12

Integrated Rice-Duck

A new farming system for Bangladesh

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Summary

Rice-duck farming is a low-cost, organic farming method for small entrepreneurs, introduced in Bangladesh in 2001. Initially, convincing people that ducks were not harmful to rice was a major struggle. By raising ducks on rice paddy, no chemical fertilisers or pesticides are required, while 20% higher crop yields are obtained and net income on a cash cost basis increased by 80%. Labour requirements are continuous at a low level and supplementary feed requirements can be high for certain ecosystems. Female household members can conduct most of the duck-rearing activities. By using an enterprise web approach, the case study helps organisations to explore how they can make best use of their competitive strengths to get involved in rice-duck farming. It also highlights the weakest links in the model. To make an integrated rice-duck system work for poor farm families, provision of ducklings and access to vaccines are key bottlenecks that have to be overcome. The first hurdle can be overcome by setting up village hatcheries, parallel to the government supply system, whereas the second depends entirely on contacts with the government vaccine suppliers. Over three years, rice-duck farms were established in more than forty villages, either as individual units or more recently on a community basis. The community rice-duck farming system reduced transaction and labour costs.

TECHNOLOGY

Integrated rice-duck production is a low-cost, organic farming method for small entrepreneurs. Ducks are allowed to forage in the paddy 20 days after rice transplanting until the flowering stage about 2 months later. While the ducks forage, they remove weeds, eat unwanted pests, soften the soil with their bill and feet movements thereby releasing trapped nutrients, and their droppings provide natural fertiliser. By raising ducks in rice fields, no herbicides, insecticides and chemical fertilisers are required, findings based on three years of research (Ahmed et al, 2004).

In the experiments, rice yields increased on average by 20%, which increased household rice availability by two to eight weeks. Duck eggs and meat also significantly increased household protein intake; surplus eggs and ducks were sold at the market for cash.

Bangladesh has three rice seasons. There is the main monsoon or *aman* season (July - November) and the now dominant irrigated *boro* or winter rice (November - May). The minor rainfed *aus* rice season (May - September) is important in Northeast Bangladesh. The rice-duck management is different for each season. Older ducklings are needed in the cold winter season, whereas a potential shortage of standing water for duck scavenging can result in a greater dependency on supplementary feeding and alter the economic viability of the technology. For *aus* and *aman* seasons standing water is not an issue and supplementary feeding is minimal.

"Ducks are harmful to rice" is a misconception often voiced. In Bangladesh many farmers rear ducks and many grow paddy, but the opportunity to integrate has never been promoted.

The partial economic analysis in Table 12.1 (Peter, 2004) shows a negative return on a full cost basis due to labour costs (particularly rearing), but on a cash cost basis there is an 80 percent increase in return, compared to cultivating rice alone. During an appraisal workshop, farmers raised the time for managing ducks and the need for supplementary feed as constraints. However, the increased cash income outweighed this. Women said that they used some of their 'leisure' time for rearing ducklings(Ahmed et al, 2004).

An interesting point to note here was the first year's experience in Sylhet. BRRI scientists had a promotional video from Japan. The video showed clearly the increase in rice tillering, root growth and yield, the decrease in insects and weeds, and how ducks soften the soil with their bill and feet movements. Along with this was the added duck production for meat. The video was the only evidence. The experimental results of the first *aman* season coupled with the farmer feedback produced a response in Magor of, 'It is just like the video!'

Table 12.1 Cost-benefit analysis of rice-duck farming. Example of Khadimnagar union, Sylhet during aman season. Taka per 20 decimal plot (0.08 ha)

ACTIVITY	RICE ALONE	RICE-DUCK
Costs		
Ducklings (30 @ Tk 12/duckling)		360
Seed	30	22
Bamboo & labour for fencing		550
Fertiliser	150	
Labour for weeding	360	
Insecticides	33	
Labour for fertiliser & pesticide application	100	
Feed (6 months)		1,530
Housing & labour for housing		145
Vaccine		90
Labour for rearing		2,300
Labour for moving in & out		900
Total variable cost	673	5,897
Benefits		
From paddy	1,600	1,735
From ducks[1]		1,740
Gross return	1,600	3,475
Net return on full cost basis	927	-2,422
Net return on cash cost basis	1,387	2,493

[1]Income from selling 6-7 month old ducks at 10% mortality rate

That first season was a confidence boosting season for each of us.

