the respondents.
4. To determine the relationship between selected independent variables and extent of adoption of the respondents about IPM practices in rice.
5. To identify the constraints faced by the respondents in adoption of Integrated Pest Management.
6. To obtain the suggestions from the respondents for enhancing the adoption of IPM practices in rice.

The study was conducted in Korba district of Chhattisgarh, during the year 2011-12. The korba district is situated in the northern half of the Chhattisgarh state and surrounded by the districts Korea, Surguja, Bilaspur, Janjgir etc. The korba district has five blocks i.e (Korba, Kartala, Katghora, Pali and Podi-uproda) out of these blocks only 3 block i.e., Korba, Katghora and Pali and blocks were selected for the study, because sizeable number of FFS trained rice growers were residing in this district. From each selected block, 2 villages (Total $3 \times 2 = 6$) were selected randomly on the basis of maximum availability of trained farmers in the villages. Village Bela and Dondro from Korba block, Arda and Ghanakachaar from Katghora block and Gopalpur and Irraf from Pali block were selected randomly. From each respective village 10 trained farmers ($10 \times 6 = 60$) were selected randomly. For comparison and to know the impact of FFS training program on adoption of IPM practices in rice 10 untrained farmers (Total $10 \times 6 = 60$) were also selected from same village through simple random sampling. In this way total number of 120 respondents was considered for the collection of data.

The independent variables included in the study were age, education, size of family, experience about IPM, occupation, land holding, annual income, irrigation

availability, sources of information, contact with extension personnel, cosmopolitaness, opinion about IPM and knowledge about IPM.

The adoption of the Integrated Pest Management practice on rice was considered as dependent variable for this study. The data were collected through personal interview by pre tested interview schedule and analyzed the data with appropriate statistical tools.

The major findings of this study are summarized as follows:

Independent variables

- **Socio-personal characteristics**

Socio-personal characteristics of the respondents indicated that the majority (50%) of the FFS trained farmers belongs to young age group (up to 35 years) and majority (61.66%) of the FFS untrained farmers belonged to middle age group (36 to 50 years). The majority (33.33%) of the FFS trained farmers were having higher secondary level of education as compared to majority (38.33%) of the FFS untrained farmers were having primary school level of education. Majority (75%) of the FFS trained farmers had medium family size (6 to 10 members) and majority (68.33%) of the FFS untrained farmers had medium family size (6 to 10 members). Majority (63.33%) of the FFS trained farmers were having medium experience (4 to 8 years) and majority (51.67%) of the FFS untrained farmers had less experience (up to 3 years).

The majorities (43.33%) of the FFS trained farmers were involved in agriculture and the majorities (41.66) of FFS untrained farmers were involved in agriculture and labor. The majority of the FFS trained farmers (51.66%) were having medium size of land holding (5.1 to 10 acre) and the majority of the FFS untrained farmers (35%) came under small size of land holding (having 2.51 to 5 acre).

Regarding annual income majority of the FFS trained farmers (41.66%) were having their income ranging from Rs. 30,001 to Rs.50, 0000 (High category) per annum as compare to the FFS untrained farmers (45%) earned Rs. 20,001 to Rs. 30, 0000 (Medium category) per annum. The majority of the FFS trained farmers (58.33%) were having irrigation through canal and the majority of the FFS untrained farmers (48.33%) were also having irrigation through canal.

- **Communicational characteristics**

The findings revealed that majority of the majority (53.33%) of FFS trained farmers preferred to get the IPM information regularly from the Farmer Field School and the majority (28.34%) of the FFS untrained farmers had made regular contact with neighbors/friends for obtaining information regarding IPM. The data of overall use of information sources reveals that the majority (60%) of the FFS trained farmers had medium level of exposure to various sources of information for getting the information regarding IPM and the majority (45%) of FFS untrained farmers had medium level of exposure to various sources of information for getting the information regarding IPM.

The majority (51%) of the FFS trained farmers had medium contact with extension personnel; followed by 28.34 per cent FFS trained farmers who had low contact with extension personnel, 20 per cent of FFS trained farmers had high contact with extension personnel and there were no FFS trained farmers who had nil contact with extension personnel. Whereas the majority (48.33%) of the FFS untrained farmers had low contact with extension personnel, followed by 38.33 per cent FFS untrained farmers who had medium contact with extension personnel while about 13.34 per cent FFS untrained farmers had high contact with extension personnel and there were no FFS untrained farmers who had nil contact with extension personnel.

- **Socio-psychological characteristics**

On analyzing the data it was found that majority of the majority of the FFS trained farmers (56.66%) had medium cosmopolitaness and majority of 53.33 per cent of the FFS untrained farmers reported low cosmopolitaness. Opinion of majority (90.00%) of the FFS trained farmers were agreed regarding IPM and opinion of majority (53.33) of the FFS untrained farmers were disagreed regarding IPM. In case of activity wise knowledge level of FFS trained farmers it was found that the majority (91.66%) of the FFS trained farmers had full knowledge about recommended soil treatment/summer ploughing, followed by 90 per cent about weed management and 88.34 per cent about recommended seed treatment of rice, 86.66 per cent about neem based/neem extract, 85 per cent about the use of recommended resistance variety/tolerant varieties, 83.34 per cent about micronutrient Zn, 81.66 per cent about recommended fertilizer doses, 80 per cent about the disease management, 78.34 per cent about recommended seedling treatment, 75 per cent about biofertilizer and pests of stored rice, 73.34 about water management, 71.66 per cent about recommended seed rate, 66.66 per cent about the soil testing, 63.34 per cent about use of NPV/ Beauveria bassiana, 60 per cent about use of pheromones/light traps respectively and majority (70%) of the FFS untrained farmers had full knowledge about recommended soil treatment/summer ploughing, followed by 65 per cent about weed management, 63.34 per cent about recommended seed treatment, 61.66 per cent about micronutrient Zn, 60 per cent about the use of recommended resistance variety/tolerant varieties, 56.66 per cent about disease management, 51.66 per cent about water management, 50 per cent about pests of stored rice, 48.34 per cent about the recommended seedling treatment, 45 per cent about recommended fertilizer doses, 43.34 per cent about neem based/neem extract, 38.34 per cent about recommended seed rate, 36.66 per cent about use of

pheromones/light traps, 35 per cent about soil testing, 30 per cent use of NPV/ beauveria bassiana, 26.66 per cent about the biofertilizer respectively.

