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Study on effectiveness of farmer field school (FFS) approach in rice ecosystem for integrated pest management

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ABSTRACT
Pesticides have become an integral part of crop production scenario, as one third of realisable crop output is lost due to the depredations by pests and diseases. Indiscriminate use of pesticides poses numerous negative externalities. Farmers' awareness regarding the ill-effects of pesticides on water and air is very limited. Farmers Field School was conducted in Aranmula rice ecosystem for integrated pest management among a set of 30 plots designated as IPM treatment and another set of 30 plots designated as non-IPM or Local Treatment. The primary learning material at a Field School was the rice field of 10 hectares area, where most Field School activities took place. It was a field based learning experience for the full cropping season, with 14 meeting times with an approximate length of four to five hours per meeting so that farmers could observe and analyse the dynamics of the rice field ecology across a full season. The primary difference between the two was that the non-IPM fields received an imbalanced dosage of nutrient treatment as well as chemical pesticide sprays while in the IPM fields farmers applied a balanced fertiliser treatment (NPK), planted at lower densities with wider spacing and need based botanical as well as bio pesticide application. . Benefit cost ratio was higher for IPM farmers (2.01) compared to that of non-IPM farmers. Over and above, FFS gave two main results: Farmers regained the competence to make rationally based decisions concerning the management of their crops (in contrast to the instructions which were part and parcel of the Green Revolution packages). Secondly the participants gained social competence and confidence to speak and argue in the public.

Key words : Rice, Ecosystem, Pest management.

INTRODUCTION

Pesticide use in Indian agriculture increased from 2353 metric tonnes in 1950-51 to about 90,586 metric tonnes in 1995-00 (Carrasco-Tauber, C. and Moffitt, J.L., 1992).FAO reports indicated that there is a list of 233 agricultural pests which have become resistant to nine major groups of pesticides. Consumption of pesticides is concentrated on two crops, namely cotton and rice. The consumption of organochlorine and organophosphorus group of pesticides with adverse effects on environment is still higher in India(Sharma.V.P. 1999).

Farmers' awareness regarding the ill-effects of pesticides on water and air is very limited (Gandhi and Patel 1997). IPM techniques and skills, by involving a varieties of methods like cultural, mechanical, biological and chemical have shown increase in rice yield in 40 ha of farmers field during 1983 to 1990 with low cost on plant protection inputs, resulting in net saving to the growers. Though the average production cost was higher in IPM plots, the percent increase in yield of rice obtained in IPM plot was found significant. (Misra *et al*. 1994). In this study a modest attempt has been made to popularize IPM techniques through Farmer field school.

The FFS approach adopted in rice ecosystem is an effective approach to technical education and capacity building. Here farmers generated knowledge that is functional and necessary to improve their production and livelihood potential. Training in the field school followed the seasonal cycle and the field was the primary learning venue The field school offered farmers the opportunity to learn by doing, by being involved in experimentation, discussion and decision-making. This strengthened the role of farmers in the researcher-extensionist-farmer chain. It also improved the sense of ownership of rural communities in technological packages and new knowledge and skills.

Through local analysis and experience, farmers adjusted input and technical packages to better suit local conditions. The FFS served as a means to better extension work. Improvement in the livelihood of participating farming communities was envisaged when each farmer's capacity to analyse problems and identify solutions was built. The school provided farmers with tools which enabled them to analyse their own production practices and identify possible solutions.

