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Impact of Farmer Field School on Integrated Pest Management in Rice Farmers in Karnataka, India

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ABSTRACT. The concept of Farmer Field Schools (FFSs) was originally developed as an extension methodology for Integrated Pest Management (IPM) in Rice in Indonesia in 1990. This training concept is not only limited to IPM in the strict sense. In Asia, many non-governmental organisations (NGOs) and farmers organisations have adapted and interpreted FFSs to suit their own specific situations and interest. Some of these organisations apply the FFSs concept not to IPM as such but to agricultural system development in general. FFSs has been widely used as valuable extension tool. These start with participatory problem analysis and integration of local knowledge or new information in order to make effective and suitable to their specific situation. Farmers and extension workers gain methodological skills to develop their own solutions.

In this context, the study was undertaken with the following specific objectives viz., to assess the impact of FFS on knowledge of farmers regarding IPM practices in rice cultivation; to find out the impact of FFS on adoption of IPM practices by rice farmers and to measure the attitude of farmers towards IPM practices in rice cultivation.

The research study was conducted during 1998 in five purposively selected taluks of Karnataka State, India. The sample size consisted of 60 trained and 60 untrained farmers. A scale was developed to measure the attitude of rice farmers towards IPM in rice cultivation. The results reveal that there was a clear difference between trained and untrained farmers in their overall knowledge in respect of IPM practices of rice cultivation. Majority (50%) of trained farmers was high adopters of IPM practices whereas less than 50% of untrained farmers had low adoption of IPM practices. Besides majority (63%) of trained farmers had favourable attitude towards IPM practices of rice cultivation compared to untrained farmers.

This implies that there is a change in knowledge and extent of adoption of IPM practices among trained farmers. Added to this, rice growers

had developed favourable attitude toward IPM practices. This calls for concerted efforts of different developmental agencies in the year ahead for effective implementation of Farmer Field School (FFS).

INTRODUCTION

"What I saw with the Field School farmers that day was truly amazing. Farmers showed a new self-confidence after learning Integrated Pest Management (IPM) through the Field School. I felt I had seen the dawn of true democracy and liberation in our villages, IPM Field Schools are truly the fore front of a peaceful revolution, without blood shed and full of love for the environment"– Mochtar Lubis (Douglas and Simon, 1996).

With the increasing pressure of population on the land for more food production, the foremost challenge facing the world is to device ecologically and socio-economically sustainable agricultural practices. For a country like India, where the agricultural sector is the foundation of the economy involving two-thirds of its population, this assumes top priority. This awareness has led to introduction of many programmes by Government to reorient the prevalent agricultural practices to make them ecologically sustainable.

One of the important programmes is the Integrated Pest Management (IPM) programme, which can be termed as a broad ecological approach for managing pest problems. The Central Government organises a number of training programmes for farmers through state agricultural institutions and its own 26 IPM centres spread throughout the country. The state governments conduct these IPM programmes through various training centres located in the states, peripatetic training is also given on farmers field (Anusuya, 1997).

IPM is an intensive knowledge based approach. Promotion of this approach at village level largely depends upon the availability of trained extension functionaries/farmers. To achieve this, a three-tier programme has been evolved *viz.*, (i) training of trainers through season long training, (ii) establishing Farmer Field Schools (FFS) and (iii) conducting IPM demonstrations for popularising field tested IPM practices (Shivakumar, 1997).

IPM Farmer Field Schools

The phrase "Farmer Field School" began to be heard in Indonesia in 1990. For most, this was a strange, if not alien, just a position of the disorderliness of the paddy field mud with the orthodox orderliness of the class room. Five years later IPM Farmer Field Schools were conducted in more than 15,000 villages in Indonesia, and in thousands in India, Sri Lanka, Vietnam, Bangladesh, the Philippines, China and Korea. In Indonesia, the sight of these "Schools without Walls", involving farmers gathering together on a weekly basis throughout a crop season to go into the mud to analyze the progress of their crops, learning of the biotic interactions between soil, plants and insects; and brining this knowledge together to make a locally responsive field management decision, is no longer strange (Douglas and Simon, 1996).