The data also revealed that majority (36.66%) of the FFS trained farmers had partial knowledge about use of pheromones/light traps, 35.00 per cent had about use of NPV/ beauveria bassiana, 30.00 per cent about soil testing, 28.34 per cent about recommended seed rate, 20.00 per cent about pests of stored rice and water management, 18.34 per cent about recommended fertilizer doses, 18.33 per cent about disease management, 16.66 per cent about recommended seedling treatment and Biofertilizer, 13.34 per cent about neem based/neem extract, 13.33 per cent about the use of recommended resistance variety/tolerant varieties, 11.66 per cent about micronutrient Zn, 10 per cent about weed management, 8.34 per cent about recommended soil treatment/summer ploughing, 6.66 per cent about recommended seed treatment respectively. Whereas majority (71.66%) of the FFS untrained farmers had partial knowledge about the biofertilizer, 65 per cent about use of NPV/ beauveria bassiana, 58.33 per cent about soil testing, 56.67 per cent about use of pheromones/light traps, 56.66 per cent about the neem based/neem extract, 55 per cent about the recommended fertilizer doses, 50 per cent about the recommended seed rate, 45 per cent about the recommended seedling treatment and water management, 36.67 per cent about the disease management, 36.66 per cent about the recommended seed treatment, 35 per cent about the use of recommended resistance variety/tolerant varieties, Micronutrient Zn and Weed management, 26.66 per cent about the recommended soil treatment/summer ploughing and 23.33 per cent had partial knowledge about pests of stored rice, respectively.

The data also revealed that majority (8.34%) of the FFS trained farmers had nil knowledge about Biofertilizer, 6.66 per cent had nil knowledge about water

management, 5 per cent had nil knowledge about recommended seed treatment, recommended seedling treatment and micronutrient Zn, 3.34 per cent had nil knowledge about the soil testing and use of pheromones/light traps, 1.67 per cent had nil knowledge about disease management and pests of stored rice, 1.66 per cent had nil knowledge about the use of recommended resistance variety/tolerant varieties and use of NPV/ *beauveria bassiana*, 0.00 per cent had nil knowledge about recommended soil treatment/summer ploughing, recommended seed rate, neem based/neem extract, recommended fertilizer doses and weed management, respectively. Whereas majority (11.66%) of the FFS untrained farmers had nil knowledge about the recommended seed rate, 6.67 per cent had nil knowledge about soil testing and use of pheromones/light traps, 6.66 per cent had nil knowledge about the recommended seedling treatment and disease management, 5.00 per cent had nil knowledge about the use of NPV/ *beauveria bassiana*, 3.34 per cent had nil knowledge about the recommended soil treatment/summer ploughing, micronutrient Zn and water management, 1.67 per cent had nil knowledge about the biofertilizer, 1.66 pests of stored rice and about 0.00 per cent had nil knowledge about had nil knowledge about the recommended seed treatment, neem based/neem extract, recommended fertilizer doses and weed management, respectively.

According to the overall extents of knowledge regarding Integrated Pest Management data reveals that the majority (78.34%) of the FFS trained farmers had full knowledge followed by 18.33 per cent had partial knowledge and 3.33 per cent had nil knowledge about Integrated Pest Management in comparison to FFS untrained farmers which is (48.34%) having full knowledge followed by 43.33 per cent had partial knowledge and 8.33 per cent had nil knowledge about Integrated Pest

Management. This indicated that the FFS untrained farmers did not have enough knowledge about the Integrated Pest Management.

Dependent variable

- **Adoption degree of biological control measures used by the respondents**

The majority of the FFS trained farmers (51.66%) were using the biological control for pest management (high adoption degree) as compared to FFS untrained farmers 38 per cent (low adoption degree). The major difference in degree of adoption between FFS trained farmers and FFS untrained farmers is quite high. The farmers who participated in FFS training were adopting biological control more than those who are not participated in FFS training.

- **Impact of FFS programme on productivity of rice**

To determine the level of difference between the FFS trained farmers and FFS untrained farmers related to their adoption 't' test data reveals that FFS trained farmers had significantly higher adoption as compared to FFS untrained farmers because the 't' value is 17.41** and was found highly significant at 0.01 level of probability.

This clearly indicated that Farmer Field School training programme played a significant role in increasing the degree and rate of adoption and substantially increase the yield of rice of FFS trained farmers through proper training.

- **Correlation analysis**

The finding revealed that out of 13 independent variables, 5 variables i.e. age, education, Source of information, opinion regarding IPM and knowledge regarding IPM were found to be positive and highly significantly correlated at 0.01 level of probability, and 4 variables i.e. land holding, annual income, contact with extension personnel and cosmopolitaness were found to be positive and significantly correlated

at 0.05 level of probability with the adoption of Integrated Pest Management. The other variables like experience about IPM, occupation and irrigation availability showed statistically non significant relationship and only 1 variable i.e. family size is negatively correlated with the adoption of Integrated Pest Management.

In FFS untrained farmers out of 13 independent variables only 2 variables i.e. sources of information and contact with extension personnel were found to be positive significantly correlated at 0.05 level of probability and family size is negatively correlated with the adoption of Integrated Pest Management. However, remaining 10 independent variables i.e. age, education, experience regarding IPM, occupation, land holding, annual income, irrigation availability, cosmopolitaness, opinion about IPM and knowledge about IPM could not indicated any significant relationship with the adoption of Integrated Pest Management respectively.