METHODOLOGY

The Krishi Vigyan Kendra, Pathanamthitta District, Kerala in collaboration with Central Integrated Pest Management Centre, Kochi (CIPMC) and State Department of Agriculture conducted Farmers Field School at Aranmula rice ecosystem in Pathanamthitta District,Kerala for integrated pest management in a group of 30 farmers and non IPM measures among other group of 30 farmers **.** The primary learning material at a Field School was the rice field of 10 hectares area, where most Field School activities took place. It was a field based learning experience for the full cropping season, with 14 meeting times with an approximate length of four to five hours per meeting so that farmers could observe and analyse the dynamics of the rice field ecology across a full season. Field School plots received two treatments. A set of plots which was designated as IPM treatment and another set as designated as non-IPM or Local Treatment. The primary difference between the two was that the non-IPM fields received an imbalanced dosage of nutrient treatment as well as chemical pesticide sprays while in the IPM fields farmers applied a balanced fertiliser treatment (NPK) with integrated nutrient management ,planted at lower densities with wider spacing and need based botanical as well as bio pesticide application. Due to the importance of the field study plots in the learning process, the Field School meeting place was usually close to the field study plots under shaded coconut trees.

Data collection

The data pertaining to the general information of paddy farmers, *inter alia*, holding size, cropping pattern, costs and returns, plant protection measures used, awareness of farmers with regard to the toxicity level of pesticides, safety procedures followed during application of plant protection chemicals (PPCs), experience of farmers with regard to the health hazards after PPC application and endemics observed in the region were collected by personal interview method using a pre tested schedule designed for the study.

Activities:

Each meeting of FFS consisted of the following set pattern of activities:

- Agro-ecosystem field observation, analysis and presentations;
- Discussion on special topics
- Group dynamics.

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Agro-ecosystem analysis was the Field School's core activity, and other activities were designed to support it.

RESULTS AND DISCUSSION

General characteristics of sample farmers

A sizable portion of the sample farmers belonged to medium and small farmers. This indicates that farmers are deprived of the advantage due to economies of scale. The average age of the farmers was 48 years, which showed farmers have a good number of years of experience in paddy cultivation. Main crop season is Punja crop, raised during summer moths (Nov – Dec to Mar–April) to avoid the risk due to flood. (Table 1&2)

Frequency of insecticide application- 2-3 times in a season at a quantity above the recommendations also indicates the growing

Table 1 : General characteristics of sample farmers

(n=60)

Sl.No.	Particulars	Average	Range
1.	Age of respondents (Years)	48	30-74
2.	Family (Numbers)	5.28	4-10
3.	Land holding (acres)		
	a) Punja crop(Nov-Dec to March-April)	4.02	0.5-15
	b) Additional crop (May-June to Aug-Sept)	1.46	0.5-15

Table 2 : Educational status of the farmers

(n=60)

Sl. No.	Educational status	Number	Percentage
1.	Illiterate	0	0
2.	Primary	10	17
3.	Secondary	33	55
4.	College and above	17	28
	Total	60	100

Table 3 : Major pesticides used by the farmers in rice cultivation

Sl.No.	Name of the pesticide	No: of farmers	Quantity used per acre	
			Qty(ml)	Value(Rs)
1.	2,4-D	59 (98%)	526.4	68.4
2.	Dimecron (Phosphamidon)	27 (45%)	183	88.2
3.	Ekalux (Quinalphos)	5 (8.3%)	301.7	126.7
4.	Metacid (Methyl parathion)	20 (33%)	300.07	135.0
5.	Nuvacron (Monocrotophos)	25 (42%)	277	116.5
6.	Bavistin (Carbendazim)	12 (20%)	179.16	125.4
7.	Contaf (Hexaconazole)	9 (15%)	266.67	186.7
8.	Hinosan (Ediphenphos)	12 (20%)	225	180

Table 4 : Health hazards observed among the sample farmers

(n=60)

Sl. No.	Health hazard	Number	Percentage
1.	Dermatitis	3	5
2.	Head ache	13	21
3.	Loss of appetite	4	7
4.	Diarrhea	9	15
5.	Vomiting	3	5
6.	Body pain	7	11
7.	Conjectivities	3	5
8.	Respiratory diseases	3	7
9.	Unconsiousness	4	5

problems of insect resistance built up and pest resurgence.

