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Review Paper

Participatory Integrated Pest Management (PIPM) Approach: An Overview

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Abstract

The combined use of chemical and biological measures, use of tactical mixture of many measures and use of pesticide only when it is inevitable were the major components of Integrated Pest Management (IPM) technologies of different time periods. All these concepts of IPM have been derailed from its core theme and was unable to reduce the pesticide use. Therefore, a new approach known as Participatory Integrated Pest Management (PIPM) consists of new principle of IPM with several novel extension approaches of farmer empowerment and education has been emerged. The objectives of this study is to update available information on various aspects of Participatory Integrated Pest Management (PIPM) strategy against major pests and diseases of different crops by reviewing the available materials. The study was conducted with data and information collected from several journals, proceedings and books. The new concept of IPM was derived from the natural agro-ecosystem of ancient time in which the pest population and the population of their natural enemies were naturally adjusted by ecosystem. The notion of PIMP was to enhance the knowledge of farmers on underlying ecological principles of their crop fields through non-formal education. The approach is popularly known as IPM farmers' field school, which provides practical knowledge to farmers on ecosystem of their crop field and focuses on empowerment of the farmers for their multi-dimensional development. PIPM conduct farmers lead practical sessions, which include planning, training and education on field ecosystem analysis, special topics on agriculture production, practical observation of interaction of pest and predators in insect zoo, group dynamic activities and self-evaluation of the experience and outcomes of FFS. The previous approach of IPM was heavily centralized and followed the top down approach. The approach was research driven instead of farmers driven, so farmers couldn't feel affection on the IPM technology generated on research station and brought directly to their field. In addition, the technology developed in a specific environment of research station was not compatible to diverse agro-ecosystem of their field and was inappropriate for varied socio-economic condition of farmers. The experience of FFS conducted so far in several countries of Asia indicates the sustainable nature of this approach; however, several factors such as institutional, socio-economical, technical and educational factor influence on the sustainability of the approach. The extent of influence of these factors may differ among countries and communities. Many of these factors could be manage in few countries, where as it is difficult to cope up with these factors in the other countries. The weak linkages among the various institution and lack of experts in under developed countries hinder the adoption of PIMP. The higher percentage of marginal farmers for whom agriculture is the only source of livelihood is the limitation as well as a prospect for extension of the PIPM approach in countries like Nepal. PIPM is a unique and appropriate approach of pest management which has been tested and adopted by several countries of Asia. PIMP could reduce the injudicious use of pesticides in agriculture sectors, if precise and sincere attempts of researchers, extension staffs, government and other stake holders are readily and constantly available.

Keywords: Ecosystem, farmers field school, IPM, participatory, pesticides.

Introduction

Integrated Pest management approach was emerged after the adverse effect of injudicious use of pesticides had upshot as pesticide resistance and resurgence of pests along with havoc to environment and natural eco-system. Introduction of chemical pesticides after World War II leads to unrestricted use of pesticides in the crops because the goal was eradication of pests from the field. Several reports on resurgence of pest outbreaks and resistance to chemical pesticides due to unlimited use of the chemicals were reported from several parts of the world by early 1950[1]. Because of these consequences, few scientists proposed a new approach of pest management that was based on integration of chemical and biological control methods as a technique of pest management to suppress the pesticide induced pest outbreak[2]. The new concept was popularly known as Integrated Pest Management (IPM) approach. Gradually, the IPM concept was focused on minimum use of chemical pesticides along with inclusion of biological and other control measures in pests management[3]. Consequently, several packages of IPM have been developed to manage the insect-pests in different agricultural crops[4-6].

Several definitions of IPM have been propounded during those periods; however, most of them remained very much at academic levels. Some definitions were derailed from the basic essence of IPM for which it was evolved[7]. For example, the definition given by FAO in 1968 reflects IPM as a pest management strategy that utilizes all suitable techniques to maintain the pest population level below the threshold under the framework of associated environment and population dynamics of pest species[8]. The concept of IPM was failed due to high dependence on use of economic thresholds as a major component of decision-making. The economic threshold levels were imperceptive to both social and economic situations of farmers; besides feeble understanding of farmers on underlying ecological principles of the field.

