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Research Article

Survey of Integrated Pest Management (IPM) Practice in Vegetable Crops of Rupandehi District, Western Nepal

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Abstract

In the present study, documentation of farmer's knowledge on Integrated Pest Management (IPM) was carried out in Rupandehi district during the year 2016. The objective of this paper is to assess the knowledge of farmers about IPM and its effectiveness in this district. It was carried out by conducting semi-structured interview with the participants of IPM FFS, vegetable growing farmers, stakeholders and local people with the help of standard questionnaire, Focus Group Discussion (FGD) and key informant interview. The IPM program is found to be conducted by an international non-government organization viz. Food and Agriculture Organization (FAO) and government organizations viz. Plant Protection Directorate (PPD), Agronomy Development Directorate (ADD) and District Agriculture Development Organization (DADO) through Farmer's Field School (FFS) in this district. In total forty IPM FFS was conducted from 1998 to 2015 which provided training about IPM in rice and vegetable crops to 1057 farmers in which 393 were male and 664 female. Although a significant difference has been found in the knowledge about the amount of pesticide used, biological method of pest control for IPM by FFS participant and nonparticipant farmers, it is not observed in their behavior during the cultivation of crops in the farm. The result showed that only 5% of participants of Farmer's Field School (FFS) are following IPM practices in their own farm after taking training.

Keywords: Integrated Pest Management; Farmer's Field School; Pocket area; Botanical pesticides; Rupandehi.

Introduction

Pests and diseases are the rising problems in the agricultural commodity in the world. Use of pesticides against these problems has been leaving an adverse effect on human health and whole ecosystem, pest outbreak, their resurgence and uprising as well. With the overwhelmingly increased awareness of the growers, consumers, traders and scientific communities in developed and developing countries as well on non-chemical agriculture, enormous number of efforts have been made to look alternatives to the chemical pesticides in recent days through either judiciary use of chemicals or through the use of bio-products. It has been estimated that annual loss due to pests before and after harvest is about 35-40% (PPD, 2003).Integrated Pest Management (IPM) as one of the tools has come up in recent years in reducing damages caused by pests without harming the environment. It also means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourages the development of pest populations and keeps pesticides and other interventions to levels that are economically justified. IPM practices also help in reducing or minimizing the risks to human health and the environment where we live. The UN's FAO (2010) describes IPM as a tool, which emphasizes on the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. (IDE Nepal, 2013).

IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a

combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines and treatments are made with the goal of removing only the target organism. Pest control materials are selected, applied in a manner that minimizes risks to human health, beneficial and nontarget organisms and the environment.The most effective, long-term way to manage pests is by using a combination of methods that work better together than separately. These are: Biological, Cultural, Mechanical and Physical and Chemical control.

Government of Nepal has adopted the IPM Program as national plant protection strategy. IPM program is implemented on crop based Farmers Field School (FFS) approach. Different curriculums on cereals, vegetables and fruit crops are developed. Crop linked farmers' field school and follow-up program are adopted under the IPM program. Human resource development, farmers resource centre, model IPM village, IPM product market outlet are the major activities performed by National IPM program. Human resource development at different levels, training curriculum development, guidelines and norms preparation are made at central level and program is implemented at local level.

In 1990, Nepal Government accepted IPM as a part of plant protection program but due to the lack of trained manpower and budget, IPM program was not lunched in the farm level till 1998. The Integrated Pest Management (IPM) approach in Nepal was initiated in Nepal since 1997 within the Community IPM support Program. During this stage, the program was financially supported through FAO and was also operated in support of FAO and Plant Protection Division. Over the time, this program has been run by Plant Protection Directorate (PPD) and been executed by the Ministry of Agriculture and Co-operatives, Nepal. The financial support from first phase (2003-2007) and for second phase (2008-2013) has been received through Norwegian Government. PPD has been the coordinating role for its operation, where FAO-Nepal has been remaining in the backstopping part in some of the selected intensive IPM Districts (PPD, 2017).

The National Integrated Pest Management Program in Nepal has been designed to support reduction of poverty, ensure food security and environment protection in a sustainable way. Its strategy is to implement and gradually up-scale participatory IPM using the Farmers Field School (FFS) approach as a national program covering seventy five districts of Nepal in integrated agricultural development with primary focus on rural poor where IPM will increase economic benefits, concomitant development of farmer empowerment and better marketing of safer commodities. The more intensification and institutionalization programmeswere conducted in 12 Districts: 5 in Terai (Jhapa, Bara, Kapilvastu, Banke, Kailali), 5 in Mid Hills (Ilam, Kavre, Syangja, Surkhet, Dadeldhura) and 2 in High Mountains (Mustang, Jumla).