The Field School approach for IPM was developed in response to two challenges: (i) the ecology of tropical rice, which is locally specific, resisting generalisations and blanket recommendations, and therefore, (ii) the need for farmers to generate their own scientific process in their fields as a basis for crop management decisions for IPM to be effective and sustainable (Douglas and Simon, 1996).

The Farmer Field School approach represents an attempt to get away from centralised extension practices and return the locus of interaction to the farmers' fields. It is at heart a process that brings people and ecology into direct interaction. If agricultural extension is defined as the practice of 'extending' packages and information developed from centralised research to farmer 'target groups', the Field School approach with its emphasis on decentralised educational processes and *in situ* discovery and learning by farmers, represents a radical departure from established practice. In short, the Field School approach for IPM seeks to replace 19th century, top-down, input technologies with 21st century, knowledge-intensive technologies (Douglas and Simon, 1996).

Some of the visible characteristics of a Field School that differentiate it from more conventional agricultural extension programmes are: (i) self-generated materials, (ii) role of the facilitator, (iii) analysis and decision-making, (iv) season-long training, (v) building farmer organisations (Douglas and Simon, 1996).

FFS and its importance

A small group of farmers meets every week through the entire rice crop season with trainers to carry out field observation, analysis of data, draw conclusions and debate these conclusions using agro-ecosystem analysis; these groups are the FFS and they maintain common field areas where they carry out season-long experiments (Shivakumar, 1997).

FFS in rice farming

Farmers Field Schools in rice conducted during the last few years have given tremendous insight to understand agro-ecosystem analysis, the role of naturally occurring beneficial fauna and inbuilt compensatory mechanism in rice plants. Small scale simulation experiments conducted by the farmers themselves have given them adequate opportunities as to how rice plants are able to withstand the damages caused by insect pests and compensate the loss during the crop growth stages. Those experiments have further given concrete evidence that certain amount of damage to foliage or stem by insect pests do not cause any crop losses, if no chemical intervention is undertaken. The outcome of the FFSs conducted have brought out two important findings (i) increase in the yield in almost all the IPM plots and (ii) decrease in the use of pesticides in FFS areas as compared to non-FFS areas (Shivakumar, 1997).

IPM programmes are an attempt to promote favourable, ecological, economic and sociological outcomes which is accomplished by the mix of pests, the tactics together. The use of appropriate scouting tactics, proper diagnosis of pests, the use of action economic thresholds and conservation of naturally occurring bio-control agents are fundamental components of a sound IPM programme.

In Karnataka, the Farmer Field School (FFS) in farmers' field was initiated during 1994-95. Under this programme, farmers are made experts in identifying natural enemies, monitoring regular pests and taking suitable management measures.

To start with, the FFS is being conducted on rice and cotton crops since usage of pesticides is more on rice and cotton crops. To increase rice yields by reducing losses from pests, extension workers give training to farmers on IPM practices for adoption through FFS (Anusuya, 1997).

Need for the study

Whether the recommended IPM practices are adopted by farmers or not, is the question that arises. The degree to which farmers adopt IPM practices depends upon their characteristics, ability to identify the pests, the specific symptoms and damages caused by the pests, ability to identify the natural enemies, familiarity with the recommended practices, availability of bio-control agents and availability of resources for executing them. More over, identifying IPM practices adopted by farmers not only paves the way for improving their present pest management practices by alleviating their problems in adoption, but also it may give some clue to researchers to evolve new techniques. This necessitated undertaking a study to analyze the knowledge, adoption behaviour and attitude of farmers on IPM practices advocated through FFS.

MATERIALS AND METHODS

The methodology section deals with a) locale of study, b) selection of respondents, c) selection of IPM practices and d) construction of indices.