- **Multiple regression analysis**

The result of multiple regression reveals that out of 13 independent variables, the 3 variables *viz.* source of information, contact with extension personnel and knowledge about IPM contributed positively and highly significantly toward adoption of IPM at 0.01 per cent level of probability, 5 variables age, education, land holding annual income and opinion about IPM contributed positively and significantly at 0.05 per cent level of probability and 1 variable family size is negatively contributed towards the adoption. The other variables i.e. experience about IPM, occupation, irrigation availability and cosmopolitaness had significant contribution in adoption of IPM of the FFS trained farmers. In case of FFS untrained farmers, out of 13 independent variables, the 2 variables *viz.* source of information, contact with extension personnel showed the positive and significant contribution at 0.05 per cent level of probability, only 1 variable i.e. family size showed the negative contribution towards adoption of

IPM and remaining 10 variables age, education, experience about IPM, occupation, land holding, annual income, irrigation availability, cosmopolitaness, opinion about IPM and knowledge about IPM had no significant contribution in adoption of IPM of the FFS untrained farmers. All the selected 13 variables which were fitted in regression model explained the 51.13 and 32.21 per cent of the total contribution were explained in the adoption of IPM of FFS trained farmers and FFS untrained farmers, respectively.

- **Constraints and Suggestions**

Among several constraints, the highest percentage of respondents (85%) were of the opinion that lack of technical knowledge regarding IPM practices was the major constraints ranked 1st, followed by lack of co-operation among farmers for adopting IPM (81.66) IInd, lack of proper training conducted for adopting improved IPM practices (60.00%) IIIrd in ranked, scarcity of labour in peak period of operation (60%) IVth in ranked, higher cost of pheromone traps Vth in ranked were reported as the major constraints in adoption of Integrated Pest Management.

The suggestions obtained from the FFS trained farmers to overcome the constraints in adoption of IPM, the data revealed that the majority of the FFS trained farmers (83.33%) were suggested that extension agent or agency should convey right information at right time and technical knowledge regarding use of IPM material like Neem Seed Kernel Extract (NSKE) and pheromone traps etc. followed by 78.33 per cent of the FFS trained farmers were suggested that regular publicity of IPM on TV, radio and newspaper should be provided, 58.33 per cent were suggested that proper FFS training should be conducted for adopting improved IPM practices, 48.33 per cent were suggested that labour should be easily available at the time of important operation, 40 per cent of FFS trained farmers were suggested that the pheromone/ light

traps should be available at reasonable price or in subsidy so that more farmers can afford it, 38.33 per cent were suggested that better organizational and extension support should be provided for adopting IPM practices, 20 per cent were suggested that more subsidies should be provided to purchase FYM/ bio-fertilizers, bio-pesticides etc. and about 18.34 per cent of FFS trained farmers were suggested that there is an urgent need to intensify the IPM extension services in major rice growing areas.

CONCLUSION

- The the majority (50%) of the FFS trained farmers belongs to young age group (up to 35 years) and (61.66%) of the FFS untrained farmers belonged to middle age group (36 to 50 years).
- The majority (33.33%) of the FFS trained farmers were having higher secondary level of education as compared to majority (38.33%) of the FFS untrained farmers were having primary school level of education.
- Majority (75%) of the FFS trained farmers had medium family size (6 to 10 members) and majority (68.33%) of the FFS untrained farmers had medium family size (6 to 10 members).
- Majority (63.33%) of the FFS trained farmers were having medium experience (4 to 8 years) and majority (51.67%) of the FFS untrained farmers had less experience (up to 3 years).
- The majority (43.33%) of the FFS trained farmers was involved in agriculture and the majority (41.66%) of FFS untrained farmers was involved in agriculture and labor.

- The majority of the FFS trained farmers (51.66%) were having medium size of land holding (5.1 to 10 acre) and the majority of the FFS untrained farmers (35%) came under small size of land holding (having 2.51 to 5 acre).
- The majority of the FFS trained farmers (41.66%) were having their income ranging from Rs. 30,001 to Rs.50, 0000 (High category) per annum as compare to the FFS untrained farmers (45%) earned Rs. 20,001 to Rs. 30, 0000 (Medium category) per annum.
- The majority of the FFS trained farmers (58.33%) were having irrigation through canal and the majority of the FFS untrained farmers (48.33%) were also having irrigation through canal.
- The majority (53.33%) of FFS trained farmers preferred to get the IPM information regularly from the Farmer Field School and the majority (28.34%) of the FFS untrained farmers had made regular contact with neighbors/friends for obtaining information regarding IPM. The data of overall use of information sources reveals that the majority (60%) of the FFS trained farmers had medium level of exposure to various sources of information for getting the information regarding IPM and the majority (45%) of FFS untrained farmers had medium level of exposure to various sources of information for getting the information regarding IPM.
- The majority (51%) of the FFS trained farmers had medium contact with extension personnel and the majority (48.33%) of the FFS untrained farmers had low contact with extension personnel.
- Majority of the FFS trained farmers (56.66%) had medium cosmopolitaness and majority of 53.33 per cent of the FFS untrained farmers reported low cosmopolitaness.

- Opinion of majority (90.00%) of the FFS trained farmers were agreed about IPM and opinion of majority (53.33%) of the FFS untrained farmers were disagreed regarding IPM.
- According to the overall extents of knowledge about Integrated Pest Management data reveals that the majority (78.34%) of the FFS trained farmers had full knowledge about Integrated Pest Management in comparison to FFS untrained farmers (48.34%). This indicated that the FFS untrained farmers did not have enough knowledge about the Integrated Pest Management.
- The FFS has significant effect on farmer's knowledge.
- The IPMFFS improves three aspects of the ability of farmer groups that is the ability to plan activity for improving agribusiness productivity, to implement and obey agreement with other institution, to apply technology, information, and team work.
- The IPM FFS for rice has good influence to improve the adoption of Integrated Pest Management (IPM) by the farmers.
- The IPM FFS has good influence to improve diffusion of IPM by the farmers to other farmers. Decision making in crop management increased.

