Integrated Pest Management Farmer Field School for Sustainable Agriculture

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Abstract

The study was conducted among the two farmer groups in Bhaktapur and Kavre districts of Nepal. The main objective of the study is to evaluate the effectiveness of IPM FFS on creating awareness and disseminating the knowledge on sustainable pest management to the farmers and to assess the relationships between enhanced IPM knowledge and adoption of IPM strategies by the farmers. The study has been based on data collected through personal interview with the farmers, focus group discussion, personal observation in the farmers field, discussions with the leader farmers, agro-vet owners, farmer facilitators of the FFS and also on secondary data collected from related publications of various organizations. The study has revealed that FFS is being an effective tool in increasing IPM knowledge and techniques of ecological pest management among the farmers. Farmers after participation in the IPM FFS were more confident in managing their fields and taking pest control decisions and have been reducing the use of hazardous chemical pesticides and adoption of eco-friendly pest control measures was on the move. This justifies the potential of IPM FFS as an effective mechanism for increasing both knowledge of IPM and the adoption of IPM strategies. **[Pawan Singh Bhandari. Integrated Pest Management Farmer Field School for Sustainable Agriculture. International Journal of Agricultural Science, Research and Technology, 2012; 2(2):99-103].**

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1. Introduction

The agriculture sector remains the economic backbone of Nepal, employing about 65.6% of the working population, producing around 33.5% of the GDP[1] (ABPSD, 2006). One of the main constraints to increase agriculture production and value-addition in the farm produce is the pest attack. Loss from crop pests is estimated to be around 35% annually. To reduce the loss, farmers are increasingly using chemical pesticides, which are not only expensive but also hazardous to environment. The illegitimate use is due to unawareness of toxicity, availability of toxic pesticides, aggressive marketing by dealers and profit interests. Although the agricultural policies during the last few decades promoting higher input of chemicals, particularly in the irrigated areas of the Terai region, have resulted in higher yields and more food, they have also resulted in poisoning, health related poverty and environmental degradation (Esser et al., 2012). During the green revolution period, pesticides were considered as one of the yield increasing inputs and so being used widely even without its real need to manage the pests. Current extension and research approaches and global tendency of dumping relatively cheaper and environmentally unsafe pesticides in developing countries attribute to increased use of pesticides (Upadhaya, 2003). Consequently it caused frequent pest outbreaks, pest resurgence, pesticide resistance issues and to handle this Integrated Pest Management (IPM) has emerged as an important approach of pest control strategy, which encourages applying measures that causes least disruption of agro-ecosystem (FAO, 2011).

Government of Nepal has adapted IPM as crop protection strategy since 1990 and incorporated the IPM as an integral component of agriculture program. The National IPM Programme in Nepal was initiated in 1997 with the support from FAO[2] under its Technical Cooperation Programme and later funded by the Government of Norway for 4 years under the umbrella of the Regional FAO Programme for Community IPM in Asia. The latter programme which ended at the beginning of 2003 but is being continued with support from the FAO's inter-regional programme has identified the basic approach to capacity building for sustainable agriculture, essentially relying on the Farmer Field School (FFS) approach to produce not only better control of crop pests, but also a range of other benefits which

1-Gross Domestic Product

2- Food and Agriculture Organization of United Nations contribute to sustainable rural livelihoods including more efficient crop management, resulting in improved food security and incomes; reduced use of pesticides, resulting in improved biodiversity and human health; farmers empowered to take greater control of their lives, resulting in better response to adversity; better bargaining position, resulting in improved support from Government and reduced threats from corporate interests and building strong community interaction (Agreement, 2003).

Various researches on agriculture extension assert that awareness and knowledge of a new technology is a necessary first step in the adoption and decision-making process. IPM FFS have been deployed around the world since their success in Southeast Asia (Erbaugh et al., 2004). However, assessments are needed to evaluate, modify and improve their effectiveness. Therefore the main purpose of this study is to evaluate the effectiveness of IPM FFS being conducted in Nepal on creating awareness and disseminating the knowledge on sustainable pest management to the farmers and to assess the relationships between enhanced IPM knowledge and adoption of IPM strategies by the farmers.