Locale of the study

Farmer Field Schools (FFS) on IPM is being conducted in rice from 1994-95 in Karnataka. The study was conducted in five districts where FFSs were in operation. In Karnataka, the five districts were selected purposively for conducting the study based on area under rice cultivation. One taluk from each district where rice was an important crop was selected for the study. From the selected taluks, one village was selected purposively from each taluk *viz.*, Halebudannur (Mandya), Basavanapur (Mysore), Tygatur (Hasan), Siddapur (Shimoga) and Dasavara (Bangalore Rural). Based on the criteria that the FFSs training programmes were conducted in these villages successively for three years.

Selection of respondents

The sample consisted of 60 trained and 60 untrained farmers for the study. By employing random sampling method, 12 trained farmers and 12 untrained farmers from each village were selected for the study. Totally 120 farmers were chosen as the sample for the study.

Selection of IPM practices

The specific IPM practices identified were grouped under four methods *viz.*, as cultural, mechanical, biological and chemical methods of pest control on the lines adopted by Santagovind (1992) and Shivakumar (1997).

Cultural methods

This includes 12 practices *viz.*, (i) summer ploughing, (ii) selection of variety, (iii) land levelling in the field, (iv) monitoring of pests, (v) water management, (vi) trimming and plastering of bunds (vii) topping of seedlings, (viii) synchronous planting, (ix) plant population per square meter (x) application of nitrogenous fertilizers and (xi) weeding operation.

Mechanical methods

This covers four practices *viz.*, (i) pest surveillance using light trap, (ii) use of pheromone traps, (iii) collection and destruction of egg masses of stem borer and (iv) burning of brown plant hopper larvae.

Biological methods

Includes four practices *viz.*, (i) use of trichogramma species to control paddy stem borer, (ii) conservation of natural enemies, (iii) application of pesticides when economic threshold level crosses for pests (iv) use of biopesticides like neem seed kernal extract, *etc.*

Chemical methods

This includes five practices *viz.*, (i) seed treatment, (ii) herbicidal application, (iii) dipping roots of seedlings in phosphomidon solution, (iv) using poison bait for rats and (v) use of chemicals.

> Note: Economic Threshold Level (ETL) defined as "the density at which control measures should be applied to prevent an increasing pest population from reaching the economic injury level". The Economic Threshold Level was developed for rice pests at different stages of crop. For instance, in case of brown plant hopper ETL is

5 to 10/hill or more at flowering stage, likewise for different pests ETL was developed.

Construction of indices

Measurement of knowledge level of farmers

The extent of knowledge on IPM practices of rice was measured by constructing a teacher made knowledge test as suggested by Anastasi (1961). Fifty IPM practices were selected to measure the knowledge. Each of these practices was put in the question form to the respondents to obtain the response. The correct response was given a score of one and incorrect response was given a score of zero. The total knowledge score for each respondent was calculated by summing up the number of items correctly answered by an individual respondent and the maximum score one could obtain was 50. The raw knowledge score of each individual respondent was converted into knowledge index by using the formula:

$$Knowledge\ Index = \frac{Number\ of\ correct\ response}{Total\ number\ of\ knowledge\ items} \times 100$$

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

Category	Score	
	Trained farmers	Untrained farmers
High > (X + ½ SD)	Above 37.90	Above 29.93
Medium (X ± ½ SD)	26.88 to 37.90	18.10 to 29.93
Low < (X - ½ SD)	26.87 and below	18.09 and below

Measurement of adoption level of farmers

The adoption level of respondents with respect to recommended IPM practices of rice cultivation was measured by adopting the scale suggested by Sengupta (1967). Score of two, one and zero were assigned for full adoption, partial adoption and non adoption of each recommended IPM practice.

$$Adoption\ Index = \frac{Adoption\ score\ of\ respondent}{Maximum\ adoption\ score} \times 100$$

Partial adoption was arrived at by taking into cognisance of any deviation in the adoption of recommended practice. The total score obtained by each respondent was converted into adoption index and they were grouped into three categories by using mean and standard deviation as a measure of check.