We can take the conclusion that the differences of FFS trained and FFS untrained indicates that knowledge and also skills are gained by joining IPMFFS in rice. Decision making positively influenced through FFS training programme.

SUGGESTIONS AND RECOMMENDATIONS FOR FUTURE WORKS

On the basis of results and experience gained after the completion of the investigation the following are some of the recommendations for future research.

1. For FFS Trainer

(I). Aging farmers should not be selected and appointed as contact farmers as they are most likely will not exhibit the zeal and interest required in promoting and Extension popularizing the new innovation.

(II)The transfer of agricultural technology would be enhanced with new technique so that the farmers are ready to receive and apply the innovation and becomes skilled with positive attitude towards IPM.

(III) Farmers Field schools (FFS) can also be established in all the rice growing areas.

(IV) It is recommended that the Delta State Agricultural Development Programme (DTADP) should swift into an aggressive campaign for the use of IPM to make it popular among the farmers.

2. For Extension Scientists

(I). Long term investigation is needed where observation method of research needs to be employed to know what type of extension methodology is followed by the trainers, whether participatory approach of facilitation of farmers is employed or not.

(II).The local KVKs and FTCs should focus on IPM training to train the farmers, farm women and farm youth.

(III). In depth evaluative study should be conducted on IPM programme in paddy and different crops to determining the extent of participation of the farmers in planning, execution and effective implementation of the Farmer Field School programme.

(IV). Extension scientists should conduct the research which is relevant to the present needs. An evaluation of the IPM-FFS programme in paddy and different crops is the need of the hour.

(V). Studies should be conducted to observe the communication behavior of plant protection scientists, trainers of FFS and IPM trained farmers.

(VI). Studies need to be conducted on the human resource development for FFS-IPM implementation.

(VII). Studies on the curricula of IPM course being taught in the university should be conducted to determine whether the course covers all the principles of IPM.

3. For Biological Scientists

(I). The researchers should conduct participatory research to determine the feasibility and applicability of ETL and EIL at farmer's level. Research conducted by the universities should be need based and applicable at field level.

(II). Participatory research with the farmers who had not applied any pesticide (other than weedicide and seed treating chemicals) on rice crop without adversely affecting their yields, should be conducted by the plant protection scientists in collaboration with extension scientists and economists for generating sustainable practices.

(III). The research conducted in universities by weed scientists, plant pathologists, entomologists, nematologists should be conducted in an integrated manner to develop IPM practices for rice and different crops.

(IV). Farmers have practical knowledge about different aspects of agriculture, based on generation-long experiences with the local soil types, tillage, management, plant protection.

(V). As the study revealed farmers prefer those varieties which are resistant, high yielding, non-lodging and have better market value. The anticipatory research for development of such varieties should be undertaken by the plant breeders.

Abstract

“Impact of Farmer’s Field School Training Program on Adoption of Integrated Pest Management practices in Rice by the farmers in the Korba District of Chhattisgarh”

By

NEHA SARTHI

ABSTRACT

The present study was carried out during 2012-13 in the Korba district of Chhattisgarh state. This study was conducted in randomly selected 6 villages [Bela, Dondro (Korba), Arda, Ghanakachaar (Katghora), Gopalpur, Iraff (Pali)] of three purposively selected blocks (Korba, Karghora and Pali) located in Korba district. A total of 120 respondents including 60 FFS trained farmers and 60 FFS untrained farmers were selected randomly. The data collection was done by the use of interview schedule through personal interview. Data were analyzed with help of suitable statistical tools.

Results of the study revealed that majority of the FFS trained farmers and FFS untrained farmers were of young age group (up to 35 years) and middle age group (36 to 50 years), having higher secondary education and primary school level educated, residing with medium size of family (6 to 10 members). Majority of FFS trained farmers had medium experience (4 to 8 years) as compared to FFS untrained farmers with less experience (up to 3 years). Majority of the FFS trained farmers were involved in agriculture as compare to FFS untrained farmers involved in agriculture and labour. Majority of the FFS trained farmers were having medium size of land holding (5.1 to 10 acre) and FFS untrained farmers were having small size of land holding (having 2.51 to 5 acre). Majority of the FFS trained belonged to Rs. 30,001 to Rs.50, 0000 (High category) per annum as compare to the FFS untrained farmers belonged to Rs. 20,001 to Rs. 30, 0000 (Medium category) per annum. Majority of the FFS trained and FFS untrained farmers were having irrigation through canal. The majority of the FFS trained farmers preferred to get information from the Farmer Field School as compare to the FFS untrained farmers made contact with neighbours/friends for obtaining information regarding IPM. The majority of the FFS trained farmers had medium contact with extension personnel as compare to FFS untrained farmers had low contact with extension personnel. The majority of the FFS trained farmers had medium cosmopolitaness and majority of the FFS untrained farmers reported low cosmopolitaness. Opinion of majority of the FFS trained farmers were agreed regarding IPM and opinion of majority of the FFS untrained farmers were disagreed regarding IPM.

The findings also revealed that majority of the FFS trained farmers were having full knowledge about Integrated Pest Management in comparison to FFS untrained farmers having partial knowledge regarding Integrated Pest Management. Majority of the FFS trained farmers acquired positively higher level of rice productivity as compared to FFS untrained farmers which shows the positive impact of Farmer Field School.

In correlation coefficient analysis of selected that out of 13 independent variables, 5 variables i.e. age, education, source of information, opinion about IPM

and knowledge about IPM were found to be positive and highly significantly correlated at 0.01 level of probability in FFS trained farmers and in case of FFS untrained farmers out of 13 independent variables only 2 variables i.e. sources of information and contact with extension personnel were found to be positive significantly correlated at 0.05 level of probability.