After experience of few years, the antagonistic effects of combined use of biological and chemical methods were revealed. The mode of actions of chemical pesticides impede the efficacy of biological control agents which ultimately poses problems in integration of chemical measure and biological control measures. However, few scientists suggest for quantification of the ratio of biological and chemical measures focusing that the resurgence is rare and the natural enemies persist in many sprayed ecosystems[9]. However, the evolution of new concepts of IPM with improvement in traditional theme was continued. During 1970s, it was accepted that only ecological aspects is not sufficient for IPM, so economic and social aspects should also be considered. Finally, IPM was revised as integration of several control measures with a wide knowledge of ecological principles.

Beside the evolution of several approaches, basic extension strategy of the IPM program was still based on top down approach. Generally, the researchers produce and extension diffuse technology on farm practices and pest biology, natural enemies, estimation of thresholds and IPM tactics for pest control[10]. The pest management strategy developed directly from research was definitely a shortcut approach; however, it was disparaged for being unable to enrich the necessary knowledge that can upsurge the decision making capacity of farmers on pest management and crop production based on the agro-ecosystem of their field.

IPM based on principle of technical mixture and traditional top down extension approach was failed to achieve the essence and objectives of IPM, so scientists have started to search new concept and strategies of IPM. Ultimately, FAO proposed a new concept known as Participatory Integrated Pest Management (PIPM) in early 1990s, which attempted to address most of the hitches that couldn't address by the prevailing approaches.

Participatory Integrated Pest Management (PIPM): a novel approach

The concept of PIPM was emerged, because the previous concept of IPM has been derailed from its core theme and was unable to reduce the limitless use of pesticides. The concept of Participatory IPM (PIMP) was first introduced by FAO in 1990. Realizing the problem of pesticide resistance and resurgence of pests in the field due to heavy use of pesticides along with other control measures, the FAO implemented IPM program for Asia with new principle and approach[11]. PIPM program was based on the principle of exploitation of ecology of pests and natural enemies and follows a participatory non-formal education approach to empower and educate the farmers about prevailing agro-ecosystem of their crop fields. Gradually, the approach popularly known as the IPM Farmers Field School[11]. The Participatory IPM featured several new departures from earlier principle and extension approach of IPM.

The major paradigm shift in traditional IPM was the change in principle of IPM. The principle was changed from the use of tactical mixtures of several control measures to understanding of ecosystem and exploitation of natural enemies prevails in the farmer's field[12]. PIPM attempts to make farmers as an expert in knowledge of agro-ecosystem of their farm and its appropriate application as and when needed. The farmers are provided an in-depth knowledge of natural enemies of their crops and their interaction with crop pests which significantly help in conservation of natural enemies and in enhancement of biodiversity of their agricultural fields for arigorous ecological balance[13].

Similarly, the extension method was changed from traditional top-down approach to farmers driven field based participatory training and learning program. Its theme is based on bottom up characters and contains a holistic approach. It combines agro-ecological elements with technical components along with socio-economic aspects[8]. The exclusivity of Farmer Field School (FFS) is the philosophy of farmer empowerment through a unique educating and learning method. The method includes season long practical training for farmers where they are not regarded as attendant of training session, but empowered as robust human resources capable of exploiting the agro-ecosystem of their field and can take appropriate decisions by themselves based on understanding of crop agronomy, major pests and natural enemies[14]. The other features of FFS include a distinctive method for agro-ecosystem analysis, special topics on plant biology and agronomy, practical observation of pest and natural enemies' interaction in insect zoo, group dynamic activities and self-evaluation.

The Farmers Field School includes practical learning by using the crop field as a field laboratory[15]. The ecology of various crops was thoroughly learned by participants of FFS through regular observation of their field. This non formal participatory learning program is led by farmers with support of extension officials and researchers. PIMP brings researchers, extension staffs and farmers in one platform where they can interact with each other about several aspects of their crops. The training approach is itself a 'learner-centered' discovery process[16].

Farmers generally conduct practical works in a team of five members. The practical works consist of regular observation of field conditions, taking notes of the activities, regular sampling of plants, collection of the insects and gathering of live specimens[17]. Insect zoo is a good example of practical works of PIPM; where farmers study the interaction between natural enemies and a number of targeted pests. The insect zoo studies help to increase the participant's understanding about the interaction among various pests and their natural enemies prevails in the crop field agro ecosystem[18].