IPM helps farmers to raise their crops yield and increases their income by improve returns on investment. In Nepal program carried out by FAO for Community IPM in Asia, the GCP/RAS/172/NOR has shown that IPM trained farmers increase their rice yield by about 15to 25 % and reduce the use of pesticides by about 40 % (Upadhyay,2002)

Although, a few literatures are available about IPM in Nepal (Adhikari, 2002; Upadhyaya, 2002; Tiwari, 2012; Kafle *et al*., 2014; Bhattarai and GC, 2015; Neupane, 2003; Joshi, 2001) but some more study is required for detailed knowledge. This paper aims to access the knowledge of farmers about IPM; to identify the organizations involved in IPM program and to access the effectiveness of this program in Rupandehi district.

Materials and Method

Study Area

The study area Rupandehi District (latitudes: $27^{O}20'$ N to $28^{O}47'$ 25" N, longitudes: $83^{O}12'$ 16" E to $83^{O}38'16"$ E), lies in Lumbini Zone, Western Development Region of Nepal. It borders India in South, and Palpa, Nawalparasi and Kapilvastu in the North, East and West respectively. The altitude ranges from 100 m to 1229 m above sea level (DDC, 2071). The district covers an area of 1,360 sq. km. The district is divided into fifty two village development committees (VDCs), five municipalities and one sub-metropolitan city. Geographically, it is divided into Chure region (14.5%); Bhabar region (0.6%) and Terai region (84.9%). Tilottama municipality (few wards), Siktahan, Suryapura and Dayanagar VDCs of Rupandehi district were selected for this study (Fig. 1).

The district has tropical and subtropical climate with maximum temperature about 43.7ºC during summer (May-June) and about 8.75ºC during winter (December- January) and annual rainfall is about 1808 mm. Temperature in Bhairahawa fluctuates from 7.10°C (in January) to 40.20°C (in May) based on DHM temperature records for Rupandehi for the past 30 years. Precipitation in the district is predominantly led by monsoon in Nepal. DHM records shows the lowest of 1081.6mm in 2005-2006 and a maximum of 2797.4mm in 1998. Precipitation data for the past 15 years show increasing annual rainfall variability. Pre-monsoon precipitation of 274.15mm on an average is received in June and the maximum rainfall received for the observed period is 1034.5mm. Similarly, post monsoon month September is comparatively wet month that receives an average of 283.56mm rainfall.