In regression analysis, out of 13 independent variables, the 3 variables *viz.* source of information, contact with extension personnel and knowledge about IPM contributed positively and highly significantly toward adoption of IPM at 0.01 per cent level of probability in FFS trained farmers. In case of FFS untrained farmers, out of 13 independent variables, the 2 variables *viz.* source of information, contact with extension personnel showed the positive and significant contribution at 0.05 per cent level of probability and only 1 variable i.e. family size showed the negative contribution towards adoption of IPM.

Among the several constraints the highest percentage of respondents (85%) were of the opinion that lack of technical knowledge regarding IPM practices was the constraint, followed by lack of co-operation among farmers for adopting IPM, lack of proper training conducted for adopting improved IPM practices, scarcity of labour in peak period of operation, higher cost of pheromone traps were the major constraints in adoption of Integrated pest management.

To overcome the above constraints, majority of the FFS trained farmers suggested that extension agent or agency should convey right information at right time and technical knowledge regarding use of IPM material like Neem Seed Kernal Extract (NSKE) and pheromone traps etc., regular publicity of IPM on TV, radio and newspaper should be provided, proper FFS training should be conducted for adopting improved IPM practices, labour should be easily available at the time of important operation, the pheromone/ light traps should be available at reasonable price or in subsidy so that more farmers can afford it, better organizational and extension support should be provided for adopting IPM practices, more subsidies should be provided to purchase FYM/ bio-fertilizers, bio-pesticides etc and there is an urgent need to intensify the IPM extension services in major rice growing areas.

On the basis of study it can be concluded that Farmer Field School programme is playing a vital role in enhancing the three aspects of the ability of farmer groups that is the ability to plan activity for improving agribusiness productivity, to implement and obey agreement with other institution, to apply technology, information, and team work. The IPM FFS for rice has good influence to improve the adoption of Integrated Pest Management (IPM) by the farmers. The IPM FFS has good influence to improve diffusion of IPM by the farmers to other farmers. Decision making in crop management increased.



Place:
Date:

(Shri M. K. Chaturvedi)
(Chairman Advisory Committee)

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Appendix

छत्तीसगढ़ राज्य के कोरबा जिले में कृषक खेत पाठशाला द्वारा आयोजित समन्वित

कीट प्रबंधन तकनीकी प्रशिक्षण के अंगीकरण का अध्ययन –

साक्षात्कार अनुसूची

परामर्शदाता :

श्री एम.के. चतुर्वेदी
असिस्टेंट प्रोफेसर,
कृषि विस्तार विभाग
इं.गां.कृ.वि., रायपुर(छ.ग.)

शोधकर्ता का नाम

नेहा सारथी
एम.एस.सी. (कृषि) अंतिम
कृषि विस्तार विभाग,
इं.गां.कृ.वि. रायपुर(छ.ग.)

1. कृषक का नाम :
2. ग्राम :
3. विकास खण्ड :
4. जिला :
5. कृषक की उम्र : वर्ष
6. कृषक वर्ग: (प्रशिक्षित/अप्रशिक्षित)
7. शिक्षा का स्तर
i) अशिक्षित ii) प्राथमरी iii) मिडिल iv) हाई स्कूल v) हा.से vi) स्ना./अधिक
8. आपके परिवार के कुल सदस्यों की संख्या –
महिला पुरुष बच्चे योग
9. जाति
i) अनुसूचित जनजाति ii) अनुसूचित जाति iii) अन्य पिछड़ा जाति iv) सामान्य

10. आपका मुख्य व्यवसाय क्या है ?

1. केवल कृषि

2. कृषि + मजदूरी

3. कृषि + पशुपालन

4. कृषि + उद्यानिकी

5. कृषि + व्यवसाय

6. अन्य

11. आपके पास कुल कितनी भूमि है ?

(अ) कुल भूमि (एकड़)

(ब) कृषि योग्य भूमि : सिंचित (एकड़/हे.), असिंचित (एकड़/हे.), कुल

12. आपके पास सिंचाई के कौन कौन से साधन हैं –

क्र.	सिंचाई के साधन	संचित क्षेत्र (एकड़/हे.)	सिंचाई की उपलब्धता*
1.	नहर		
2.	कूप + पंप		
5.	अन्य i) ii)		

*1 = केवल खरीफ, 2 = खरीफ एवं रबी 3 = पूरे वर्ष

13. कृपया पिछले वर्ष लगायी गयी फसलों के बारे में जानकारी दीजिए -

क्र.	फसल का नाम	रकबा (एकड़/हे.)			कुल उत्पादन
		सिंचित	असिंचित	कुल	
(अ)	खरीफ				
1.	धान				
2.	अन्य i) ii)				
(ब)	रबी				
1.	तिवरा				
2.	चना				
4.	अन्य i) ii)				

14. आपकी विभिन्न स्रोतों से कुल वार्षिक आय कितनी है ?

क्र.सं.	व्यवसाय	वार्षिक आय (रुपये)
1.	कृषि	
2.	कृषि + मजदूरी	
3.	कृषि + पशुपालन	
4.	कृषि + उद्यानिकी	
5.	कृषि + नौकरी	
	कृषि + व्यवसाय	
6.	अन्य i) ii)	
कुल वार्षिक आय (रुपये में)		

15. क्या आपने कृषि उत्पादन के लिये ऋण लिया है ? (हाँ/नहीं) यदि हाँ तो निम्न जानकारी दीजिये -

(अ) ऋण राशि रुपये (ब) ऋण अवधि (स) ऋण स्रोत

16. आपको धान में समन्वित कीट प्रबंधन तकनीक से संबंधी जानकारी किन स्रोतों से प्राप्त होती है ?