One of the important activities of PIPM is the group dynamic exercises which help to enhance critical thinking and analytic ability of the participant farmers. The activity boosts decision making and action executing capacities of pathetic farmers based on visible discussion on various ideas without any domination of commanding individuals. Discussions are based upon participant's analysis of field conditions. The analytical session is completed after the group leaders of each group of the particular session present their group's reports among the other members of the Farmers field school. The spectators' farmers raise queries and questions on the presentation, while the presenter and their group clears the queries raised by the audience farmers of the FFS. The future strategies of field experiments and management activities are based on outputs of the discussion[18].

Principles of FFS for IPM

The approach of FFS is generally based on four major principles, which reveals the increased capability of farmers due to participation in an FFS[18]. The following four principles form the working definition of PIPM.: i. Conservation and use of natural enemies: It implies that participants will obtain detail understanding of agro-ecosystem of their field. It increases their knowledge of pest population dynamics and crop field ecology. ii. Regular field observations: Participant farmers must acquire the habit of regular observation of their field, critical analysis of the latest situation and efficient execution of a suitable action based on the agro-ecological conditions of their fields. iii. Farmers become IPM experts: Because of diversities between field, the judgements of farmers for their fields are better and more relevant than the general ruling of any agriculture specialists. iv. Growing of a healthy crop: The capacities of FFS participants on good agronomic practices, agro ecosystem and plant biology are boosted significantly. The boosted capacities help the farmers to protect their crops from devastating disease and pest infestations which ultimately increases the productivity of their crops.

Scaling up of IPM Farmer Field School

The IPM Farmer Field School was introduced as a unique tactic of participatory integrated pest management strategy initially in selected countries of Asia, Africa and Latin America. Gradually, the farmer field school has been implemented in more than 20 countries. The major countries were Indonesia, Vietnam, Thailand, China, Malaysia, India and Nepal etc. The IPM school approach was very successful in few countries like Malaysia, China, Vietnam and Indonesia etc. In addition, the PIMP has been practiced in over 5000 communities in a large number of countries of Asia, Latin America and Africa [8].The IPM farmer field school approach has been widely used in several crops such as paddy, small grains, grain legumes, cotton, cabbage, coconut, tea, coffee and vegetables etc[18].

Scope of Participatory IPM

The pressures for the reduction of injudicious pesticide use in agricultural sectors to protect the natural agro ecosystem and environment have been arisen very rapidly since last few decades. As a result, IPM approach was emerged and adopted in many countries during 1970s and 80s; however, the concept couldn't sustain for long time and had failed to achieve its objectives. The participatory IPM concept was emerged because of deviation of IPM from its basic principle and heavily centralized and traditional top down extension approach used by agricultural projects conducted during green revolution[8].

The deviated principle of IPM failed to meet the objective of IPM. IPM was considered as measures which integrate more than one pest management methods. This concept enhances development of simple integrated techniques in research stations for the management of pests in farmer's field. Guided by these techniques, plant protection experts had advocated the increased use of pesticides as an effective method of pest management. Ultimately, these approaches derailed the basic instinct of IPM and increase development of pesticide resistance and resurgence of pests[11]. For example; The insecticide induced outbreak was occurred in rice fields of west java (Indonesia) where application of insecticides to control stem borers, not only increased stem borer pressure, but also increased BPH densities in fields where insecticides were not used[16].

The traditional IPM was research driven instead of empowerment of farmers to establish them in the core of IPM activities. Farmers couldn't feel affection and couldn't rely on the IPM technology that consists of a package of technology developed by researcher in confined environment of their stations[8]. In many instances, the basic biology of pests, beneficial organisms and their interaction in diverse agricultural ecosystems is ignored by the researchers. The consolidated approach was failed to justify the worth of enormous diversity of agro-ecology that prevails in the farmers' field. The technologies developed in the station are not compatible for different ecological and socio-economic conditions of farmers[18].

One of the factors of requirement of PIMP was the prevailed policies of government regarding the use of pesticides. The considerable increases of yield just after the green revolution mislead the government policy.

The package of technology developed to increase the yield had involved pesticides as a foremost constituent of pest management tactic. As a result, the government made those policies which pushed up chemical control as a mainstream approach to crop protection. The severe outbreaks of many pests in Thailand, Vietnam, Cambodia and Malaysia are due to the pesticides based crop protection policies which heavily promoted the injudicious use of pesticides and ultimately pest resurgence[19].