Traditionally, women in Bangladesh conduct about 80% of duck-rearing activities, involving hatching, housing, nursing, feeding, and herding. Once rice farmers have learnt duck rearing techniques, it is sufficiently easy even for younger family members.

Under their duck programme, the national NGO Friends In Village Development Bangladesh (FIVDB) already trained about 500 vaccinators in Sylhet, 30 in Moulvibazar and 100 in Sunamganj, two thirds of which are women. In future, more women may be trained to vaccinate ducks. They will be able to make cost savings by vaccinating their own ducks and earn extra income by vaccinating ducks of neighbours.

ACTORS AND NETWORKS

An overview of all actors is given in Table 12.2.

The Bangladesh Rice Research Institute (BRRI) provided overall leadership for testing and validating the rice-duck technology.

FIVDB was established in 1981. Apart from formation of self-help groups, development of human and social skills, promotion of savings and microcredit, and adult education with village libraries and cultural activities, it supports sustainable

Table 12.2 Actors involved in rice-duck project in Bangladesh, 2001-2003

ACTORS	CONTRIBUTIONS	LONG-TERM EXPECTATIONS
Lead organisations BRRI and FIVDB	Provide technical knowledge and support; establish links with different stakeholders	Both partners will explore the potential of rice-duck for organic production of paddy, duck meat and eggs
Partner organisation (BDS)	Provide necessary knowledge and support	BDS plans to extend rice-duck to more farmers
Hatchery owners (Small businesses)	Sell duckling to farmers	They will be able to increase duckling production; more hatcheries will be established
Farmers with less than 0.2 ha plots	Demonstrate rice-duck at village level; build up community awareness to involve more farmers	Community will shift from individual plots to co-managed communal rice-duck systems
Farmers' wives	Rear ducklings, sell eggs and meat; conduct rice post-harvest activities	Women get extra cash income and invest in better family nutrition
Other NGOs	At least 4 other NGOs have initiated new rice-duck plots in other villages	More NGOs will embark on rice-duck cultivation
Government agencies	DAE, Livestock Offices, govt. poultry farm and BADC provide seed, ducklings, vaccine and services	Government organisations (GOs) will provide more support to rice-duck
Union Parishad	Some UP members and chairmen are providing moral support and help to establish links	More involvement and moral support will be needed
Private duck vaccinator in the village	FIVDB, government organisations and NGOs coordinate and network and ensure they provide vaccines	More duck vaccinators will emerge where rice-duck practice starts

agriculture, livestock and poultry activities. Under its livelihood programme, it aims to improve homestead-based production, mainly of women-headed households, by promoting integrated production systems.

FIVDB provides training on duckling production, and duck husbandry and management. Malik Anwar Khan, one of the founders of FIVDB and the coordinator of the Poultry Unit in the Livelihood Enhancement Programme has acquired a wealth of duck experience over 25 years during which he has published three books on duckling production, duck rearing and duck diseases. Malik Anwar Khan's passion for, and knowledge of how ducks can significantly improve rural livelihoods has made him a driving force in the rice-duck project.

FIVDB's central facility has an effective duckling production unit with two automatic electric incubators and one Chinese incubator. The latter is a low-cost solution whereby eggs are kept at constant temperature in a bamboo cylinder; primary heat being provided by sun light or by a kerosene stove on cloudy days. FIVDB has established over 20 duckling production units with Chinese incubators in Northeast Bangladesh. Some of these units produce ducklings regularly, while others function only seasonally.

In July 2001, BRRI teamed up with FIVDB to conduct research on integrated rice-duck farming with poor households in Sunamganj, Moulvibazar and Sylhet districts of Northeast Bangladesh (Table 12.3). For each district, FIVDB appointed a project assistant with an agricultural diploma.