क्र.सं.	स्रोत	हां / नहीं	हमेशा	कभी - कभी	बहुत कम
1.	पड़ोसी/मित्र/रिश्तेदार				
2.	ग्राम सेवक				
3.	कृषक खेत पाठशाला				
4.	रेडियो				
5.	टी.वी.				
6.	अखबार				

7.	कृषि विज्ञान केन्द्र				
8.	किसान काल सेंटर				
9.	किसान मेला				
10.	कृषि विश्वविद्यालय				
11.	अन्य i)				

17. प्रसार कार्यक्रम में सहभागिता

क्या आप अपने क्षेत्र में होने वाले प्रसार कार्यक्रम से अवगत होते हैं ? यदि हाँ तो निम्न में आपकी कितनी भागीदारी है -

क्रं.म.	कार्यक्रम	नियमित	कभी - कभी	कभी नहीं
1.	प्रशिक्षण कार्यक्रम			
2.	क्षेत्र भ्रमण			
3.	शैक्षणिक भ्रमण			
4.	समूह सभा			

18. आप धान उत्पादन की तकनीकी से संबंधित जानकारी के लिये किनसे संपर्क करते हैं कृपया जानकारी दीजिए ?

क्र.	कृषि विस्तार कार्यकर्ता	संपर्क का अंतराल				
		प्रतिदिन	सप्ताह में एक बार	माह में एक बार	वर्ष में 2-3 बार	कभी नहीं
1.	ग्रामीण कृषि विस्तार अधिकारी					
2.	कृषि विकास अधिकारी					
3.	कृषि वैज्ञानिक					
4.	विषय वस्तु विशेषज्ञ					
5.	अन्य 1. 2.					

19. धान में समन्वित कीट प्रबंधन के बारे में जानकारी प्राप्त करने के लिये आप अपने आस-पास के गांव/शहर/ब्लॉक से कितना संपर्क रखते हैं ? कृपया ग्राम/शहर जाने का अंतराल बताइये -

1. कभी नहीं 2. माह में एक बार सप्ताह में 1 बार सप्ताह में 2 या अधिक बार

20. आप धान में कीट नियंत्रण हेतु समन्वित कीट प्रबंधन तकनीक को कब से अपना रहे हैं: वर्ष

21. आपके पास उपलब्ध धान के कुल एरिया (एकड़) में आप कीट नियंत्रण हेतु कौन-कौन सी विधियाँ अपनाते हैं -

क्र.	समन्वित कीट प्रबंधन तकनीक	एरिया (एकड़)	कब से अपना रहे हैं
1.			
2.			
3.			
4.			
5.			
6.	देशी परंपरागत विधि		
7.	किसी भी विधि का उपयोग नहीं		

22. क्या आपने कृषक खेत पाठशाला में प्रशिक्षण लिया है ? हाँ/नहीं यदि हाँ तो जानकारी दीजिये-

क्र.	प्रशिक्षण के प्रकार एवं काम	अवधि	उपयोगिता
1.			
2.			
3.			

	कीट प्रतिरोधी किस्म					
	i).....	.....			
	ii).....	.....			
	iii).....	.....			
7.	क्या आपको धान के समन्वित कीट प्रबंधन में कृषण क्रियाओं के अंतर्गत थरहा जड उपचार की जानकारी है? (हाँ/नहीं) यदि हाँ तो विवरण दें- (क्लोरोपायरीफास 0.025% व यूरिया घोल में डुबाकर)					
	रासायन	मात्रा				
	i).....	.....			
	ii).....	.....			
8.	क्या आपको धान के समन्वित कीट प्रबंधन में कृषण क्रियाओं के अंतर्गत बुवाई/रोपाई के समय की जानकारी है ? (हाँ/नहीं) यदि हाँ तो विवरण दें- (15 जून तक बुआई व 15 जुलाई तक रोपाई का काम करें)					
					
					
9.	क्या आपको धान के समन्वित कीट प्रबंधन में कृषण क्रियाओं के अंतर्गत खाद एवं उर्वरक प्रबंध की जानकारी है? (हाँ/नहीं) यदि हाँ तो विवरण दें - (नत्रजन स्फूर व पोटाश की मात्राओं का अनुपात 3:2:1 रखें)					
	मात्रा	अनुपात				
	i).....	.....			
	ii).....	.....			
	iii).....	.....			
10.	क्या आपको धान के समन्वित कीट प्रबंधन में कृषण क्रियाओं के अंतर्गत जल प्रबंधन की जानकारी है ? (हाँ/नहीं) यदि हाँ तो विवरण दें -					
					
					
11.	क्या आपको धान के समन्वित कीट प्रबंधन में कृषण क्रियाओं के अंतर्गत पौधों से पौधों एवं कतार से कतार की आपस में दूरी की जानकारी है ? (हाँ/नहीं) यदि हाँ तो विवरण दें - (15X20 या 20X20 से. मी.)					
	i)पौधों से पौधों से दूरी	.....			
	ii)कतार से कतार की दूरी	.....			
	भौतिक विधि					
12.	क्या आपको समन्वित कीट प्रबंधन में भौतिक विधियों की जानकारी है ? (हाँ/नहीं) यदि हाँ तो विवरण दें - (तापमान, प्रकाश, आर्द्रता, ध्वनि, ठण्ड तथा र्जजा) विधि					
	i).....	iv).....				
	ii).....	v).....				
	iii).....	vi).....				
13.	क्या आपको जानकारी है कि भौतिक विधि में सूडियां मारने हेतु बीजों को कितने तापमान पर गर्म किया जाता है ? (हाँ/नहीं) यदि हाँ तो विवरण दें - (बुवाई से पहले बीजों को यदि 60 डिग्रि से. ग्रे. पर कुछ मिनटों तक गर्म किया जाय तो सूडियां मर जाती हैं)					
					
					
14.	क्या आपको भौतिक विधि में प्रयोग होने वाली प्रकाश की जानकारी है ? (हाँ/नहीं)					

