
Integrated pest management farming in Bangladesh: present scenario and future prospect

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Abstract Under the broad policy of sustainable agricultural development, the government of Bangladesh with alliance of Food and Agricultural Organization (FAO) has been trying to implement Integrated Pest Management (IPM) farming since 1981. Based on secondary data, this study first analyzes the present context of IPM farming followed by the developmental perspective of this environment friendly agriculture. The findings reveal that in spite of having continuous efforts from several governments, non-government and international organizations and agencies, adoption and extent of IPM are increasing slowly. Furthermore, the distribution of IPM farmers in various regions is not balanced. Conversely, though desired progress has not been achieved, but profitability of IPM over conventional farming in social, economic and environmental aspect, predict a fair probability to set up IPM farming in the future. In order to improve present scenario as well as to fulfill the prediction regarding promotion of IPM farming, way are suggested.

Keywords: IPM farming; present context; developmental perspective; conventional agriculture; sustainable agriculture

Introduction

Millions of farmers in Bangladesh have long been using huge chemical pesticide in their limited land to cultivate crops, as the country is one of the most densely (964/sq.km) populated in the world with per capita cultivated land of 0.06 hectare only, less than one-fourth of the existing projected world average of 0.25 hectare (BBS, 2011). The overuse of pesticide has several negative impacts on soil, health and environment (Kabir *et al.*, 2010). In one hand, the farmers are bound to increase their yield to meet the demand of ever-growing population. On the other hand, they should keep soil and environment

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safe and sound. In this dilemma, the solution is only one, and that is sustainable agriculture.

Scholars have assorted opinions on sustainable agriculture. Some consider integrated nutrient management (Edwards and Grove, 1991), biodiversity and landscape quality (Clemetsen and van Larr, 2000), and maintaining agro-ecological health are the major determinants of agricultural sustainability while others (Ouedraogo *et al.*, 2001; Pretty, 1995; Tisdell, 1996; De Jager *et al.*, 2001; Webster, 1997) consider less use of inorganic inputs and enhancing productivity are the key requirements. However, there are three fundamental features of sustainable agriculture; environmental soundness, economic viability and social acceptability (Thapa and Rattanasuteerakul, 2010). The question arises—what kind of agriculture embodies such features? Prokopy (2003), IFPRI, (1998), and Mullen *et al.* (1997) find integrated pest management (IPM) farming, which is an agriculture follow coordinated use of multiple tactics in an ecologic and economic sound way, synonymous with sustainable agriculture, as it has no adverse impact on ecological health, which is an essential for maintaining agricultural productivity.

Although there is no universal definition of IPM, thus several time several organizations and agencies have given the definition of IPM to fulfill their own mission and vision, but at the end they come to conclude about IPM as a tool to combat pest in a sustainable way. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks (National Coalition on Integrated Pest Management, 1994). According to the Food and Agricultural Organization (FAO) Integrated Pest Management is:

"A pest management system that, in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains the pest populations at levels below those causing economic injury"

IPM has evolved from an exclusively technical approach to a more holistic view of the agricultural production system that links the long-term sustainability of agricultural production with economic, environmental, and social issues, including public health (World Bank, 2003). IPM practices where different from of conventional practices are judicious and need based use of chemical pesticides, and integrated all plant protection approaches in an umbrella (Rahman *et al.*, 2009).

Considering three major facts that Bangladesh needs: (i) to increase food production by keeping soil, environment and health safe and sound, (ii) pests are an important threat to crop production which continue to cause serious damages and (iii) to control pest, farmers use toxic pesticides and that such

continued heavy reliance on chemicals would lead to several negative impacts on soil, health and environment; there is a need for an alternative method rather than to rely exclusively on pesticides. In general no individual methods can fulfill all the criteria and as such an integrated approach is necessary. One such alternative is IPM that is considered the most appropriate one (MoA, 2002). In this context, this paper reviews and synthesizes the present context and future prospect of IPM farming in Bangladesh.

Methods and data

This study employs the longitudinal methods of IPM farming in the context of evolution, present and future. In this regard, to assess current achievement, from the introduction of this sustainable program to present context has been critically analyzed especially in organizational aspect. Attempt has also been taken to predict the future prospect of IPM farming through a profitability analysis with conventional farming in social, economic and environmental aspect. The output of the assessment could contribute to formulating policies in promotion of IPM farming.