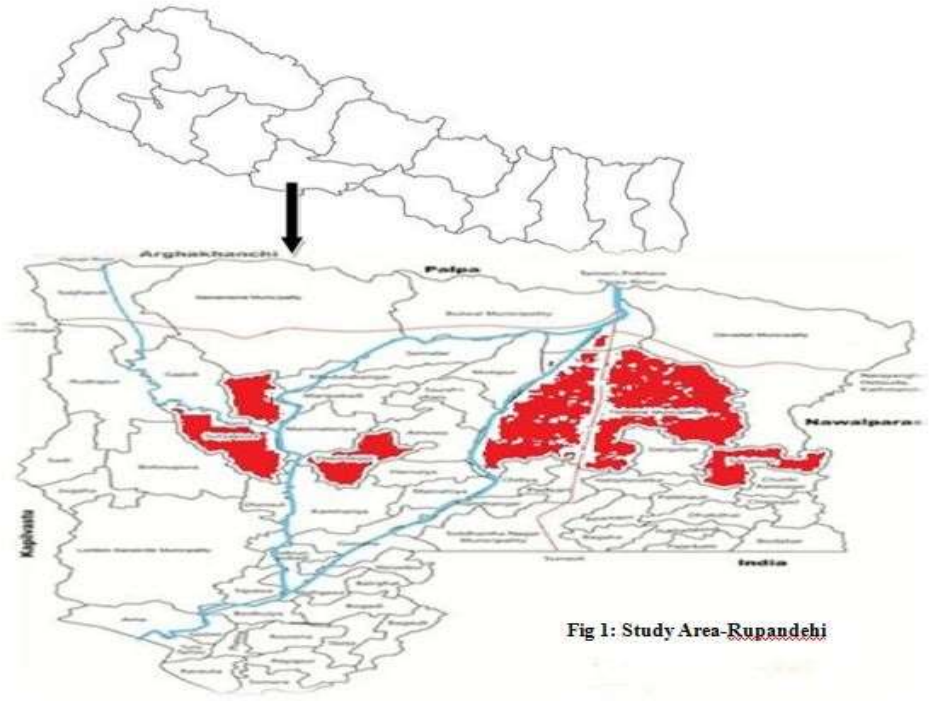

Fig 1: Study Area-Rupandehi

Major rivers of Rupandehi districts are Tinau, Rohini, Danav, Kothi, Mahav, Baghela, Danda, Ghagara, Koyilijhang. The rivers flow through 52 VDCs providing access to some forms of irrigation to the farmers while also putting them at the risk of flooding.

Rupandehi is agriculturally important south western district of Nepal. More than half of the land in the district (58.45 per cent or 82,622ha) is under cultivation and 70 per cent (98,956) of population are engaged in agriculture (Census, 2013). Due to diverse geography of the district, it provides a basis for diverse agriculture in the district. It is a food surplus district with about 57 per cent of cereals produced available for export (District Report, 2011/12). While about half of the vegetables, pulses, and oilseeds consumed are produced within the district, unmet increasing demands for the commodities are addressed through imports, mostly from India.

Major cereal crops produced in the district are paddy, wheat, corn, and finger millet; pulses are kidney bean, black gram, and soybean; and oilseed crops are mustard, sunflower, and peanuts. Among horticultural crops, the major fruits are mango, banana, litchi, jackfruit, and guava and the major vegetables are onion, potatoes, cabbage, cauliflower, tomatoes, radish, cucumber, ole, bottle gourds, and pumpkin. In addition to that, some spices and condiments are grown in the district such as turmeric, chili, and garlic.

Data Collection

The present research includes field surveys, field observation, formal interviews, key informant interview and focus group discussion. Before visiting the field, the potentially rich area for vegetable cultivation in the area, were identified from secondary data or literature review. The primary data were collected in one municipality (ie. Tilottama) and three Village Development Committees (ie. Siktahan, Dayanagar and Suryapura) of Rupandehi district during May to December, 2016.

Pocket areas (ie. Siktahan and Suryapura VDCs) for growing seasonal or off-season vegetables on commercial scales as well as non pocket areas (ie. Tilottama municipality and Dayanagar VDC) were selected for the study. A standard questionnaire was prepared for the collection of primary data on the farmer's knowledge of Integrated Pest Management (IPM), organizations involved and its usefulness as well as effectiveness of this program. Then semi-structured interview was conducted with the participants of IPM FFS, vegetable cultivated farmers, local people, stakeholders, pesticide retailers and other elderly people to collect information. Focus Group Discussion (FGD) was conducted with the vegetable cultivated farmers, especially in IPM program implemented areas. Participatory Rural Appraisal (PRA) method was also applied for the collection of information on IPM.

Secondary information related to this study were obtained from several published as well as unpublished journals, research reports, records, documents, articles and websites related to IPM programs.

Result and Discussion

It is found that there are four organizations which conducted Integrated Pest Management (IPM) Programs in different parts of Rupandehi district from 1998 to 2015. Among them Food and Agriculture Organization (FAO) is an international non-government organization, other three are national government organizations. It shows that most of

the programs (70%) were conducted by FAO. Altogether 40 programs of IPM FFS were implemented in summer paddy, winter paddy and vegetable crops by these organizations in this district. After lunching three projects supported by FAO, Norway, Nepal Government and other agencies from 1998 to 2014, over one hundred thousands of farmers have been graduated from FFS and 2700 trainers are actively facilitating IPM process across the nation (Kafle *et al.*, 2014). In recent year no one IPM FFS program has been conducted by any international organization in Rupandehi district but a few programmes are conducted in the study area by DADO, Rupandehi.