	<p>यदि हॉ तो विवरण दें- (रात्रि मे निकलने वाले कीटों को आकर्षित करने के लिए प्रकाश का उपयोग किया जाता है)</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>15. क्या आपको भौतिक विधि मे प्रयोग होने वाले आर्द्रता की जानकारी है ? (हॉ/नही) यदि हॉ तो विवरण दें- (फसलों को सिंचित करके अथवा खेतो मे पानी भरकर कीटों के प्रभाव से बचाना)</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>16. क्या आपको भौतिक विधि मे प्रयोग होने वाले ध्वनि की जानकारी है ? (हॉ/नही) यदि हॉ तो विवरण दें- (रात्रि मे निकलने वाले कीटों को ध्वनि द्वारा आकर्षित करने के लिए उपयोग किया जाता है)</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>यांत्रिक विधि</p> <p>17. क्या आपको समन्वित कीट प्रबंधन में यांत्रिक विधियों की जानकारी है ? (हॉ/नही) यदि हॉ तो विवरण दें - (कीट की विभिन्न अवस्थाओं जैसे अंडे, अवयस्क तथा वयस्कों को हाथ से नष्ट करना, चिपचिपे पाश, तथा उनकी यांत्रिक रोकथाम) विधि</p> <p>i)..... iv).....</p> <p>ii)..... v).....</p> <p>iii)..... vi).....</p> <p>18. क्या आपको जानकारी है कि धान के समन्वित कीट प्रबंधन के यांत्रिक विधि मे तना छेदक के लिये प्रति एकड़ कितनी संख्या मे फिरोमोन ट्रेप अथवा फंदा लगाना चाहिये ? (हॉ/नही) यदि हॉ तो विवरण दें- (8 फिरोमोन ट्रेप/हे. की दर से लगाएं)</p> <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">ट्रेप अथवा फंदा</td> <td style="text-align: center;">मात्रा</td> </tr> </table> <p>i).....</p> <p>ii).....</p> <p>जैविक विधि</p> <p>19. क्या आपको धान के समन्वित कीट प्रबंधन में जैविक विधि के बारे में जानकारी है ? (हॉ/नही) यदि हॉ तो विवरण दें- (परभक्षी- मकड़ी, मीरीड बग, वाटर बग, चुरचुरी, परजीवी- ट्इकोग्रामा, टैलेनोमस, रोगाणु- एन.पी.वी. वायरस, बावेरिया) विधि</p> <p>i)..... iv).....</p> <p>ii)..... v).....</p> <p>20. iii)..... vi).....</p> <p>क्या आपको जैविक कीट प्रबंधन में परजीवी एवं रोगाणु के दर के बारे में जानकारी है ? (हॉ/नही) यदि हॉ तो विवरण दें- (ट्इकोग्रामा अंडा परजीवी 50,000/हे. की दर से दस दिन के अंतराल मे 3 बार छोड़ें व एन.पी.वी. 250 एल.ई./हे. का छिडकाव करें)</p> <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">परजीवी अथवा रोगाणु</td> <td style="text-align: center;">मात्रा</td> </tr> </table> <p>i).....</p> <p>ii).....</p>	ट्रेप अथवा फंदा	मात्रा	परजीवी अथवा रोगाणु	मात्रा					
ट्रेप अथवा फंदा	मात्रा									
परजीवी अथवा रोगाणु	मात्रा									

				नहीं सकते
1.	क्या आपको धान में समन्वित कीट प्रबंधन तकनीक का उपयोग करने से लाभ हुआ ? (हाँ/नहीं) यदि हाँ तो विवरण दें – लाभ i)..... ii)..... iii).....			
2.	क्या धान में कम रसायन उपयोग करने से लागत दर में कमी आई ? (हाँ/नहीं) यदि हाँ तो विवरण दें –			
3.	क्या समन्वित कीट प्रबंधन प्रकृति के लिये भी लाभकारी है? (हाँ/नहीं) यदि हाँ तो विवरण दें– लाभ i)..... ii)..... iii).....			
4.	क्या समन्वित कीट प्रबंधन मानव स्वास्थ्य के लिये लाभप्रद है ? (हाँ/नहीं) यदि हाँ तो विवरण दें – लाभ i)..... ii)..... iii).....			
5.	क्या समन्वित कीट प्रबंधन टिकाऊ खेती के लिये मदद करता है? (हाँ/नहीं) यदि हाँ तो विवरण दें –			
6.	क्या समन्वित कीट प्रबंधन में कम से कम रसायनों का उपयोग किया जाता है ? (हाँ/नहीं) यदि हाँ तो विवरण दें–			

25. कृषक खेत पाठशाला/फार्म स्कूल के बारे में निम्न जानकारी दिजिये :-

क.	धान में समन्वित कीट प्रबंधन तकनीक	जानकारी का स्तर		
		पूर्ण	अपूर्ण	निरंक
1.	क्या आप जानते हैं कि कृषक खेत पाठशाला में किस-किस विषय में प्रशिक्षण देते हैं ? यदि हाँ तो विवरण दें – (कृषक खेत पाठशाला में किसानों को धान कपास, धान, अरहर आदि में समन्वित कीट प्रबंधन तकनीक के संबंध में प्रशिक्षण देते हैं) प्रशिक्षण विषय i)..... ii).....			
2.	क्या आप जानते हैं कि कृषक खेत पाठशाला की स्थापना कब हुआ? यदि हाँ तो विवरण दें – (कृषक खेत पाठशाला की स्थापना सन् 1989 में हुआ)			
3.	क्या आप जानते हैं कि कृषक खेत पाठशाला में धान के समन्वित कीट			