This study is primarily based on secondary information available from various sources like books related to integrated pest management, journal, thesis, proceedings and periodicals. Furthermore, few informal discussions were held with experts in crop science, agricultural extension and environmental scientist to get proper direction of the study. In addition to this, various reports like government statistics report (BBS, 2011), national IPM policy report (MoA, 2002), country report (IPM, 2002), and World Bank report (ARD, 2003) were assisted to fulfill the purpose of the study in an effective and meaningful way.

The evolution of IPM in Bangladesh

In globally, the seeds of the IPM movement were planted during the first half of the twentieth century. However, in the 1960s, the Californian entomologists detected early signs of the catastrophic results from overreliance of insecticide and developed an integrated management to combat pest. In this consequence, in the early of 1970s the modern concept of IPM was born (Kogan, 1998; Ehler, 2006; Prokopy and Kogan, 2003).

Following the independence of Bangladesh in 1971 to next three years, the government provided pesticides to the farmers at a 100 % subsidy. As a result farmers were totally dependent on chemical pesticides to combat insect and pest. Thereafter, in order to decrease the dependency on pesticides, the subsidy reduced to 50 percent in 1974 and withdrew completely in 1979.

Although pesticides usage initially declined after this policy taken, their use has been on the increase again on the following year (MoA, 2002). This trend was a matter of be anxious. This is because, though pesticide use is needed to minimize losses due to pest infestation, but its heavy use leads the pests to be resistant and emerge as new pests. Without judge, to solely rely on pesticide is a threat for sustainable agricultural development (Kabir, *et al.*, 2010).

From this realization, in 1981 the government of Bangladesh, started IPM activities with the introduction of the first phase of FAO.s inter-country program (ICP) on IPM. Later, it was in 1987 that IPM activities move to expand seriously and became a popular topic to all types of people who are directly or indirectly involved with farming activities. From 1989 to 1995, the ICP played more significant role for the promotion of IPM concept and approach among the government officials and donor community (MoA, 2002).

Current organizational involvement and achievement in IPM activities

From the beginning to present, besides government organization’s several non-government organizations, development banks, bilateral and international agencies are involved for establishing IPM practices throughout the country (Table 1). Research organizations like Bangladesh Agricultural Research Institute (BARI) and Bangladesh Rice Research Institute (BRRI) is responsible for technology dissemination in a small scale; however, the major liable is for Department of Agricultural Extension (DAE) the largest public agro-based organization in Bangladesh. The plant protection wing of DAE directly deals IPM activities. There are some other semi-government organizations, such as Bangladesh Agricultural Development Corporation (BADC), and the Bangladesh Academy for Rural Development (BARD) that is engaged in transfer of IPM technologies to the farmers.

Table 1. Organizations involved with IPM activities in Bangladesh

| Government organizations | NGOs | Development Banks | International Agencies | Bilateral donor agencies |
|---------------------------------|-------------|--------------------------|-------------------------------|---------------------------------|
| 1. DAE | 1.MCC | 1.World Bank | 1. FAO | 1. USAID |
| 2. BARI | 2. GKSS | 2.Asian | 2. UNDP | 2.DANIDA |
| 3. BRRI | 3. SABL | Development | | (Denmark) |
| 4. BADC | 4. Ispahani | Bank | | |
| 5. BARD | Biotech | | | |
| | 5. CARE | | | |
| | 6.IPM | | | |
| | CRSP | | | |

Data Source: Harris, (2011), Rickert-Gilbert, (2005), MoA, (2004)

Among various NGOs, the Mennonite Central Committee (MCC) and GrameenKrishakShahaukShangtha (GKSS) teach IPM practices to the farmers through conduct training and field days. Additionally, companies such as Ispahani Biotech and Safe Agriculture Bangladesh Ltd. (SABL) conduct advertisements and training to extend IPM technologies. The development banks, international and bilateral donor agencies carry out project activities to disseminate and adoption of IPM through collaboration with government and non-government organizations.