2. Materials and methods

The study was conducted among the two farmer groups which had participated in the IPM FFS conducted by DADO[1] in Bhaktapur and Kavre districts namely, Bimaleswor IPM FFS and Saradadevi IPM FFS respectively. The total member population of Bimaleswor IPM FFS was 21 and that of Saradadevi IPM FFS was 25. Purposive sampling method was used to select the farmer groups after the consultation with Officers in the DADOs of both districts. The study has been mainly based on the primary sources of data collected by organizing personal interview with the farmers, focus group discussion, personal observation in the farmer's field and discussions with the leader farmers, agro-vet owners and farmer facilitators of the FFS. Secondary data were collected from publications of government line agencies DADO in Bhaktapur and Kavre, NARC[2], PPD[3] and international agencies like FAO and IPGRI[4]. The collected data were carefully edited for missing and incomplete information. It was then processed in computer using statistical and non-statistical software tools.

3. Results and discussion

1-District Agriculture Development Office
2 - Nepal Agriculture Research Council
3 -Plant Protection Directorate
4 -International Plant Genetic Resources Institute

Analysis of some key socio-economic variables of the respondents was done. Findings reveal that majority of the respondents were between the age group 20-40 years, 60 percent were female and 35 percent were illiterate. The average household size of farmers was 7 members with the range of 3-19 members. The average land holding of the farmers was 8 ropani[5], with the range of 1-25 ropani and in 60 percent of the respondents' households, male hold the land titles. Data on major sources of household income reveal that majority of respondents rely on other non-farm activities along with agriculture for their livelihood.

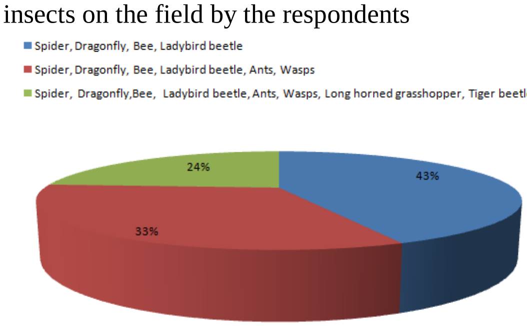
3.1 Awareness about the negative impacts of pesticides

All the respondents interviewed reported that they were aware about the negative impacts of pesticides on human health and environment. However their level and extent of awareness was found varying. This does imply that there is more to do for fostering awareness level in farmers about negative impact of pesticides.

3.2 Identification of beneficial insects

Knowledge on identifying the beneficial insects on the field by the respondents is presented in the figure 1. Of the total respondents, 43 percent could easily identify Spider, Dragonfly, Bee, Ladybird beetle as the beneficial insects while 33 percent could identify Spider, Dragonfly, Bee, Ladybird beetle, Ants and Wasps. However 24 percent identified more numbers of beneficial insects e.g. Spider, Wasps, Ants, Dragonfly, Long horned grasshopper, Ladybird beetle, Tiger beetle and Bee. This indicates that majority of the respondents understood about some key beneficial insects in their fields.

Figure 1. Knowledge on identifying the beneficial insects on the field by the respondents



5 - Ropani is equivalent to 0.058 hectare

3.3 Change in cultivation practices

Among the total respondents surveyed, 88 percent replied that they have brought change in the cultivation practices. Major changes were use of improved seeds, use of mix of organic and inorganic fertilizers, reduction in use of chemical pesticides along with increase in spacing between plants, reduced seed rate, crop rotation, proper timing of irrigation and fertilizer application etc.

3.4 Adoption of alternative pest management strategies

The priority for pest management methods given by the respondents was studied to reveal if there has been any change in use of chemical pesticides and adoption of environment friendly pest control measures after the participation in IPM FFS. Earlier all the farmers adopted chemical method as the only method of pest control, however the data in the table below reveals that this practice is changing and farmers had been found searching alternative method of pest management. After the participation in IPM FFS, 70 percent of respondents allotted chemical method of pest management the first priority whereas 17 percent respondents allotted botanical method, 9 percent allotted cultural method and 4 percent allotted physical method of pest management as first priority. During the study it was learned that farmers due to the unavailability of organic pesticides compared to chemical pesticides in the local agro-vets and lack of time due to involvement in other off-farm activities for income generation were not practicing other methods of pest management.