	<p>प्रबंधन तकनीक प्रशिक्षण से कौन-कौन से उद्देश्यों की पूर्ती होगी ? यदि हों तो विवरण दें – (धान में समन्वित कीट प्रबंधन तकनीक से कृषि उत्पादन लागत न्यून, वातावरण प्रदूषण में कमी, स्वस्थ नैसर्गिक संतुलन)</p> <p>उद्देश्य</p> <p>i).....</p> <p>ii).....</p> <p>4. क्या आप जानते हैं कि एक कृषक खेत पाठशाला में एक समय में कितने किसान प्रशिक्षण लेते हैं ? यदि हों तो विवरण दें – (कृषक खेत पाठशाला में एक समय में 25 से 30 किसान प्रशिक्षण लेते हैं)</p> <p>किसानों की संख्या</p> <p>.....</p> <p>.....</p> <p>5. क्या आप जानते हैं कि एक कृषक खेत पाठशाला में कितने बार बैठकें होती हैं ? यदि हों तो विवरण दें – (कृषक खेत पाठशाला में सप्ताह में एक बार एवं कुल बैठकों की संख्या 10 से 16 होती है)</p> <p>बैठकों की संख्या</p> <p>.....</p> <p>.....</p> <p>6. क्या आप जानते हैं कि एक कृषक खेत पाठशाला में कीट नियंत्रण के कौन-कौन से विधियों की जानकारी दी जाती है ? यदि हों तो विवरण दें – (कृषक खेत पाठशाला में कृषक क्रियाएं, भौतिक विधि, यांत्रिक विधि, जैविक विधि तथा रासायनिक विधियों की जानकारी दी जाती है)</p> <p>कीट नियंत्रण विधि</p> <p>i).....</p> <p>ii).....</p> <p>iii).....</p> <p>iv).....</p> <p>v).....</p> <p>7. क्या आपके कृषक खेत पाठशाला में प्रशिक्षण लेने से समन्वित कीट प्रबंधन के अंगीकरण में बढ़ोत्तरी हुई ? यदि हों तो विवरण दें – (कृषक खेत पाठशाला में धान के समन्वित कीट प्रबंधन तकनीक की अनेक सरल उपयोगी विधियों की जानकारी देते हैं)</p> <p>i).....</p> <p>ii).....</p> <p>8. क्या कृषक खेत पाठशाला की प्रशिक्षण से आपके ज्ञान में बढ़ोत्तरी हुई ? यदि हों तो विवरण दें – (धान के प्रमुख कीट, खरपतवार, रोगों की जानकारी एवं उनके प्रबंधन विधि)</p> <p>.....</p>			
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26. कृषक खेत पाठशाला के निर्देश द्वारा बताये गये विभिन्न समन्वित कीट प्रबंधन विधि-

1. क्या आपने कृषक खेत पाठशाला में बताये हुए कृषक क्रियाएं का उपयोग किया ? यदि हों तो विवरण दें-

अ. कीट प्रतिरोधी किस्मों का उपयोग – (महामाया, रत्ना, आशा)

i)

ii)

iii)

ब. गर्मी की जुताई – (तना छेदक)

i)

ii)

iii)

स. अन्य

i)

ii)

iii)

2. क्या आपने कृषक खेत पाठशाला में बताये हुए यांत्रिक विधि का उपयोग किया ? यदि हाँ तो विवरण दें-

अ. लाईट ट्रेप (गन्धी बग)

i)

ii)

ब. फीरोमोन ट्रेप (तना छेदक)

i)

ii)

स. अन्य

i)

ii)

3. क्या आपने कृषक खेत पाठशाला में बताये हुए जैविक नियंत्रण का उपयोग किया ? यदि हाँ तो विवरण दें-

अ. ट्रेड्कोग्रामा जैपोनिकम (पत्ती मोड़क व तना भेदक)

i).....

ii).....

ब. अन्य

i).....

ii).....

4. क्या आपने कृषक खेत पाठशाला में बताये हुए रासायनिक विधि का उपयोग किया ? यदि हाँ तो विवरण दें -

अ. मोनोकोटोफास 36% : (चितरी, हरा माहो, सफेद पीठ का माहो)

i).....

ii).....

ब. क्लोरपायरीफास 20% : (गन्धी बग, चितरी, सफेद पीठ का माहो)

i).....

ii).....

स. अन्य

i).....

27. कृषक खेत पाठशाला द्वारा आयोजित प्रशिक्षण कार्यक्रम को अधिक प्रभावी बनाने हेतु निम्न के बारे में आपके क्या सुझाव हैं-

1) कृषक खेत पाठशाला द्वारा प्रशिक्षण कब आयोजित करना चाहिए?

(फसल काल)

i) केवल खरीफ

ii) खरीफ एवं रबी

iii) पूरे वर्ष

2) कृषक खेत पाठशाला प्रशिक्षण में एक समय में कितने प्रशिक्षणार्थी होना चाहिए?

(प्रशिक्षणार्थी संख्या)

i) 15 से 20

ii) 20 से 25

iii) 25 से 30

3) कृषक खेत पाठशाला प्रशिक्षण कहां आयोजित करना चाहिए?

(जगह)

i) खेत पर

- ii) पेड़ के नीचे
- iii) घर पर
- 4) कृषक खेत पाठशाला प्रशिक्षण कितने समय का होना चाहिए?
(समय काल)
- i) 4 से 5 दिन
- ii) 5 से 10 दिन
- iii) 10 से अधिक दिन
- 5) कृषक खेत पाठशाला प्रशिक्षण द्वारा अन्य सुविधाएँ—
- i)
- ii)
- iii)

28. आपको धान में समन्वित कीट प्रबंधन तकनीक को अपनाने में किन-किन समस्याओं का सामना करना पड़ा –
समस्यायें

- 1)
- 2)
- 3)
- 4)
- 5)

29. आपको धान में समन्वित कीट प्रबंधन तकनीक को अपनाने में आनेवाली समस्याओं को दूर करने के लिए अपने सुझाव दीजिए –
सुझाव

- 1)
- 2)
- 3)
- 4)
- 5)