Table 12.3 Rice-duck activities in three districts of Bangladesh, 2001-2003

	SUNAMGANJ	MOULVIBAZAR	SYLHET
No. of unions	4	4	3
No. of villages	9	18	13
Farmers involved in research	40	48	64
Other farmers adopting rice-duck in extension phase	28	37	17
No. of ducks	2,190	2,400	2,620

FIVDB also collaborated with the local non-government organisation (NGO), Barisal Development Society (BDS), which played a significant role in networking with other NGOs, private sector and government institutions such as BADC, DAE, district livestock officer, government poultry farm, and the Union Parishad office of the local government. One agriculturist and two supervisors were involved from BDS. "We already had a friendly relationship and good understanding with BDS. To make a partnership, it is very much important that you know a person in that organisation and that there is mutual goodwill and understanding," said Malik Anwar Khan.

EVOLUTION OF THE METHOD

The traditional practice of duck raising in rice fields involves herding the birds in paddy fields after the rice is harvested. Although integrated rice-duck farming has been practiced for generations in Japan, and is practiced in many other Asian countries (Cagauan et al., 2004), it was unknown in Bangladesh, until recently.

When two BRRI scientists, Mr. Shaikh Tanveer Hossain and Dr. Gazi Jashim Uddin, visited Japan in 1998, they were impressed by the benefits integrated rice-duck farming brought to the farmers and by the environmental friendliness of the system. Upon their return, they discussed their experiences with the director-general of BRRI.

Early in 2000, a first concept note was developed and submitted to PETRRA, but not approved. PETRRA stressed that the institutional support was not in place for BRRI to make the model work, unless strategic partnerships were developed. When, later on, a new proposal was submitted in partnership with FIVDB as the leading institute in Bangladesh with duck expertise, the proposal was approved.

The first challenge of the project was to introduce the new concept to all the actors and consequently to evaluate which key activities and links had to be established to make the rice-duck system work under Bangladeshi conditions.

THE RICE-DUCK EXTENSION METHOD

The first output of the rice-duck project was to validate the technology and the second output was to articulate the essentials to extend the technology. It is the latter for which the enterprise web tool was used. The different activities that require attention are depicted in Figure 12.1, and referred to in each of the paragraphs below.

Select suitable ecosystems

Those areas where duck rearing and paddy cultivation exist side-by-side are suitable for integrating both systems. Apart from saline water and upland or drought prone areas, most parts of Bangladesh are suitable. In places where line transplanting is already being practiced, such as in Comilla, the system can be quickly established. Under this sub-project, sites in the northeast and south tidal area were selected.

Select resource-poor households

In the northeast all rural poor households involved in the project had had a long-term relation with FIVDB and expressed their interest in embarking on rice-duck. They practiced homestead agriculture, had water facilities near their home, a possible duck-rearing space and owned some paddy land.

BDS selected households in Barisal from within their group programme. Other examples of building on comparative strengths in selecting poor farmers can be