By the end of 2001, a total of 1,137 persons from DAE have been trained as IPM trainers. In this way, the DAE/UNDP/FAO and DAE/DANIDA SPPS project have produced 829 farmer trainers (FTs) (MoA, 2002). Moreover, the DAE and DANIDA have completed training on IPM to 117,000 rice and 78,000 vegetable farmers with the ending of phase II in 2006. Currently, the DAE is expanding their project for the use of ecological approaches to pest management to almost four hundred thousand households that depend on agriculture for their livelihoods. This is an important achievement, yet it represents only a very small proportion of the country's 14.7 million farming households (FPMU, 2012). Like this, almost 100,000 farmers have already received season-long practical in depth training on IPM which is not adequate in comparison to total number of farmers. This is because; statistics say this represents just 0.27 percent of the estimated 37 million farmers of the country (MoA, 2003).

Around 300 personnel from different NGOs have been trained as IPM trainers with in 2001. The Cooperative for American Relief Everywhere (CARE) programs focus on assisting 221,375 illiterate and poor farmers, through implementing IPM programs dealing with crop husbandry (Den Tex, 2004). The USAID funded IPM CRSP (Collaborative Research Support Program) has a partnership with CARE to disseminate IPM technologies to farmers. In addition to this, IPM CRSP financially assisted to conduct research to know the economic aspect of IPM for better dissemination and adoption (Debass, 2000).

These efforts are appreciable, but not enough in comparison to the total number of NGOs. There are hundreds of NGOs are active in the country. Very few of them are working for the promotion of IPM farming. Unfortunately, majority of the NGOs are not interested with the sustainable agricultural program as they always seek more profitable program like micro-credit. In some country, like Thailand, NGOs have played an important role for the encouragement of organic farming (Rattanasuteerakul andThapa, 2010). Few NGOs are contributing to disseminate and adopt IPM technologies against hundreds, which is not enough for promotion of IPM farming.

Although IPM is a promising area in the context of sustainable agricultural development, but few research has been conducted by GOs and NGOs. Under the financial assistance of IPM- CRSP, already some studies have been conducted to know the economic aspect of IPM. Except this matter, there are a wide range of issues related to IPM where research should be conduct. Adoption of IPM technologies is multifaceted and a number of factors are involved with this phenomena. In spite of continuous support from different public and private organizations to increase IPM adoption among the farmers, there is a scarcity of publish research where analysis are done to identify the factors that influence or limit the adoption and extent of IPM.

Dissemination techniques of IPM

In order to extend IPM technologies all over the country, there is a need to develop some approaches which assist the farmers to get information about IPM, and DAE finally developed some dissemination techniques like, Extension Agent Visit, Farmers Field School (FFS), IPM Club and Field Days. Until the present, approximately 12,640 extension agents, who are the treated as Sub Assistant Agricultural Officers (SAAO), are influencing farmers to adopt IPM technologies. Annually they reach around 11 million farmer household (MoA, 2004). The Agricultural Extension Component (AEC) of DAE conducted 2,313 FFS program in 2009. FFS assist farmers to develop their analytical skills, creativeness, and critical thinking, and also help them to learn how to make better decisions (Feder *et al.*, 2004). At present, there are over 16,000 IPM clubs existing in different regions of the country and the number of members in each club size ranges usually 50 to 100 (Harris, 2011).

Besides these, government uses different print and electronic media like TV, Radio, Newspaper and Magazine to disseminate information regarding IPM practices. These media can be serving as the cheapest form of information diffusion and at the same time they have the potentiality to reach a large portion of a population (Bentley *et al.*, 2003). The NGOs also inform the farmers to cultivate crops with IPM practices and provide training. Moreover, the farmers get information regarding IPM practices from the pesticide dealers and their neighbors.

The dissemination techniques that are developed, all are not cost effective. According to Rickert-Gilbert et al (2008), for diffusing simple, intermediate and complex IPM technologies and practices, the extension agent visits and FFS are the more effective methods than others. The government should utilize their funds on FFS and extension agent visit in a more proficient way (Harris, 2011). Only two among several are serving effectively which is not a good sign for better dissemination of IPM technologies. Hence, it is the high time to

reevaluate the rest techniques, and a more effective dissemination strategy should be developed for increasing the adoption of IPM technologies.

Adoption and extent of IPM

Harris, (2011) and Rickert-Gilbert, (2005) conducted studies on cost effectiveness of IPM dissemination techniques covering 7 districts where rice and vegetables are plenty grown and IPM practices are present. Both of them found the adoption of IPM practices is low after having different initiatives by the government and other organization and agencies. Dasgupta *et al.*, (2007) conducted a survey in a large scale among the rice farmers of different regions of Bangladesh and found a negligible rate of IPM farmer in comparison to the conventional farmers (Table 2).