Kinds of pesticide used

Organophosphates were the major groups of pesticides used by the farmers(Table 3). Organophosphates are highly toxic to humans / livestock compared to other groups of insecticides (Langham and Edward, 1969). They may often cause health problems like irritation of the gastro-intestinal tract, manifesting as intense nausea, vomiting and diarrhea (Rola and Pingali, 1993). Organophosphates are also applied at much higher rate than the recommended level. Dimecron was applied at 183 ml /acre compared to the recommended level of 100 ml/acre. Metacid ad Nuvarson were applied at the rate of 300 ml of 277 ml per acre respectively, eventhough the recommended quantities were 200 ml and 240 ml /acre, respectively. So this a clear indication of over use of pesticides which could be due to the resistance build in pests and pest resurgence. The study by Ganganna and Satyanarayana (1991) also indicated that about 233 pests have become resistant to 9 major groups of pesticides

Majority of the farmers (60 %) experienced health hazards due to pesticide poisoning. Farmers who took curative measures (26 %) spent Rs. 86 in the crop season. Head ache, diarrhea, body pain, conjectivitis, dermatitis, were the major health problems observed among farmers 9Table 4).

Agro-ecosystem Analysis

The agro-ecosystem analysis process sharpened farmers' skills in the areas of observation and decision making and helped to develop their powers of critical thinking. The process began with small group observations of the IPM and non-IPM plots. During the observation process farmers collected field data—such as the number of tillers per hill and varieties of insects and their populations—and samples of insects and plants. These data were collected from ten rice hills. The facilitators from KVK were present throughout the observation to help farmers in their observations.

After the field observation, the farmers returned to the meeting place and, using sketch, drew what they had observed in the field on poster paper. The drawings included:

a) A rice plant in the centre that indicated the size and stage of plant growth, along with other important features such as the number of tillers, the colour of the plant and any visible damage;
b) Important features of the environment (the water level in the field, sunlight, shade trees, weeds, and inputs).
c) Pests and natural enemies observed in the fields (pests on one side, natural enemies on the other All members of the group involved in the creation of the drawing and analysis of data. While drawing, farmers discussed and analysed the data they had collected in the field. Based on their analysis they determined a set of action decisions to be carried out in the field. A summation of these action decisions as agreed by the group was also included in the drawing.

One member who was selected as person in charge of the group then presented the findings and decisions to further larger group. After this brief presentation of results the floor was opened for questions and discussion. Good large group discussions often involved the posing of alternative scenarios. This cycle of presentation, question and answer and discussion repeated until all five groups presented their results The "Agroecosystem Activity Matrix" describes what an observer should be able to see when an agroecosystem analysis activity is being conducted. Here the role of the facilitator is to just help farmers learn, not to teach them.

Special Topics

Special topics support the agroecosystem analysis by delving more deeply into specific issues relating to the rice agroecosystem and IPM principles. Special topics also provided training in basic experimentation methods. Special topics included land preparation, nursery raising , termite attack in rice and its control measures,

Agroecosystem Activity Matrix

Activity	Critical Steps	Purpose	Indicators
AESA (Primary FFS activity Develops Good IPM: Habits: -Observation -Analysis -Decision making Farmers become IPM experts)	Observation & Drawing of Agro-ecosystem	Farmers understood the methodology of taking field observation and its objective. In field they took observation, wrote notes,collected specimens. Purpose of drawing was to make them summarise observation and to conduct analysis.	1. Before FFS activity farmers told a) goal of activity and b) Process to be followed in activity. 2. After that all farmers were in the field. 3. Process of observation included the whole plant. 4. Observations were noted down down. 5. Specimens were collected. 6. Drawings summarized these field observations.
	Presentation & Analysis	Results of analysis was then further presented to large group by one member of each small group problems were posed, questions were asked. Purpose: They discussed the field conditions & solved many problems by themselves with help of facilitator. Objective: Improved decision making & analytical skills based on ecosystem observation. Facilitator helped groups to achieve objective by asking probing questions to help analytical process.	1. Presentations made by leader of each small group. 2. Farmers asked questions to presenter. 3. Facilitator asked questions appropriate for better analysis 4. Enabled sound groups discussion on field conditions & agroecosystem relationships. 5. Previous weeks agro-ecosystem drawings were used for comparisons. 6. Field management decisions were critically examined by group. 8. Other factors in addition to economic thresholds were analysed (e.g. plant stage, natural enemies) beneficial insects to Pest ratio was worked out. 9. Facilitator posed questions to help farmers analyse what was learned during activity.