Category	Score	
	Trained farmers	Untrained farmers
High > (X + ½ SD)	Above 77.70	Above 63.40
Medium (X ± ½ SD)	60.61 to 77.70	49.86 to 63.40
Low < (X - ½ SD)	60.60 and below	49.85 and below

Measurement of attitude of rice farmers

The attitude scale consisting of 16 statements was administered to the respondents. The responses were obtained on five point continuum with the weightage of 4, 3, 2, 1 and 0 for positive statements and 0, 1, 2, 3 and 4 for negative statements. Attitude score of a respondent was calculated by adding the score obtained by him on all the statements. Thus 64 and 0 were the maximum and minimum score, respectively obtainable by each respondent. Based on the score obtained, the respondents were categorised into three groups considering mean and standard deviation as a measure of check.

Category	Score	
	Trained farmers	Untrained farmers
High > (X + ½ SD)	Above 42.76	Above 35.53
Medium (X ± ½ SD)	33.98 to 42.76	24.62 to 35.53
Low < (X – ½ SD)	33.97 and below	24.61 and below

RESULTS AND DISCUSSION

Mean knowledge score of farmers on IPM practices in rice

Table 1 reveals that the trained farmer had more mean knowledge compared to untrained farmers. The mean knowledge score of trained farmers was 32 and that of untrained farmers was 24. The mean knowledge score was obtained by summing up of knowledge score of all the trained farmers and divided by the total number of trained farmers. Similarly, the mean knowledge score of untrained farmers (24) was obtained. Further, the 't' value indicated significant relationship between trained and untrained farmers' knowledge on IPM practices in rice. The possible reason may be that the farmers' participation in IPM Field School conducted in their villages might have influenced to gain knowledge. This finding is supported by Anusuya (1997), Santagovind (1992) and Shivakumar (1997).

Table 1. Mean knowledge score of farmers on IPM practices in rice.

Farmers	N	Mean knowledge score	't' value
Trained	60	32	4.32**
Untrained	60	24	

** - Significant at 0.01 level

Table 3. Mean adoption score of farmers on IPM practices in rice.

Farmers	N	Mean adoption score	't' value
Trained	60	69	4.42**
Untrained	60	57	

** - Significant at 0.01 level

Extent of adoption of specific IPM practices by rice farmers

A cursory glance at results in Table 4 reveal that a majority (>60%) trained farmers had fully adopted practices *viz.*, summer ploughing, seeds and seed treatment, land levelling, synchronous planting, crop rotation, trimming and plastering of bunds, application of nitrogenous fertilizer, top dressing of N-fertilizer, herbicidal application, pest monitoring, water management and weeding operation. Whereas, 50% of untrained farmers had fully adopted IPM practices namely, summer ploughing, land levelling, synchronous planting, herbicide application, pest monitoring, water management, trimming and plastering of bunds and 70% of untrained farmers had adopted weeding operation. It is interesting to note that cent per cent of trained and untrained farmers had fully adopted application of chemical fertilizers. Sixty seven per cent of untrained farmers did not adopt application of nitrogen fertilizer. A great majority (75%) of respondents had not adopted pest surveillance using light traps. The possible reason might be due to lack of knowledge, fragmented land holdings, high cost of inputs, complex technology and non-availability of seeds and fertilizers. The findings of study are in conformity with Santagovind (1992) and Shivakumar (1997).

Mean attitude score of farmers on IPM practices in rice

Table 5 reveals that the mean attitude score of trained farmers were 38 and that of untrained farmers were 30. This was computed by adding all the attitude scores of trained respondents towards IPM practices and dividing by the total number of trained respondents to arrive at the mean attitude score

Table 4. Extent of adoption of specific IPM practices by rice farmers.