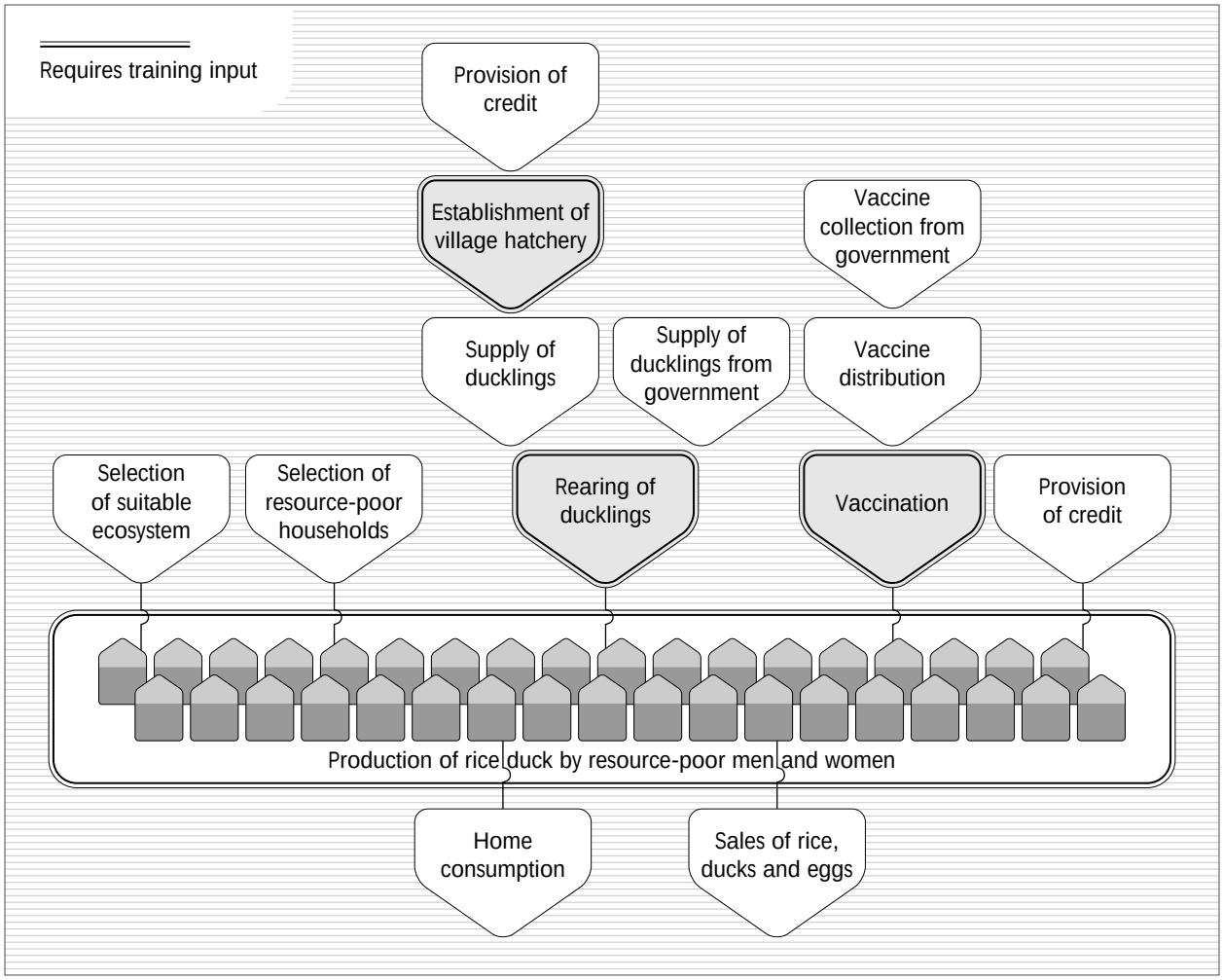

Figure 12.1 Enterprise web for rice-duck farming

found in the Farmseed (see Chapter 18) and the women-led group extension (Chapter 3) projects by the NGO Agricultural Advisory Society (AAS).

After the initial success of the rice-duck project with FIVDB and BDS, another NGO AAS commenced rice-duck promotion in collaboration with MAC Bangladesh, an NGO in Srimongal upazila under Moulvibazar district. Their staff and farmers received training from FIVDB at PETRRA's request. But the way they introduced this new system differed. They set the pre-condition that the whole community had to agree to conduct rice-duck culture before AAS/MAC would provide support, anticipating that by doing so future social conflicts over natural

resource management would be minimised. In addition there may be some economy of scale in field supervision of ducklings and removing the need for boundary fencing of paddy fields (see Box 12.1).

Box 12.1
Community Approaches in Rice-Duck

The NGOs MAC Bangladesh and AAS discussed with communities in two villages (Sirajnagar and Uttara Varaura) of Srimongal in northeastern Bangladesh, about the benefits of integrated rice-duck farming. In both places, farmers had experience with rice and duck rearing, but farmers from Uttar Varaura did not combine them. Two systems emerged through group discussions and a trial in aman season 2003.

In Sirajnagar village, 21 farmers with adjacent plots purchased 2,000 ducklings individually, but through MAC, who also provided support for vaccination and farmer training. Other community members with adjacent plots agreed on refraining from insecticide use; before they sprayed twice a season. Each farmer shelters, rears and grazes his or her ducklings individually. Because the land available for grazing is seven acres (2.8 ha), fencing is not required. The group, as per suggestion of MAC Bangladesh, started producing duckweed in their abandoned ponds an in situ source of duck feed.