preparation of neem oil and its application, life cycle of stem borer and leaf eating caterpillar, and rat control, plant physiology, issues surrounding pesticide use, and general field ecology were discussed in an interactive discussion manner. After the master trainer introduced the topic and explained the steps to be used in the process, the farmers, in small groups, took on the active management of the experiment or small group activity. As with agroecosystem analysis, the skills of observation, data collection and analysis were emphasised. In general they are discovery learning activities that depend upon the facilitator's ability to pose questions which could enable the farmers to critically analyse what they have observed during the activity.

Group Dynamics

Group dynamic activities helped farmers to develop an understanding of how:

- Groups worked in given problematic situations;
- Cohesiveness and collaboration could be developed;
- Communicative action which is a fundamental element in well functioning groups.

These activities generally began with an introduction by the master trainer, who had set up a problem that the groups were made to solve. Many of the exercises were physical and active, while some were more on the order of 'brain teasers'. In either case, the group members had some fun while sharing their experiences of working to overcome any specific problem and they learned from the session about how to help people collaborate.

Activity	Critical Points	Purpose	Indicators of Quality
Group Dynamics (enhanced teamwork & problem solving skills.	Process	Farmers were informed about objectives and process before activity began. Materials for activity, if needed, were given before. Time allowed for each activity was sufficient enough to achieve objective. .	1. Before activity began farmers told goal and process of activity. 2. All farmers involved/active, no single individual dominated activity.
	Synthesis	Leader took time to: review objective of activity;lead discussion concerning what happened during the activity; pointed out important issues arising during activity; helped farmers draw conclusions based on their experience during the activity.	1. Facilitator: a)reviewed goal and process of activity; b)helped farmers identify key learning points based on activity; c)asked questions which helped farmers learn from their experience.

The role of the facilitator was to help farmers analyse what they have experienced so that they reached a greater understanding of how people tend to behave in various social situations.

Costs and returns in paddy cultivation

A comparative study has been conducted to assess the economic feasibility of IPM.. Both Non-IPM and IPM farmers incurred heavy labour costs during their cultivation. Labour cost constituted 60 per cent of total cost for non-IPM farmers and that of IPM farmers was 63 per cent. Rice is basically a labour intensive crop, which needs huge amount of labour for land preparation, weeding and harvesting practices. High wage rate existing in Kerala is another cause for this. Male and female wage rate are Rs. 110 and 60, respectively, which will be revised every year due to intensive labour unionism.

There was significant difference, in the expenditure on PPCs, between IPM and non-IPM farmer. Non-IPM farmers spent 4.71 per cent of total cost on PPCs to check the depredations by pests and diseases. However, IPM farmers, under direct guidance by extension workers and scientists, resorted to judicious use of pesticide and thereby reduced the expenditure to 1.7 per cent of total cost.

Quantity of seed and fertilizer used was less in IPM fields compared to non-IPM farmers as IPM farmers were directed to follow the recommendations by the experts.

Inspite of realising a better yield 17.25 quin./acre, non-IPM farmers earned a profit of Rs. 4518, which is less than that of IPM farmers (Rs. 5375). The reasons could be obviously due to the overuse of inputs.

Benefit cost ratio was higher for IPM farmers (2.01) compared to that of non-IPM farmers. This finding is line with Nalinakumari *et al*. (1997).