Table 1. Pest management practices

Management	Priority after IPM training			
	1st	2nd	3rd	4th
Chemical	32(70)	10(21)	4(9)	-
Botanical	8(17)	-	-	8(17)
Physical	2(4)	4(9)	5(11)	-
Cultural	4(9)	5(11)	-	-
Total	46(100)	19(41)	9(20)	8(17)

Note: Figures in parenthesis indicate percentage

3.5 Change in use of chemical pesticides

Of the total respondents, 65 percent expressed that the trend in use of pesticides had decreased compared to the past, 20 percent of the respondents expressed that the trend was still increasing while 15 percent respondents expressed that the trend was constant. The changes brought were application of less hazardous pesticides, judicious application to targeted pest according to the pest severity and use of alternate safer pesticides. Pesticide application was found more in vegetable crops than cereals. Among the vegetable crops Potato, Tomato, Cole crops and Cucurbits received the highest dose and frequency because of their high commercial value in terms of quality and quantity, farmers were reluctant to take risks in these crops using other methods of pests control. If these crops are damaged by insect pests and diseases, yield reduces significantly this in turn reduces the major share of household income through sales of these crops. Major insect pest and diseases of crops in the study area and common insecticides and fungicides used by the farmers are presented in the tables below.

Table 2. Major insect pests in the study area

Crop	Insect pests
Rice	Rice moth, Rice leaf folder, Rice Bug, Mole cricket, Yellow stem borer
Maize	Maize Stem Borer
Potato	Potato tuber moth, White grubs, Red ants, Semilooper, Flea beetle, Cutworms
Tomato	Tomato fruit worm
Cole crops	Cabbage butterfly, Cabbage aphid, Cutworms
Cucurbits	Fruit fly, Aphid, Semilooper, Red beetles
Leafy	Flea beetle

Table 3. Common insecticides used by the farmers

Trade name	Common name	Group	Hazard category
Malathion	Malathion	Organo phosphate	Blue
Metacid	Methyl parathion	Organo phosphate	Red
Nuvan	Dichlorovos	Organo phosphate	Yellow
Stactox-10	Phorate	Organo phosphate	Red
Axis	Alphamethrin	Synthetic pyrethroids	Yellow
Rogor	Dimethoate	Organo phosphate	Yellow
Gambhir	Chlorpyriphos 50% + Cypermethrin 5% EC[1]	Organo phosphate + Cypermethrin	Yellow
Fen-Fen	Fenvalerate	Synthetic pyrethroids	Yellow
Monodhan-36	Monocrotophos	Organo phosphate	Red
Confident	Imidacloprid 17.8% SL		Yellow
Polyram	Metiram 70% WG		Green

Note: WHO classification of pesticides according to hazards; Red: Extremely hazardous, Yellow: Highly hazardous, Blue: Moderately hazardous and Green: Slightly hazardous)

1- Emulsifiable concentrate

Table 4. Major diseases in the study area

Crop	Diseases
Rice	Blast, Bacterial leaf blight
Wheat	Yellow Rust, Loose Smut
Solanaceous (Potato, Tomato)	Early Blight, Late Blight
Cucurbits	Powdery Mildew, Downey Mildew, Cucumber Mosaic Virus
Cole crops	Alternaria Leaf Spot, Club root, Downy Mildew

Table 5. Common fungicide used by the farmers

Trade name	Common name	Group	Hazard category
Dithane M-45	Mancozeb 75% WP[1]	Dithio-Carbamates	Green
Leo M-45	Mancozeb	Dithio-Carbamates	Green
Bavistin	Carbendazim 50% WP	Bemzimedozol	Green
Derosal	Carbendazim	Bemzimedozol	Green
Sixer	Carbendazim AI[2] 12% + Mancozeb AI 63% w/w WP		Green
Dhanucop	Copperoxy chloride	Inorganic	Blue
Polyram	Metiram 70% WG[3]		Green
Victo-Virus		Aqueous herbal extract	
Karathane	Dinocap		Blue
Kriloxyl	Metalaxyl + Mancozeb		Blue
Blitox	Copperoxy chloride	Inorganic	Blue
Kriloxyl	Metalaxyl 8% WP + Mancozeb 64% WP		Blue
Rhino	Mancozeb 75% WP		Green
Indofil	Mancozeb 75% WP	Dithio-Carbamates	Green
Jatayu	Chlorothaloni l 75% WP		Green

Note: WHO[4] classification of pesticides according to hazards; Red: Extremely hazardous, Yellow: Highly hazardous, Blue: Moderately hazardous and Green: Slightly hazardous)

3.6 Change in fertilizer use

All of the respondents reported change in type of fertilizer application, which was mainly the use of mix of organic and inorganic fertilizers. Earlier, urea was the most widely used inorganic fertilizer by almost all farmers and use of Phosphorous fertilizer (commonly the DAP[5]) was in very small amount due to its high price. The practice of applying Potassic fertilizer was nil. Application of FYM[6] and compost was also very less. There was no balance use of chemical and organic fertilizers. Now the dose of urea has been reduced considerably. Farmers complain acidic soil due to high urea application earlier so very few farmers now use urea as top dress only. Farmers practice balance use of Urea, DAP and MoP[7] recommended by the technicians in the DADO and ASC[8]. Farmers use Effective Microorganisms (EM) for fast and quality compost making.