In Uttara Varaura village, seven farmers joined their plots totalling 3 acres (1.2 ha) on which they graze 350 ducklings owned by the group. But interestingly only three farmers shelter and rear the ducklings, while they take turn in grazing the ducklings. They meticulously keep track of all expenditures, including their time, and share costs and benefits with the group. 'Practicing rice-duck farming in a group works well for us," said Ratan Dev, one of the group members.

Supply ducklings

A reliable supply of ducklings is essential for this model to work. Two parallel sources may be explored: government duckling suppliers or NGO/private small-scale duckling production units.

In Bakergonj upazila in Barisal district, government farms provide ducklings, but not at the right time. This resulted in poor performance of the newly established rice-duck farms. To overcome similar problems, the project assisted in setting up a village hatchery or duckling production unit. For two months an experienced duck farmer from Sylhet district, trained by FIVDB, helped poor households in Barisal to establish a small-scale duckling production unit and to teach them the tricks of the trade. By the end of 2003, about 20 families were supplying eggs to two duckling units, each capable of producing about 600 ducklings per batch. Having seen the benefits for their members, BDS is planning to establish more hatcheries in their project area.

To establish a new hatchery, at least 500 fertile eggs need to be obtained from any duck farm in the country. In order to ensure the eggs are fertile, the chosen farms must have at least one male for every eight female ducks.

Ensure access to vaccines, provide vaccination & disease treatment support

Timely availability and provision of duck vaccines is the next essential element of the model. In Bangladesh, duck vaccine production is limited and in the hands of the government. Production takes place in the Livestock Research Institute in Dhaka and Comilla, and at the vaccine production centre of the Bangladesh Agricultural University in Mymensingh. Vaccines are then distributed to the districts.

In some cities, vaccines may be available in the bigger agribusiness shops, but generally they can only be bought routinely at the district or upazila Livestock Office. Their staff and those of FIVDB, can diagnose duck diseases. For diagnosis and timely access to vaccines, good contacts with these government institutions are essential.

Various companies such as Bangladesh Pharmaceuticals produce medicines. Duck medicines are similar to those for chickens, which because of wide-scale government support to the industry, are readily available in every pharmaceutical shop. The bottleneck clearly lies in the availability of duck vaccine, not the medicines.

Once vaccines are available, the ducklings have to be vaccinated. Professional vaccinators were trained in areas where new duck farms were established. In some cases, village women were trained and became vaccinators for all rice-duck farms in their community.

Rear ducklings

This household activity is generally conducted by women. Rice-duck rearing families purchase ducklings from outside or produce them themselves. As housewives become experienced at hatching and nursing the ducklings the mortality rate decreases significantly. Ducklings are reared until they are 20-25 days old when they can graze in the paddy fields.

"It is very time consuming to look after the eggs and ducklings, but I now make better use of idle time and plan my day much more," says Anowara Begum from Donokandi village in Sylhet. She's been involved in rice-duck culture since 2001 and hasn't regretted a single minute of it. Anowara Begum hatches the eggs and rears the ducklings in the bedroom of her mud house. Clearly, no large expensive infrastructure investment are needed.

Hatching ducklings in your bedroom. Anowara Begum looks at her one-day old ducklings. She will nurse them for the next three weeks, until they are old enough to graze outside.

Implement rice-duck farming

Resource-poor farmers can rear about 30 ducks on 20 *decimals* of land (a *decimal* is hundredth of an acre, or about 40 square meters, so fields are 800 square meters). Without the technical details, it is worth mentioning that

management costs can be significantly reduced if rice-duck is implemented at the community level with groups of farmers having adjacent plots, rather than by individual farmers (see Box 12.1). This improves the efficiency of duck herding, and protection from predators while reducing fencing costs.