Sl.No.	IPM Practices	Trained (N=60)								Untrained (N=60)							
		FA		PA		NA		Total		FA		PA		NA		Total	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
I	Summer ploughing	42	17	-	-	18	30	60	100	30	50	-	-	30	50	60	100
II	Seeds and Seed treatment																
1	Resistant variety used	40	67	-	-	20	-	60	100	26	43	-	-	34	57	60	100
2	Certified seed used	55	92	-	-	5	-	60	100	50	83	-	-	10	17	60	100
3	Chemical used for seed treatment	41	68	-	-	19	-	60	100	33	55	-	-	27	45	60	100
4	Quantity of chemical used	16	39	25	61	-	-	41	100	13	39	20	60	-	-	33	100
5	Duration of seed treatment	11	27	-	-	30	73	41	100	8	24	-	-	25	76	33	100
6	Nature of mixing	11	27	30	73	-	-	41	100	6	18	27	82	-	-	33	100
III	Land levelling in main field																
1	Number of times of land	36	60	24	40	-	-	60	100	29	48	31	52	-	-	60	100
2	Implement used for levelling	55	92	-	-	5	8	60	100	39	65	-	-	21	35	60	100
3	Water level maintained	42	70	18	30	-	-	60	100	32	53	28	47	-	-	60	100
IV	Synchronous planting																
1	Time of planting (days after sowing)	49	32	-	-	11	18	60	100	32	53	-	-	28	47	60	100
2	Date of planting	48	80	-	-	12	20	60	100	30	50	-	-	30	50	60	100
3	Plant population per square metre	43	72	-	-	17	28	60	100	23	28	-	-	37	62	60	100
V	Crop rotation	43	72	-	-	17	28	60	100	36	60	-	-	24	40	60	100
VI	Herbicidal application																
1	Herbicide applied	42	70	-	-	18	30	60	100	31	52	-	-	29	48	60	100
2	Quantity of herbicide	15	36	27	64	-	-	42	100	11	26	20	64	-	-	31	100
3	Quantity of sand use	13	31	-	-	29	69	42	100	10	32	-	-	21	68	31	100
4	Method of mixing	13	31	-	-	29	69	42	100	10	32	-	-	21	68	31	100
5	Time of application (DAS)	14	33	-	-	28	67	42	100	10	32	-	-	21	68	31	100

Continued ....

VII		Pest Monitoring																
	1	Time of monitoring (DAP)	43	72	-	-	17	28	60	100	31	52	-	-	29	48	60	100
	2	Interval of Monitoring for pest	40	68	-	-	20	33	60	100	28	47	-	-	32	53	60	100
VIII		Water Management																
	1	Time of draining out water from nursery	45	75	-	-	15	25	60	100	34	57	-	-	26	43	60	100
	2	Water level maintained 10 days after sowing (in inches)	43	72	-	-	17	28	60	100	32	53	-	-	28	47	60	100
	3	Common water channel used to drain out stagnant water.	55	92	-	-	5	8	60	100	41	68	-	-	19	32	60	100
	4	Water level maintained at different stages of rice crop	39	65	-	-	21	35	60	100	32	53	-	-	28	47	60	100
IX		Trimming and plastering of bunds	48	80	-	-	12	20	60	100	32	53	-	-	28	47	60	100
X		Application of chemical fertilizers																
	1	Chemical fertilizer used	60	100	-	-	-	-	60	100	60	100	-	-	-	-	60	100
	2	Quantity of NPK used	42	70	18	-	-	-	60	100	21	35	39	65	-	-	60	100
	3	Method of application	60	100	-	-	-	-	60	100	60	100	-	-	-	-	60	100
	4	Water level maintained at the time of application	55	92	-	-	5	8	60	100	42	70	-	-	18	30	60	100
XI		Application of nitrogenous fertiliser																
	1	Nitrogenous fertilizer used	38	63	-	-	22	37	60	100	20	33	-	-	40	67	60	100
	2	Neem coated urea applied	15	25	-	-	35	75	60	100	5	8	-	-	55	92	60	100
	3	Quantity of Neem seed used	12	20	-	-	48	80	60	100	3	5	-	-	57	25	60	100
	4	Neem seed crushed	8	13	-	-	52	87	60	100	3	5	-	-	57	95	60	100
	5	Soaking of Neem coated urea overnight before application	6	10	-	-	54	90	60	100	2	3	-	-	58	97	60	100
XII		Top dressing of N-fertilizer																
	1	Fertilizer used for top dressing	39	65	-	-	21	35	60	100	28	47	-	-	22	53	60	100
	2	Quantity of fertilizer applied	30	51	19	49	-	-	39	100	12	43	16	57	-	-	60	100
XIII		Weeding operation																
	1	Time of weeding (DAP)	55	92	5	8	-	-	60	100	42	70	18	30	-	-	60	100
	2	Number of weeding	55	92	5	8	-	-	60	100	42	70	18	30	-	-	60	100
XIV		Pest surveillance using light traps	15	25	-	-	45	75	60	100	2	3	-	-	58	27	60	100

