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INTEGRATED FARMING SYSTEM : BANGLADESH PERSPECTIVE

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Abstract : Farmers of Bangladesh generally practice subsistence farming. There is a need to develop suitable integrated farming systems for such farmers. This paper explored the experience and feasibility of the integrated farming system in Bangladesh. A literature review type method is used for this research. Various materials like empirical papers, documents, progress reports and PhD thesis related to the topic were used in preparing the paper. Status of integrated farming system in Bangladesh is reviewed and several forms of integration are traced here. It is also found that the integrated farming is both technically and economically viable in Bangladesh. Though integrated farming system can solve most of the existing economic and ecological problems but it is not widespread in Bangladesh. Extensive efforts should be made to transfer this technology to farmers.

Key Words: Integrated farming, Integration, Agriculture, Bangladesh

Introduction

Agricultural sector is one of the most important sectors for Bangladesh. It has always been given more importance to crop sub-sector for the development of agriculture. The non-crop sub-sectors like livestock and fishery are not given the same importance. The development of crop-livestock-poultry-fishery all together could be a timely solution for overall agricultural development. These days in the name of food security and poverty eradication these non-crop sub-sectors are getting importance individually through different government programs. But we can see that crop and non-crop sub-sectors are related with each other. With the principle of integration these different components of farm system can be tied together and operated as one farm. This is the Integrated Farming (IF) and this could be one way to utilize the available farm resources optimally.

Research exploring the experience and feasibility of the integrated farming system has not been undertaken in Bangladesh before. To some extent

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Mamun and others (2011) explored the linkages of components in the farming system to enhance the farm productivity, reduce the environmental degradation, improve the quality of life for poor farmers and to maintain sustainability. That research reviewed the integrated farming system in general and tried to evaluate the efficiency of integrated component technologies in terms of productivity, increase income, employment generation, energy production and to quantify the nutrient flow efficiency of linked components to soil. Though that paper concluded the prospects of integrated farming system in Bangladesh, but that did not explored the feasibility reviewing empirical papers related to Bangladesh. All the paper reviewed on that study is related with other countries than Bangladesh. This research gap has been tried to meet in this present research.

This present research explores the prospects of integrated farming system with the objective to evaluate the experience and feasibility in the context of Bangladesh. A literature review type method has been employed here. Various materials like empirical journal papers, documents, progress reports and PhD thesis related to the topic are used here. The concepts with some historical development of integrated farming are reviewed in the next section followed by experienced so far with feasibility in Bangladesh. In the next section an attempt is made to construct a hypothetical resource flow model for an integrated farm in Bangladesh. Different issues related with the development of integrated farming in Bangladesh are discussed at last.

Concept and History of Integrated Farming in Asia

The word 'integrated' is derived from the Latin word 'integrare' which means 'to make whole by addition, or to combine parts into a whole' (Edwards et al. 1988). According to Cambridge Dictionary 'integrated' means to combine two or more things in order to become more effective. The Integrated Farming is a system of agricultural technique developed these days. It can be defined as a holistic pattern of land use which integrates different farming activities to achieve maximum replacement of off-farm inputs and to sustain farm income (Morris and Winter, 1999). Integration occurs when outputs (usually by products) of one production sub-system are used as inputs by another within that farm unit (Csavas, 1992). There will be sequential linkages between two or more enterprises of agriculture. But it is different from mixed farming in which production sub-systems of a farm are not mutually supportive and do not depend on each other. Integrated farming is an attempt to reconstruct a farm by balancing food production, profitability, safety, animal welfare, social responsibility and environmental care (Little and Muir, 2003). All enterprises like crop, livestock, poultry and fishing or two or more enterprises can be there together in one farm and in this farm all products are produced in such a way that it will increase productivity, reduce spoilage and must also not degrade the environment. In broader perspective, this can be viewed as part of Integrated Resource Management.

Integrated farming is as old as farming itself in Asia. The integration in the form of livestock-fish system is documented since 14th-17th century in China during the period of Ming dynasty (Csavas, 1992). Latter on it spread to Thailand, Vietnam, Malaysia, Singapore and Indonesia in the 19th century. Now this integrated farming has developed very much as farming system in those countries. Though the integrated farming is not much widespread in Bangladesh but the traditional mixed farming systems exist with dominance of crop enterprise. Even thirty to forty years back most of the farm household had its own crop, livestock, poultry, fish pond and other sub-systems (Huque, 1992). The household provided labour and management; crop provided food and feed; animal provided milk, meat, power, manure and capital; fish pond provided food and irrigation and orchard provided fire wood and fruits.

Experienced so far and the feasibility of Integrated Farming in Bangladesh

Several forms of integrated farming are traced in Bangladesh through literature survey. Patterns of integration include crop-livestock, livestock-fish, crop-fish and crop-livestock-fish systems (Sharmin et al. 2012; Alam et al. 2009; Mamun et al. 2011). Integrated duck-cum-fish farming has been introduced by Fisheries Research Institute in 1986 (Huque, 1992). The integrated layer/broiler chicken-cum-fish farming operation is also undertaken in the country where the birds are kept at the floor over the ponds. It has been proved that this type of integration is not only technically feasible but also economically viable (Uddin, 1990; Huque and Ebabul, 1991). Economic analysis of integrated poultry-cum-fish system reveals a net profit of Tk.219836/ha/year where the fish production is 5-7 times higher than the normal fish culture (Nuruzzaman, 1991).