3.7 Introduction of new crop and crop varieties

Of the total respondents, 81 percent had introduced new crop species in their farm. Examples of newly introduced crop species include Squash, Cabbage as seasonal vegetables and Cauliflower, Radish, Tomato as off-season vegetables. But this was not solely the contribution of participation in IPM FFS but also due to the availability of irrigation facility in the area. Earlier farmers used to plant wheat after rice in lowland whereas now they cultivate potato and other seasonal vegetables in both upland and lowlands. Earlier, farmers used to plant local seeds of cereals and vegetable crops produced by them. Now hybrid seeds are used in almost all vegetables. In case of cereal crops like rice, maize and wheat, recommended improved seeds from government farms were being used.

3.8 Perception towards empowerment

After the participation in IPM FFS and adoption of IPM technologies, changes in empowerment are expected (Pontius et al., 2002). With the changes observed on empowerment of an individual before and after the participation in FFS, conclusion could be drawn of its usefulness. All of the respondents interviewed opine they are empowered, one way or other. Changes in empowerment were expressed in terms of skill development, increase in income, increase in decision making capacity, confident enough to participate in group discussions, increase in awareness, increase in capacity. Many respondents expressed that they experience increase in awareness and felt much more confident in managing their fields and taking pest

1- Wettable powder
2- Active Ingredient
3- Water dispersible granules
4- World Health Organization
5- Di-Ammonium Phosphate
6- Farm Yard Manure
7- Muriate of Potash
8 -Agriculture Service Centre

control decisions. The responses mentioned above are positive signal towards empowerment. Though some of the responses do not directly link with empowerment process, however the outcomes of these developments will ultimately lead to the empowerment process.

Discussion

There has been change in frequency of use of hazardous chemical pesticides and adoption of eco-friendly pest control measures is on the move. Empowerment of farmers has initiated and majority of the farmers were found involved in socio-economic development activities and developed the leadership capacity. The change in the cultivation practices brought by farmers tends to conserve the environment. There was increase in the soil fertility status and priority of using chemical pesticides was decreasing. Regardless of the methods used, most farmers who have received IPM training seem to have either lowered the production costs, raised their yields, or both. This finding agrees with (Pontius et al., 2002a) which has also found that farmers in Asia and Southeast Asia who have participated in field schools have reduced their use of pesticides, improved their use of inputs such as water and fertilizer, realized enhanced yields and obtained increased incomes.

4. Conclusion

Integrated Pest Management approach has been a good means to management of pest and ensuring the sustainable yield. Findings of the present study in the study area suggest that the subsistence traditional agricultural production systems have been shifting towards commercial mode of production, especially in vegetable crops. Despite unavailability of local resources for pest management and lack of time due to involvement in other off-farm activities for income generation, the motivation level of farming communities is very high. The cropping pattern has been changed and the demand of inputs for production has increased at the farm level. The finding also shows a significant shift from traditional chemical based agricultural production systems to more ecological based sustainable agricultural system. This assessment indicates FFS being an effective tool in increasing IPM knowledge, and IPM knowledge is the most important variable in explaining the adoption of IPM strategies. These findings also provide a confirmation of the adoption decision making process and also a validation of FFS as an effective mechanism for increasing both knowledge of IPM and the adoption of IPM strategies.

5. Recommendations

Based on the findings of this study and conclusions drawn following recommendations have been made for the further conduction of farmer field school for IPM in order to achieve the expected goal and outputs and help improve overall livelihoods of the farming communities.

- Growing of healthy crops should be the principle of all kind of FFS. IPM focuses on factors mainly related to pests and pesticide management. A more holistic approach of overall crop, soil, pest and ecosystem management will be more appreciable to farmers. Integrated crop management needs to be the common goal of all FFS.
- Presence of an IPM club, IPM farmers' group etc. in the community could be an important factor in the sustainability of IPM Practices. These groups provide a forum for farmers to discuss new problems of the farm, interpret new events as they occur and carry out studies or other activities to address issues of local importance. Equally crucial is the sense of community and shared experience that comes with club membership. Thus formation of such farmers' group should be encouraged.

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