FA - Full adoption　　PA - Partial adoption　　NA - Non-adoption
DAS - Days after sowing　　DAP - Days after planting

Table 5. **Mean attitude score of farmers on IPM practices in rice.**

Farmers	N	Mean attitude score	't' value
Trained	60	38	4.58**
Untrained	60	30	

** - Significant at 0.01 level

of trained farmers. Similarly, the mean attitude score of untrained farmers was also obtained. The 't' value shows a highly significant difference between the trained and untrained farmers with respect to mean attitude score. This might be due to the fact that involvement of rice farmers in FFS training programme had influenced the farmers to develop a favourable attitude toward IPM technology as this may be viable option compared to other approaches of pest control.

CONCLUSIONS

During the course of the FFS, the farmers' concept of the rice ecosystem and their understanding of the function of beneficial insects in that ecosystem deepened considerably. In the FFS, understanding and skills are developed through direct participation in specially designed situations. The careful arrangement of FFS activities in this educational experience strongly contributed to the formation of more scientific concepts. The FFS was effective because learning activities took place in a rice field–a familiar and learner–friendly environment. The use of small groups of farmer trainees to make observations, and the role played by the FFS in challenging their conclusions, proved effective in bringing about change in farmer practices. The application of these new IPM methods taught through Farmer Field Schools in environmentally sound and sustainable. The FFS is an efficient model for empowering farmers to reduce the use of pesticides, wider application of this training approach benefits farmers economically, they save money because they buy less pesticides and benefits the planets environment. Every one wins. Through IPM field schools, farmers can help other farmers learn important ecological principles and practices in their own fields, with some continued assistance these principles can be applied to a number of crops and cultivation problems, resulting in more sustainable crop management without reductions in the yield. In this context, IPM Farmer Field Schools played an important role in changing farmers' knowledge, adoption and attitude towards IPM practices. The knowledge, adoption and attitude of trained and untrained farmers towards IPM practices on rice were measured by a well structured schedule with appropriate scales. To find out the nature of relationship between the trained and untrained farmers 't' test was applied. The 't' values showed that there was a clear difference between trained and untrained farmers with their knowledge, adoption and attitude towards IPM practices of rice cultivation.

Majority of trained and untrained farmers had knowledge regarding selection of variety, crop rotation, synchronous planting, topping of seedlings, trimming and plastering of bunds, pest surveillance using light traps, collection and destruction of paddy stubble's and egg masses of stem borer, seed treatments and herbicidal application. However, they lacked enough knowledge on use of pheromone traps. Nearly, 50% of trained farmers were high adopters of IPM practices whereas, only 43% of untrained farmers were low adopters of IPM practice of rice. More than half of trained farmers had adopted cultural and mechanical methods, but only a few of the trained farmers had adopted biological method. Forty per cent of trained farmers had adopted chemical method as a last resort to control the pests.

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