The culture of fish into rice fields in fresh water or estuarine areas of Bangladesh is an old practice (Ahsan, 1996). Rice-cum-shrimp farming in the Southwestern part of the country is known as 'Gher' method. Near about 0.2 million tons of different types of fishes are being harvested from rice field per year in Bangladesh (Huque, 1992). Barmon and other (2004) examine the impact of rice-prawn farming on agricultural income as well as household income in southwestern Bangladesh. It is found that the gher farming system is very profitable than only rice cropping. The gross revenue and agricultural income of gher farmers are respectively five times and seventeen times higher than those of single rice farming. Not only this but also the rice-prawn gher farming is found as a cost saving technology for rice production. The input cost of chemical fertilizer in single rice farm is about six times higher than rice-prawn farming system (Barmon et al., 2006). In another study a benefit-cost ratios reveals as 1.71 and 1.80 by taking both cash and non-cash cost into consideration (Gupta et al. 2002).

Apart from those the pond based integrated aquaculture and agriculture has been found very much promising in Bangladesh. This type of integrated

farming is practiced in Mymensingh district. Link between the pond and surrounding land for horticulture is a distinctive feature of this type of integration. In a study on this type of integrated farming system in Mymensingh district Karim (2006) found that there is a significant increase in production of both fish and vegetables. Livestock farming especially the goat raising is increasing now a days in Bangladesh due to high price of meat but the integrated practice is found very few in Bangladesh. Moreover, the farm can get the benefit of manure of cow/goat/sheep in integrated animal-fish farming but this is not yet used widespread in Bangladesh (Taj-Uddin and Talukder, 1997). Goat-fish farming was being encouraged by one NGO name 'Bangladesh Mission' in Bangladesh during 1990s (Huque, 1992). So far we know that it is not being carried on by any organization in Bangladesh later on.

Model for Integrated Farming in Bangladesh

The numbers of small farm system are more in Bangladesh. For a small farmer this integrated farming could be a way to diversify its production, reduce risk and increase efficiency of resource use. But it is challenging to build a proper linkage among the enterprises of small farms. On the basis of the evidence in Bangladesh and other countries a hypothetical integrated farm having all possible integration that can operate interdependently can be sketched. This could be a household based farm with crop-poultry-livestock-aquaculture system. The tentative resource flows among the sub-systems in the farm are shown in Figure 1. Feed and fertilizer play the key role in the farm production and farmers cannot afford to purchase feed and fertilizer round the year. These feed and fertilizer could easily be supplemented trough integrated culture (Figure 1).

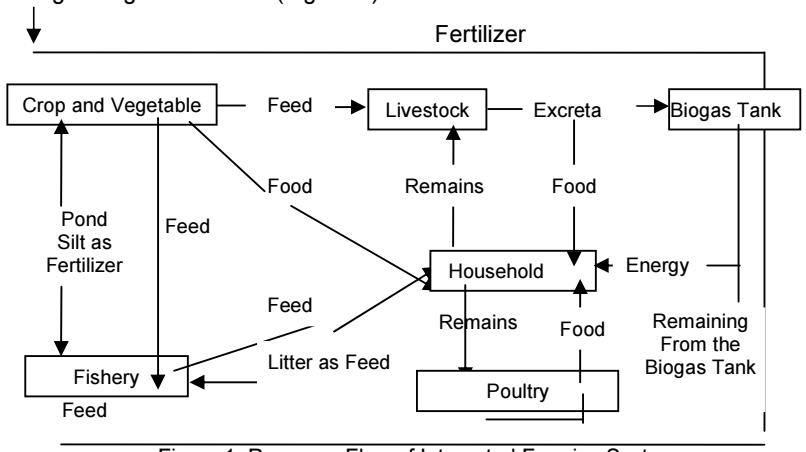

Figure 1: Resource Flow of Integrated Farming System

In this farm the livestock and poultry get their feed as straw-grains-bran, part of vegetables and grass produced in the farm, and wastes from the households. The livestock provide daily wastes, which are valuable renewable resources. The livestock's organic wastes can produce biogas using a biogas plant. This biogas could be the source of free and renewable energy for domestic use. After producing the biogas, the rest can be used as fertilizer, which is a nutrient-rich effluent for land of crop production and fishpond. A comparison of an integrated farming with a conventional one found that both number and biomass of earthworms are up to six times higher in integrated farm field than the conventionally treated field (Titi and Ipach, 1989). In the fishpond this also enhances the growth of different kinds of plankton which serves as feed for fish.

The poultry shade could be built on fish pond dicks. Poultry droppings and feed waste can be poured directly into the pond to constitute feed for fish. Production of fish in such pond with chicken/duck rearing over the pond increases because it constitutes a continuous organic fertilization of the pond by the poultry litter (Mamun et al. 2011). Embankment of the pond can also be utilized properly for cultivation of grass and vegetables especially of creeping types round the year. Some locally grown grass and part of vegetables can be used as feed for livestock and some herbivorous fish in the fish culture unit. In this way not much of extra feed is required for fish-poultry-livestock units in this farm.