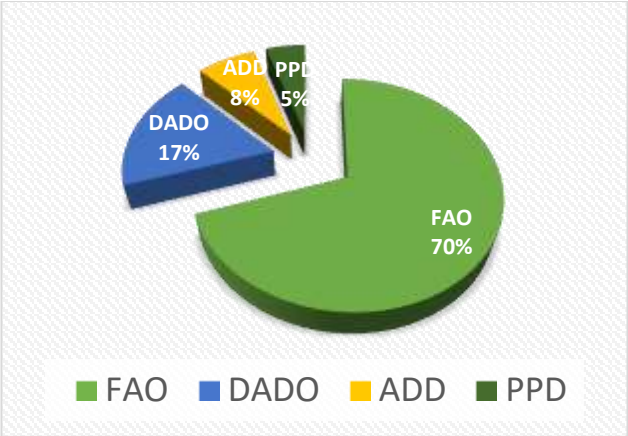

Fig 2: Involvement of Institutions in IPM [PPD-Plant Protection Directorate; ADD- Agronomy Develovment Directorate; DADO- District Agriculture Development Organization; FAO- Food & Agriculture Organization]

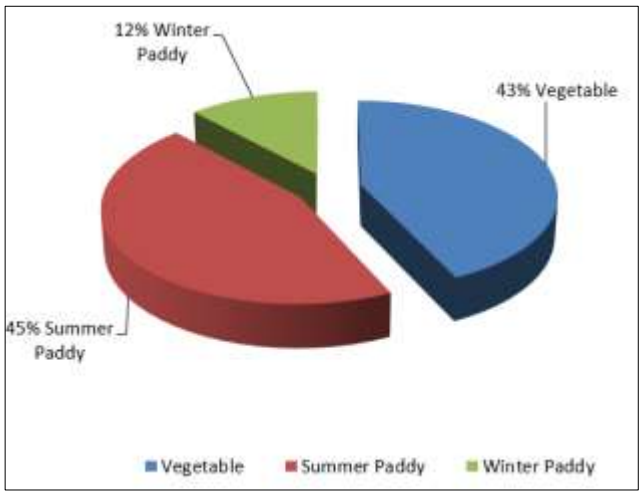

Fig 3: IPM Applied Crops

Though these Government and non-government organizations conducted IPM FFS programs in different parts of Rupandehi district, most of the vegetable growing farmers, other farmers and local people don't have good knowledge of IPM technology on crop plants and useful effects of IPM practice on human health and environment. In total 1057, male 393 and female 664, were participated in this program. The number of female participant was more than male. The principle of IPM emphasized in the FFS are; 1. Grow healthy crop, 2.Visit field regularly, 3.Identify and conserve natural enemies and 4.During this process farmers become experts in their field management. Facilitating farmers to understand biological control through field investigation are the key to successful implementation of Integrated Pest Management (Upadhyaya, 2002).

It has been found that the number of female participant (63%) is more than the male (37%) but they did not give more time in the field due their busywork in household task. From the discussion with participants it was also found that most of the females were illiterate, so they could not identify applied methods; types of useful and harmful pests; preparation of organic fertilizers; usefulness of biopesticides and botanical pesticides etc in the study area. The basic objective of organizing FFS is to make the farmers self decision maker about their own field on crop cultivation and IPM activities. It is a season long activity which is confined in 14 weekly sittings in form of FFS in a village where the program is to be conducted. The villages /area with more use of pesticides and having a pest history is generally selected for organizing FFS. Altogether 40 IPM Farmer's Field Schools were conducted in this district from 1998 to 2015. The farmer's field school is a model of a non-formal education process of learning by experiments and discovery and has proven to be very effective. This approach emphasized the need for farmers participating in the farmer field school to understand the crop ecosystem.

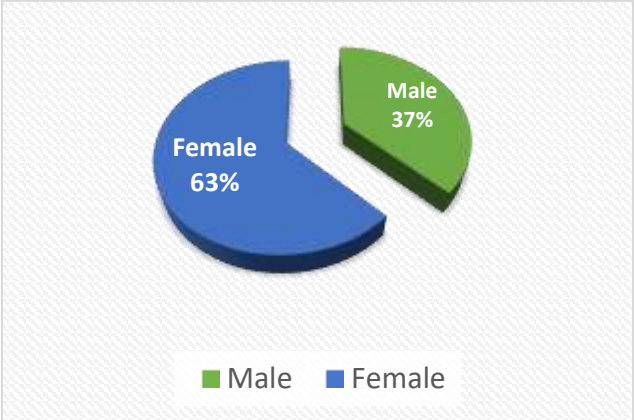

Fig 4: Participants in IPM Program

It is found that only 5% participants of Farmer's Field School (FFS) are following IPM practices in their own farm after taking training. Other 95% farmers are not following the IPM practice in their field. It shows a very little effect of IPM FFS on farmer's behavior towards biological control of pest. At the discussion with farmers, it is found that the number of participants in Farmer's Field School (FFS) used to decrease up to the end of the program due to the lack of incentives given to farmers. They take part in program if they are benefitted in monetary basis. It shows no keen interest of farmers to control pests in crops without using chemical pesticides, which is environmentally sound. They feel nuisance to prepare botanical pesticides at home by mixing solution of *Artemisia indica*, *Nicotiana tabaccum*,