The new extension approach followed in PIMP was able to convince the farmers to understood basic concept of IPM in several ways. The response of farmers to the novel IPM FFS tactic was fervent in all the areas, wherever they have been organized[20]. Several farmers were largely motivated to IPM FFS because of the extensive use of ecological principles in crop production and management which has become a very low cost technology as compare to pesticide use. The selection of subject matters, planning of experiment and execution in the field by farmers themselves have been the other major attractions which significantly enhanced the rapid adoption of the approach among the farmers. Group interactions, discussions and debates which have been an integral part of each session of FFS were the other major eye-catching activities of the PIPM tactic. Because of the heavy assurance of the farmers on PIPM tactics, they had initiated a new concept of "Farmer to Farmer" FFS, in which few experienced participant farmers of regular farmer field school have conducted special session of FFS for other interested farmers of their locality[21].

Robust elements of PIPM for its sustainability

Wide scale adoption and sustainability of new agricultural technologies is a tenacious problem for most of the underdeveloped countries. The sustainability of new agricultural technology depends on efficiency and practicability of technology, extension approach and continuous follow-up, socio-economic conditions and farmers' empowerment, belief and affection to new concepts.

The exploitation of natural enemies in pest management is the key feature which supports wider adoption and sustainability of PIPM technology. The exploitation of natural enemies in pest management strategy is a cheaper, humbler and sustainable method of pest management for farmers. The presence of more than 100 natural enemies in a specified agro-ecosystem for each pest indicates the practicality of this principle. The natural enemy ones introduced in an area can suppress the targeted pest populations for several years with little or no input from farmers[22]. The stable and constant interactions between natural enemy and host decides the effectiveness of biological control measures [23], therefore a thorough understanding of ecological and biological characteristic of bio-control agent is an indispensable requirement of PIPM [24]. The association and interaction of targeted host and its natural enemies is one of the most crucial ecological events of every agricultural land[25,26].

The success of PIPM in tropical irrigated rice with robust use of applied ecological activities confirmed the decisive role of natural enemies in pest management. Several experiments and activities have already proved that a successful IPM mainly depends on exhaustive knowledge and skill of the ecology, structure and dynamics of agro-ecosystem of the targeted locations. The economic threshold level was replaced by Agro Ecological System Analysis (AESY) and priority was given in implementation of faultless ecological and allied behavioral tactics which is complemented with the natural situations of the field[17].

The new approach of technology extension by empowering the farmers is the crucial factor of sustainability of PIPM. IPM Farmers Field Schools empowered the farmers by enhancing their knowledge and skills to cope up and overcome the harsh conditions which they face regularly in their crop fields. The strategy of Farmer Field Schools is solely based on farmers' empowerment, because they have to handle several competing forces associated with relevant technology, markets and society. The PIPM has helped farmers to shift from the margin towards the core of community to withstand strongly against the technical, political, market and social forces[18].

Farmer's recognition as owner of the program rather as obeyed follower is also a major factor of PIPM sustainability. Farmers are taken as a focal point of PIPM program. In PIPM, the entire schedule is developed and run by farmers and they become a master about the various aspects of IPM techniques and socio-economic status[16]. In contrast, the highly centralized production oriented old extension approach discouraged the farmers from decisions making regarding their livelihoods and agricultural activities. In addition, the enriched ability of farmers to apply ecological principles, to follow innovative approaches which help them to apprehend, improve and extend various indigenous skills for better management of their crops ultimately enhance the sustainability of PIPM[8].

The acquired critical thinking skills, leadership skills encourage the farmers to prolong the PIPM program. Almost all participants have sequentially get a chance from different activities of FFS to augment their skills of critical analysis of every event related to their agricultural activities. The analytical skills of the participant farmers are boosted mainly through rigorous group presentations and discussions which are regularly followed in the activities of FFS. The FFS approach fosters the farmers' ability of critical analysis about government policies on agriculture, popular and latest agricultural technologies, market situations of major crops and diverse agro-ecosystems of their field[20].

The robust organization of FFS alumnae is one of the major factors of sustainability of PIPM. Because of empowerment gained during the session of PIPM, the alumnae organize themselves after the termination of FFS[18].