Again fish pond silt is an excellent fertilizer for crops though it is acquired very occasionally. The livestock manure and the occasional silt from the pond will help to reduce chemical fertilizer use. Even sometimes paddy cum fish culture can be practiced in the field in suitable time. In this way wastage reduces as well as increases the overall benefits by recycling resources efficiently.

Discussion

There could be several advantages of integrated farming for developing country like Bangladesh. It could increase employment because of its diverse activities (Alam, et al. 2009). Hussain and others (1994) concluded that as the rice-fish farming requires high labour input so there is a tendency for adoption of technology by the households with large family size. So the demand for higher labour could increase with the increase of this technology. As outputs (usually by products) of one production sub-system are used as inputs by another so it reduces input cost and so increases income of the farm (Devendra, 1992, Alam et al. 2009). It increases income of the farm as having different enterprises (Taj-Uddin and Takeya, 2007). Along with more income it could raise the standard of living (Karim, 2006). This farm can also help to reduce the use of chemical fertilizer. It creates a micro-ecosystem that recycles resources and reduces inorganic pollution (Prein, 2002). The

importance of nutrient recycling of otherwise unused waste materials is an important element of integration. Integrated farming systems also improve nutrition and food security, both within integrated farm households and in non-integrated households in the community (Ahmed et al. 2007; Prein and Ahmed, 2000; Sharmin et al. 2012).

Models of integrated farming are well tested and documented for different countries but the spread of this technology is not satisfactory in Bangladesh. For the dissemination of the technology the process should be identified like the model developed for aquaculture in Bangladesh (Lewis et al. 1996). In that model the fish deficit areas are chosen first; like the same for the integration of particular type should be identified for each area first. For example integration of aquaculture with rice farming during the rain fed and irrigated seasons in Bangladesh is viable but not always and not for all regions. There are also in need of further research to select species for crops, fish, livestock and poultry for integration for particular region. Which varieties (whether the indigenous varieties or the hybrid varieties or the mixture of both) should be included that is researchable further. The farm size is also important thing to be considered here because most of the farms in Bangladesh are small in size having small crop sector. Small farm can integrate other components with less number of cattle and/or poultry with a small pond. As all components will depend on each other so the size of all units must be critical, otherwise the symbiosis will break down and farm will run in either over utilization or under unitization stage. So the optimum size for different sections related with different level of production has to be identified. Suitable pilot project will then have to be designed and implemented to test the system. Based on the result of such projects the appropriate technology will then to be disseminated in that area.

There are some concerning factors for the sustainability of integration in agriculture (Ahmed et al. 2007). First concern is related with low supplies of inputs for different enterprises (i.e. for aquaculture low supplies of fish fry, for poultry low supply of chicks). Second concern is related with poor institutional supports like inadequate extension services and lack of credit. It is therefore necessary to provide appropriate policy support in this respect from government for the development of integrated farming. A number of NGOs are active in Bangladesh those are working with farmers at the grassroots level to understand their problems; to provide appropriate technologies, training and credit; to ensure availability of needed inputs for adoption/implementation of the technology, and to monitor them periodically. With appropriate policy guidance from the government side these NGOs could also be utilized to the development of integrated farming system in Bangladesh.

Different study found different insight related with the implementation of the farming systems among the farmers. Gupta et al. (2002) found that the

farmers who adopted rice-fish farming had bigger land holdings, larger household size and higher literacy. The study indicated that the relatively better-off farmers not only adopted the technology but also intensified the operations. These findings are similar to the studies undertaken in Bangladesh on the adoption of modern rice farming technology in the face of green revolution (Herdt and Garcia, 1982). So for the successful dissemination of integrated farming system, those types of farmers have to be targeted with the pilot project. It should be remembered here that there could be many reasons for marginal farmers not adopting integrated farming at the initial stages of development. Those reasons could be lack of knowledge, lack of additional resources needed for integration, lack of credit availability and unwillingness to take risk (Gupta et al. 2002). In a study which tried to see the impact of adoption of new technologies disseminated by NGOs for the culture of fish (tilapia and Silver barb) in seasonal pond/ditches (Gupta et al. 1992). It is found there that though the poor farmers were able to benefit from the technologies but in the early stages of technology adoption small farmers require support in terms of training, input supply and credit, which is normally ensured by NGOs for their target group, while government extension agencies concentrated on transfer of knowledge only. This type of model could be used for the dissemination of integrated farming technology in Bangladesh.

Conclusion

In a country like Bangladesh where land is scarce, effort should be taken to increase production through integration of various production subsystems in agriculture for efficient utilization of resources. It would maximize production of diversified products from a minimum area which will increase the income of the farmers and would enhance food production. In the conclusion it can be said that the integrated farming system is not only technically feasible but also economically viable in Bangladesh. Extensive efforts should be made to transfer this technology among the farmers.

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