Table 2. Regional distribution of IPM farmers in some selected areas of Bangladesh

| Division | District | Conventional Farmers | IPM Farmers |
|-----------------|-----------------|-----------------------------|--------------------|
| Dhaka | Kishorgonj | 35 | 20 |
| | Muhshigonj | 25 | 0 |
| | Mymensing | 84 | 0 |
| Rajshahi | Narsingdi | 82 | 0 |
| | Rajshahi | 137 | 8 |
| | Chapainawabgonj | 3 | 0 |
| Rangpur | Bogra | 27 | 0 |
| | Rangpur | 68 | 26 |
| Khulna | Jessore | 111 | 54 |
| Chittagong | Chittagong | 56 | 0 |
| | Comilla | 61 | 31 |
| Total | | 689 | 139 |

Data Source: Dasgupta *et al.* (2007)

Out of seven divisions of Bangladesh, five are considered for the study. The findings represent the overall picture of the country regarding IPM adoption rate where there is a huge gap between the IPM and conventional farmers in terms of a number. Moreover, the picture not only reveals that still the adoption rate is low but also there is a huge variation in the intensity of IPM farmer from one district to another.

After several initiatives from different organizations and agencies for promotion of IPM farming, little progress has been achieved. Until now millions of farmers are engaged in conventional farming. Inadequate organizational efforts are not only the reason, but the farmers' poor socio-economic characteristics are also another crucial factors for this laggard. In

Bangladesh, the current literacy rate is 64 % and among the farmers this rate is near to the ground (BBS, 2011). Majority of them have no education, and it has a negative impact on their knowledge, perception, attitude and awareness, which ultimately affects the adoption of IPM practices. Moreover, their average farm size is too small that also limited the adoption of IPM practices.

IPM versus conventional farming

In the conventional farming, farmers use pesticide at a high rate by following their ancestors. There is a widespread presumption that chemical pesticides are harmful to human health and environment (Backman, 1997). The increased use of insecticides and pesticides which is a common phenomenon of conventional farming has led to the contamination of water bodies and the spread of diseases, which have adversely affected aquatic life, livestock and people's health (Hossain *et al.*, 1994; Asaduzzaman, 1995; Hossain and Kashem, 1997; Rahman and Thapa, 1999). Farmers spraying pesticides in many cases, suffered from heart and skin diseases (Country report, 2002). A 2009 health bulletin released in Bangladesh indicated that 7,438 people had died from pesticide poisoning in the previous year (Rory, 2010).

IPM is intended to reduce ecological and health damage from chemical pesticides by using natural parasites and predators to control pest populations (Dasgupta *et al.*, 2007). In conventional farming, farmer use more chemical pesticides while IPM farming these is used when needed and also recommended rate. As IPM ensures appropriate use of pesticide through monitoring, then it is better over conventional farming in social and environmental aspect.

Over the last few years, a debate is continuing that, is IPM really profitable than conventional farming in production as well as the income aspect. Several studies argued increased crop yield and farm income are evident through IPM. In Bangladesh, work carried out by FAO regional IPM program from 1989-1995 showed IPM trained farmers' increases in rice yields by about 10 percent and reduction in pesticides use by about 80 percent. (Country report, 2002).

Nasrin, (2010) conducted a study and found IPM practices can minimize pest-control cost for a vegetable farmer by BDT 16,000 (~\$195.12 USD) for Egg Plant, BDT 11,000 (~\$134.14 USD) for Bitter Gourd and BDT 7,500 (~\$91.46 USD) for Cucumber per hectare. Results of an IPM project in selected parts of the country showed that Boro(summer) rice yields were 12% higher for IPM farmers. In addition, those farmers reduced pesticide use by 90%, which led to a reduction in expenditure on pesticides by as much as 94% with a

positive effect on production cost (FPMU, 2012). Fig 1 and 2 shows higher yield and lower production cost of IPM farmers in Boro rice.