In traditional approaches, the field activities have been conducted through specified organizers who structured various agricultural activities by involving farmers to achieve their targeted annual programs. In contrast; the alumni of FFS structured various field activities by themselves based on the need and requirements of their own farmers group. The alumnae have worked on several aspects of farmers' right around the world. For example; they investigate the quality of fertilizer available in the market to identify the fake materials; they urge the political leaders with dignity about their rights; raise sounds against the inefficient execution of extension system and improve the agricultural strategy of government which are unfavorable for successful implementation of IPM. Similarly; Chinese women farmers who have been an alumnae of successful farmer field school organize several FFS for other women farmers of their locality to advance their farming skills[18].

Government new policy to limit the pesticide use and augment the use of PIPM plays a vital role in sustainability of PIPM. Inclusion of PIMP program in regular program of government enhances sustainability. For example; IPM program started with donor funding in 1980 is now gradually followed by funding from national or local government budgets in various countries[8]. The shift from grant funding to national funding and loans are important indicators of sustainability.

The systematic channels of marketing and aware consumers are the other major influencing factors of PIPM sustainability. The increased demand of product from pesticide less field encourages the farmers to follow the PIPM. The awareness of consumers about the IPM products must be increased to rapidly boost the demand of IPM products. The farmers who have been using advanced IPM technology in their agricultural activities should highlight their products as 'IPM-produce' for higher demand and tranquil transaction. Besides, the IPM produces must fetch good market prices to encourage the farmers; the government should purchase and export the produce in favor of farmers.

Follow-up programs and community IPM have vital role in the sustainability of PIPM. The sustainability of PIPM can achieve through the inclusion of the activities in the regular planning process of the local government. The farmers should have direct approach and influence on the planning and implementation process of their IPM program. One of the methods is the Farmers to Farmers field schools which involved skilled farmer-facilitators who trained and shared their updated skills and experience with the other farmers of their community[13]. The farmer field school conducted by farmers harmonized the traditional FFS conducted by government facilitators by establishing proprietorship among participant farmers which ultimately contributes in the sustainability of IPM. One of the major factors of rapid expansion of IPM in India, China, Pakistan, Vietnam and Bangladesh is the learning system that follows a Farmer-to-Farmer approach.

Prosperity for farmers

Farmers have been benefited in several ways by PIPM approach. The use of pesticides reduced significantly in regions where the PIPM was successfully executed[27]. Effective biological controls are safe, permanent and very cost effective, so it is very beneficial in long run[22]. FFS contributes on poverty alleviation, rural development and women's status. FFS enhance the decision making capability of farmers based on the real situation of their field for excellent management of their crops. Similarly, the FFS improve the social competence of the farmers for better discussion and argument on burning issues in public forums[18].PIPM enables farmers to adopt group approach by enhancing collaborative and collective decision making process, to improve business skills and to develop local organizations. PIPM empowers rural community to overcome the diverse situation of their fields and surroundings proficiently without depending on external services. For example; Several IPM alumni of different countries have managed their cotton fields expertly than before. They also managed the other crops more efficiently by applying newly-acquired skills in regular activities of their farm[13].

Farmers involved in PIPM have been amplified in social, economic, leadership and technological sectors. The well proven reduction of pesticides uses, increased use of quality seed, fertilizer and irrigation, stable or even increased yield in part of farmers involved in FFS indicate the considerable benefit from the program[18]. Farmers who have been involved in FFS activities are keen to share their knowledge and skills of advanced agricultural technologies with other farmers. The FFS have also reinforced in emergence of potential leaders at local as well as regional levels from IPM alumni. The groups of farmers involved in FFS have been reflected as valuable resources of their communities. FFS improves the conditions of poor farmers by enhancing the income-generating capacity, food security, family health and environmental conservation quality. The focus of FFS on rigorous analysis of the diverse situations and happenings ensued in the field gradually enhance farmers' abilities of through inspection of their surroundings before taking any decisions and actions to improve the prevailed situations[11].

Farmers involved in PIPM are not benefited only through the development and use of new technology in agriculture but also they get benefited by conducting several other activities. One of the active FFS groups had started a dairy farm in Bangladesh to improve the economic conditions of the participant farmers. Similarly, another group (Cotton IPM)from the same country had provided short term credits to the members of FFS for regular household expenses so that the farmers can store their cotton till they get the maximum price from the market. In addition, mass-wedding arranged for deprived villagers in India; literacy classes and vegetable seed production training organized by women alumni in Bangladesh are the other few examples of farmers' welfare through PIPM[13].

Small bridges built by communities, sewing training and set up clinics in Pakistan are the other successful examples completed by the participants of FFS.