Azadirachta indica, *Zanthoxylem armatum*, *Acorus calamus*, urine of cow etc. It takes more time to prepare botanical pesticide as well as sometimes it is difficult to find its ingredients at local area. Rather they can get chemical pesticides easily from Agrovets/Agrocenters. IPM materials like trapping nets for butterfly capture etc are also not easily available in the market. There is a problem of timely and adequate supply of quality inputs, including biocontrol agents and biopesticides.

At the discussion with farmers, it is found that they did not get appropriate price in market for vegetable which was grown without using chemical pesticides. It needs more effort and care to cultivate such vegetables in the field. Moreover customers did not rely on such vegetable. They try to buy cheaper vegetable. In IPM-FFS, farmers are taught to identify natural enemies of pest and conserve them but it needs a long practice of identification with the help of experts. According to farmers they don't have enough time to observe the pests and their enemy in the farm and it is not possible in the farm with a large scale of cultivation. Most of the farmers did not know the harmful and beneficial insects. Farmers did not follow the practice of crop rotation in their farm. Crop rotation, fallowing, manipulation of planting and harvesting dates, manipulation of plant and row spacing, and destruction of old crop debris are a few examples of cultural method of pest control that are used to manage the pests.

It was found that there was no change in adoption of some practices like variety selection, weeding, use of organic manure, management of irrigation and planting date management before and after participation in IPM FFS. The frequency of farmers adopting the practices like selection of resistant variety, soil treatment, cutting the plant at the time of harvest, use of light trap, use of botanical pesticide, removal of infected plants, use of well decomposed manure, use of balanced fertilizer, application of fertilizer in split dose, pest monitoring, keeping the bund clean, management of appropriate distance, seed treatment, summer ploughing was not found to be increased.

Conclusion

Although a significant difference has been found in the knowledge about the amount of pesticide used and biological method of pest control for IPM by FFS participant and nonparticipant farmers, it is not observed in their behavior during the cultivation of crops in the farm. The FFS has been an effective tool to increase IPM knowledge and techniques of ecological pest management among the farmers. The IPM-FFS program was conducted by FAO, PPD, ADD and DADO in Rupandehi district. Vegetable growing farmers, local people, pesticide retailers and stakeholders are not aware of harmful effect of pesticides in human health and environment. Though some efforts was done by Government of Nepal (GoN) and Non Government Organizations (NGOs) to control heavy use of pesticides in vegetable crops through Integrated Pest Management (IPM) programmes, it has become ineffective in this district due to very less participation of farmers and lack of regular monitoring system. Farmers are misapplying pesticides by disregarding the potential harmful effects of pesticides on human health and the environment.

The Government of Nepal is implementing a long term Agriculture Perspective Plan (APP) to address the problem of widespread rural poverty and to increase growth rate in agriculture. The introduction of suitable environment friendly technologies and management practices to intensify and increase production is a part of APP's strategy. Therefore, the APP has identified "Integrated Pest Management" (IPM) as the specific strategy of plant protection.The IPM through FFS approach has not only been a means to sustainable management of pests thereby ensuring sustainable yield of crops but also the IPM based crop management has positive effect on food security, income, empowerment of farmers and minimize pesticide residue to the ecosystem. But this program could not gain its achievement all over the country so, now, it has been stopped in the country.

Although, IPM has been accepted as the most attractive tool for protection of crops from the destruction of pests, implementation at the farmer level has been limited. A successful IPM program needs time, money, patience, short- and long term planning, flexibility and commitment. The research managers must spend time on self-education and making contacts with extension and research personnel to discuss farming operations, which vary widely. This would help in developing integrated plans. The government should create policy environment for the development of IPM program. The Governments must take lead in changing the pest control strategy through measures that would make chemical control less attractive through legislation, regulatory and fiscal measures.

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