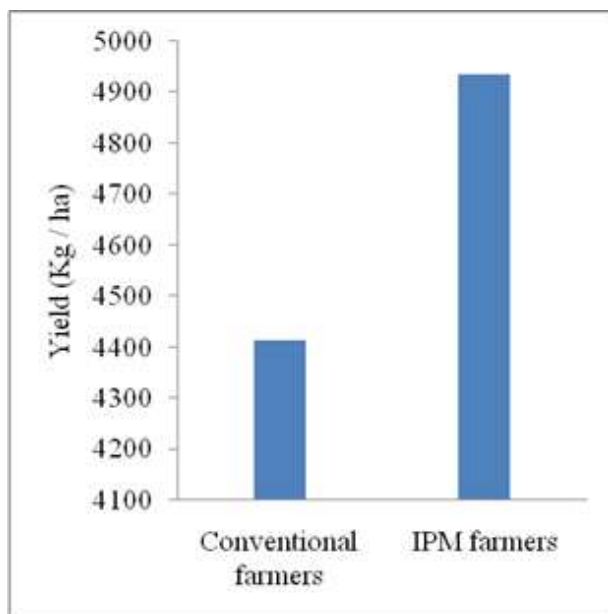


Fig. 1. Yield of IPM and conventional farmers in Boro rice (2002)
Data Source: FPMU, 2012

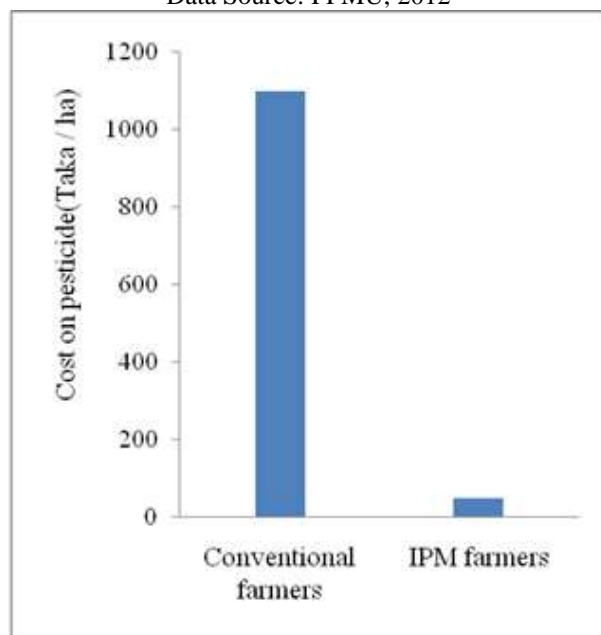


Fig. 2. Production costs of IPM and conventional farmers in Boro rice (2002)
Data Source: FPMU, 2012

In fact, there is no significant difference between IPM and conventional farming in aspect of production. Since IPM reduces pesticide cost with no countervailing loss in production, it appears to be more profitable than conventional farming (Dasgupta *et al*, 2007). Ecological agriculture has a tendency towards becoming ecologically, economically and socially more sound than conventional agriculture (Rasuland Thapa, 2004). This result reflex in favor of IPM because IPM is ecologically based approach. The above discussion indicates that apart from social and ecological view, IPM farming is more profitable than conventional farming in economic aspect. Therefore, finally, it can be argue that IPM farming is more profitable than conventional one in social, economic and environmental aspect.

Conclusion and recommendations

Despite efforts being made from different organizations for promotion of IPM, adoption and extent of this sustainable farming is increasing slowly. After thirty-one years have passed of its introduction, still conventional farming is largely intact. Moreover, not only the number of IPM farmers is less than conventional but also the distribution is not balanced throughout the country. To improve the present scenario, the government should establish national IPM program to coordinate IPM activities among the country, and give equal emphasis to all districts for balancing expansion of IPM farming. Beside this, not only continuation but also project with larger scale on IPM should be introduced and implemented by the development banks, bilateral and donor agencies. Additionally, DAE and NGOs should create more training facilities to cover all categories of farmers especially the small and medium farmers, who are the majority in number (57 % of total farmers) but have low risk bearing capability. Another significant issue is IPM farming is more profitable than conventional farming in social, economic and environmental aspect. Relative advantage is an important criterion of technology adoption. Since IPM farming is more profitable than conventional farming, the farmers will be interested to acknowledge this program. Sometimes farmers are reluctant to adopt any new technology if the production is low. In this context, the DAE and NGOs should come forward to remove this confusion and make IPM financially attractive.

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