CONCLUSION

Farmers used huge quantities of synthetic pesticides like organophosphates, which can cause both health hazards and faster resistance built up among pests, pest resurgence and reduction of natural enemy population. Use of botanical and biopesticides is both effective and environment friendly. For instance neem pesticides are highly effective and scientists have reported that resistance build up against it is very difficult as neem contains a good number of active ingredients. Evolution of insect biotype against all these active

Table 5 : Per acre costs and returns in paddy cultivation

Sl. No.	Particulars	Non-IPM		IPM		t-value
		Amount (Rs)	Percentage to the total	Amount (Rs)	Percentage to the total	
1.	Seeds	673	10.65	506	9.23	4.79
2.	Fertilizers	932.7	14.77	533.2	9.73	0.002
3.	Plant protection chemicals	297.3	4.71	93.5	1.71	3.93
4.	Mechanical labour	588.1	9.31	579.6	10.58	0.59
5.	Manual labour	3757.5	59.50	3456.4	63.1	0.07
6.	Total cost	6314.7		5477		0.004
7.	Gross returns	11160.1		11014.6		0.83
8.	Net returns	4518		5375.5		0.1
9.	Benefit-cost ratio	1.77		2.01		0.09

ingredients is a remote possibility. Use of *Bacillus thisurgiensis* known at Bt technology is another promising biopesticide. Research and extension programmes should be strengthened in this direction. It is observed that the IPM has helped the farmers to reduce the use of PPCs drastically. IPM farmers managed to earn a better profit than and non-IPM farmers. Therefore, immediate initiative should be taken for large scale popularization of IPM technology by strengthening extension programmes.

Over and above, FFS's gave two main results: Farmers regained the competence to make rationally based decisions concerning the management of their crops (in contrast to the instructions which were part and parcel of the Green Revolution packages). Secondly the participants gained social competence and confidence to speak and argue in the public.

The basis for the training approach is non-formal education which itself is a 'learner-centred' discovery process. It seeks to empower people to solve 'living problems actively by fostering participation, self-confidence, dialogue, joint decision making and self-determination. The 'discovery learning' by farmers on the basis of 'agro-ecosystem analysis', by using their own field observation, is science informed. The agro-ecosystem analysis methodology was analysed carefully on the basis of the latest entomological knowledge. Hence this participatory approach does not represent a violation of the 'integrity of science', but rather a new interactive way of deploying science.

REFERENCES

Carrasco-Tauber, C. and Moffitt, J.L. (1992). Damage control econometrics : Functional specification and pesticide productivity. *American Journal of Agricultural Economics,* **74 (1) :** 158-161.

Gandhi, V.P. and Patel, N.T., (1997). Pesticides and the environment :A comparative study of farmer awareness and behaviour in Andhra Pradesh, Punjab and Gujarat. *Indian Journal of Agricultural Economics*, **52 (3) :** 519-529.

Gangamma, G.N. and Satyanarayana, B.S., (1991). Danger posed by pesticides. *Spice India*, December : 7 –9.

Langham, M.R. and Edwards, W.F., (1969). Externalities in pesticide use. *American Journal of Agricultural Economics*, **51 :** 1195-1201.

Misra, R.P., Arasumallaiah, L., Ravi, K. and Diwaakar, M.C., (1994). Integrated pest management approach for rice – A case study in Karnataka. *Plant Protection Bulletin*, **46 (1) :** 6-7.

Nalinakumari, T., Sheela, K.R. and Achuthan Nair, M., (1997). Integrated pest management in rice. Scientific Conference on Food Security in Harmony with Nature – Abstracts (ed.) Shivashankar, K., pp. 136.

Rola, A.C. and Pingali, P.L., (1993). Pesticides, rice productivity and farmers health – An economic assessment, IRRI, PO Box 933, Manila, Philippines.

Sharma, V.P. and Sharma, P., (1999). Pesticide use in Indian agriculture : Some issues and constraints in its growth. *Pestology special issue*, February, 1999. pp. : 242-252.

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