Feeding is required during two months of the dry and two months of the flood season when natural food is unavailable. If proper care is not taken, ducks lose weight and become prone to diseases. Better-off farmers with 300-500 ducks generally buy broiler food for when natural feed is unavailable, whereas poorer farmers with less than 100 ducks mix rice husks with weeds, and collect frogs and snails from the flood plains. In Srimongal, MAC Bangladesh and AAS promote the use of duckweed *Lemna perpusilla*. Although readily available, duckweed can also be cultivated to have a more steady supply (Skillicorn et al., 1993).

Provide credit

Credit may be required to set up a small-scale household duckling production unit and to embark on rice-duck farming. NGOs and non-commercialised banks are the main sources of credit. Typically setting up a small-scale household duckling production unit will cost Tk 15,000 (US$ 264).

Resource-poor families who want to embark on rice-duck need about Tk 12 (US$ 0.21) per duckling and some additional capital to purchase feed and vaccines. These costs can be recovered in one season, so only a short-term loan is needed. However in Barisal, farmers who were not BDS members said that they were too afraid to take microcredit because they feared they would not be able to make weekly repayments (Orr et al., 2004).

Provide training

To optimise the rice-duck system, specific training is essential for paddy and duck farmers to integrate the two farming methods. It is essential that farmers are first made aware through village group discussions and video shows that ducks do not harm the rice.

Women are trained at FIVDB's training centre, through practical field orientation at their homestead, group discussions, farmers' workshops, and communication materials such as videos, posters, leaflets and the monthly FIVDB newsletter *Gram Bhanhob*. A training module for rice-duck is available, along with a guide book by Khan and Ahmed (2004).

In FIVDB's working area there are many male and female groups, village federations, farmer extension agents, community learning centres and community libraries. These community institutions have facilitated the implementation and management of field activities, and ensure long-term sustainability. It is anticipated that within a few years farmers will be capable of sustainably managing rice-duck systems themselves.

THE WEAKEST LINK

Vaccine supply is the weakest link of the system, as this is entirely in the hands of the government. When selecting partners to implement rice-duck, establishing good links with the vaccine supplier in the region is of utmost importance. In future, it would be highly beneficial if private companies like Bangladesh Pharmaceuticals were to produce vaccines. With their efficient distribution system duck vaccines could become more readily available to farmers at crucial times.

The supply of ducklings in the right quantity, at the right age and on time is also a weak link. Setting up a village duckling production unit can be pursued to overcome this weakness.

Rice-duck is a new system and thereby its extension needs to be coupled with capacity building for both the service provider and farmers. As we needed to build confidence, each organisation and each village will need to build confidence in the technology itself.

INTERCHANGEABILITY OF ACTORS

One organisation or a number of partners, depending on their comparative advantage, could potentially implement each activity of the enterprise web. Selecting households in a new area, for instance, is better done by local NGOs or community-based organisations, as they have a long-term engagement and commitment to their communities.

All NGOs with an interest in agriculture can embark on rice-duck culture, if they get the necessary training. Large NGOs with credit programmes which are already working with poor farmers would seem obvious potential collaborators at first. "Most large NGOs are engaged with broilers rather than ducks, because it is a shorter-term investment," says Malik Anwar Khan, "so it is better to build partnerships with smaller NGOs." These days, government policy favours more highly intensive poultry farms.

DIFFICULTIES, RISKS AND ASSUMPTIONS

The first major obstacle to overcome was to change an old misconception that ducks are harmful to rice. This has been overcome by involving farmers and other community members in the research.

Letting the ducks out. Young ducklings need particular protection from predators, such as birds of prey or mongooses. Any family member, but usually children and/or women, are given this responsibility.

During the first season duck mortality occurred because of poor management during hatching and nursing and because of a scarcity of duck food and vaccines. Another concern, which was unexpected, was the loss of ducklings from the predatory mongoose. Also, sudden seasonal flash floods and droughts occurred in some areas. All these difficulties triggered project staff to emphasise specific technical issues in future training sessions and to jointly look for local solutions.