Participatory IPM in Nepal

Nepal is an underdeveloped agricultural country. Still, more than 65% people depend in agricultural sector for their livelihood and more than 25% of populations are below the poverty level[28]. The average land holding of Nepalese farmers is 0.68 ha. More than 92 % of farmers, who shared about 69% of the land devoted to agriculture, have land holding less than 2 ha. In contrast, only 0.75% of the total holders operated 7.31% of the total area, with average holding size of 7.64 hectares[29].

IPM has been followed in Nepal since very long time knowingly or unknowingly. In traditional farming system of Nepal, various measures were included which reflects the essence of IPM[30]. However, systematic IPM study was started when several pests and predators of vegetables were identified by Nepalese scientist in 1968. The PIPM in the form of farmer field school approach was introduced in Nepal along with other South East and South Asian countries in 1990. After this, few work of IPM on citrus, apple wool aphid and other pests have been carried out[31].

Same as other countries, the use of tactical mixture was a sole concept of IPM in Nepal for several years. IPM has been applied as a mixture of chemical and other control measures following the traditional top down extension approach. Initially, the combination of high yielding varieties, chemical fertilizers and chemical pesticides had definitely help to increase the agricultural productivity of Nepal; however, in the long run it was failed to sustain under Nepalese agricultural system[31].

Afterward, many governmental and non-governmental organizations have been involved in establishment of new approach of PIPM. Sufficient support has been provided by government to enhance IPM FFS by endorsing IPM as a policy of pest management to increase agriculture production[32]. Many IPM schools have been conducted as a core program of district agriculture development offices. Several IPM FFS have been conducted as an IPM approach in various districts of Nepal such as, Kathmandu, Bhaktapur, Dhading, Lalitpur, Bara, and Bardiya. Besides government agencies, several NGOs have been conducting IPM FFS programs in Nepal.

The impact of PIPM was comparatively vigorous than the old approach. The outcome was encouraging and farmers were convinced to reduce the number of pesticide application in the pilot village where the PIPM program was conducted[33]. The use of pesticide was reduced by 95% in Bhaktapur district of Nepal during 1995-96[31]. Farmer field school was very successful in cabbage, cauliflower and other vegetables in Nepal. The school effectively aware vegetable farmers about the menaces of chemical pesticides which ultimately help to decrease the use of chemical pesticides in vegetable production[34].

The increased sale of organically produced vegetables indicates the awareness of Nepalese consumer about IPM produces[31].

Despite few encouraging examples, the achievement of PIPM in Nepal was not as much countable as in other Asian countries. Probable causes behind this might be weaker linkages among various stakeholders, confusion about the actual concept of IPM and lack of study on location specific ecological factors as a base for IPM implementation. Despite the slow pace of adoption of FFS in Nepal, the successful examples of other developing countries indicate a bright future of PIPM among small farmers of Nepal. PIPM has been proved suitable for both large and small scale implementations in developing countries. PIPM was successful among small scale farmers who have been heavily distracted due to elevated and expensive use of pesticides in the cultivation of cotton and rice crops[35,13].

Conclusion

The Participatory Integrated Pest Management (PIPM) was evolved due to the upsetting problems created by over dependence of government sectors and farmers on pesticides for pest management. The approach was advanced as solutions to the problem of pesticide resistance, pest resurgence and environmental degradation due to imprudent use of pesticides.

Exploitation of natural enemies through in-depth knowledge of field agro-ecosystem and farmer's empowerment through practical training session is the main theme of PIPM. Farmer's field school is an approach of PIPM which run practical education session driven by farmers regarding ecology, natural enemies, pest management, crop production and other socio-economic related matters. The PIPM is an economic and practicable approach of pest management in several crops. It has been followed by many countries of Asia; however, potent effort has to be made for its wide adoption in countries of South Asia. The dominancy of marginal farmers for whom agriculture is the only source of livelihood is the constraint as well as an opportunity to extend the PIPM approach in countries like Nepal.

The successful methodology and follow-up activities of FFS conducted so far indicates the sustainable nature of this approach; however, the factors of sustainability vary from countries to countries and also highly depend on socioeconomic and other factors. In conclusion, PIPM is a stout approach which could implement IPM successfully and could reduce the use of pesticides, but it needs rigorous and honest attempts of researchers, extension staffs and other stakeholders.

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