Snail collection to feed ducks is an important additional income source for women, but snails may become overexploited if no plan for sustainable management of the *beel* (seasonal water body) is developed (Sultana et al., 2001). Therefore, in areas where natural food scarcity occurs, experiments should be conducted to expand the integrated rice-duck system with rearing of snails or duckweed, as mentioned earlier. Or the nitrogen-fixing fern *Azolla* could be used to enhance nutrients and provide an in *situ* source of duck feed, as successfully tested in the Philippines (Cagauan et al., 2004). FIVDB also has experience in culturing earthworms (Khan, 1994).

Organic rice. Ducks eat weeds, insects, and snails while fertilising the land with their droppings. They create perfect conditions for organic rice cultivation.

When water comes from communal irrigation sources, ducks may die following pesticide application in neighbouring fields, further emphasising the importance of a community approach.

But above all, for Bangladeshi farmers timely access to crucial duck vaccines, as described earlier, remains the major risk.

SCALING UP

As rice-duck is a new concept for Bangladesh, changing people's perception is the first prerequisite to adoption. PETRRA introduced rice-duck to the nation through *Rhidoye Mati o Manush* (Land and People), a popular weekly agricultural programme on Channel i.

Wherever ducks are available in the country, rice-duck could be introduced once there is a positive attitude towards the new system. Experienced farmers could become increasingly involved in convincing and training others. To scale up, FIVDB plans to experiment with local users-pay systems whereby poor farmer groups save funds and contribute a nominal fee in return for training and technical assistance.

Rice-duck could become a suitable system for the organic production of aromatic rice, which is generally grown in larger blocks of land. The specific conditions that have to be fulfilled for this system are described in Chapter 14. The potential for rice-duck culture in Bangladesh is high: not only is rice yield increased by 20%, but the rice is also produced organically. Millions of babies eat cereals on a daily basis, so the market potential for organic rice is enormous. Certification for 'organic rice' can also provide a price premium for farmers.

Conclusion

Three years of research have shown that rice-duck farming is economically profitable, environmentally friendly, and technically feasible for poor farmers in Bangladesh. However, before embarking on this new system, an organisation must carefully plan with whom to partner, and where credit, vaccines and ducklings can be sourced. Technical expertise is available in Bangladesh which was strengthened during this project, but this integrated system will only work if all the required conditions are fulfilled.

References

Ahmed, G. J. U., Hossain, S. T., Islam, M. R., Anwar, M. A. and Biswas, J. P. (2004) Integration of rice-cum-duck farming for resource-poor farm households. In: Workshop Proceedings: Emerging Technologies of the PETRRA Sub-projects. Organised by PETRRA-IRRI and BRRI, at BRRI Auditorium, Gazipur.

Cagauan, A. G., Branckaert, R. D. S. and Van Hove, C. (2004) Rice-duck farming in Asia: Increasing its production potentials by integration with fish and the nitrogen-fixing aquatic fern Azolla. The First INFPD/FAO Electronic Conference on Family Poultry. Available from http://www.fao.org/ag/AGA/AGAP/LPA/Fampo1/freecom4.htm

Khan, M. A. (1994) Hansh Paloner Adhunik Padhti. A book on the principles of duck farming system and its management. ITDG and FIVDB, Dhaka, Bangladesh. [in Bangla]

Khan, M. A. and Ahmed, G. J. U. (2004) Technical Guide Book on Integrated Rice-Duck Farming Systems. IRRI, Dhaka, Bangladesh.

Orr, A., Seema, F., Nabi, S. A. and Peter, J. I. (2004) From Technology to Livelihoods: Case studies of four PETRRA sub-projects. Consultancy report. IRRI, Dhaka, Bangladesh.

Peter, J. I. (2004) Cost-Benefit Analysis of Three PETRRA Sub-Projects: Second Part. IRRI, Dhaka, Bangladesh.

Sultana, P., Thompson, P. M. and Ahmed, M. A. (2001) Women-led fisheries management - A case study from Bangladesh. Global Symposium on Women in Fisheries, 29 November 2001, Koashiung, Taiwan.

Skillicorn, P., Spira, W. and Journey, W. (1993) Duckweed Aquaculture. A New Aquatic Farming System for Developing Countries. The World Bank, Washington. Available from http://www.ntrnet.net/~skilli/duckweed.htm#Duckweed