The novel tilapia–rabbit integrated culture: A means for poverty reduction for rural people

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Why Tilapia-Rabbit Integration?

Rabbit (Oryctolagus cuniculus), the “micro livestock” has great potential in providing protein to the vast low-income populations in developing countries (Chakrabarti et al. 1999). Because of a shorter generation interval (Lebas et al. 1986) and high prolificacy, (breeding 5-7 times a year), rabbit farming gives quick returns with low investment, needs little space and results in a high market price compared to other livestock. Many people in Bangladesh prefer rabbit meat as a conventional food item, if available (Reza 1999). Rabbit meat is highly nutritious, easily digestible and an excellent quality food for all people, especially old age and cardiac patients. The meat has comparatively less fat (8 percent), high protein (25 percent) and low cholesterol (50 mg/kg wt), suggesting that it is more suitable for patients (Alabama and Ardeng 1989). The per capita animal protein consumption in Bangladesh is only 17.3 g per day (BBS 1998), contrasting with the standard requirement of 36 g recommended by UNO (Ahmed and Islam 1985). The supply of animal meat lags far behind the requirement for a healthy life. Thus, rabbit can play a major role in supplying protein for a healthy diet, mitigating the impending food security problem.

Bangladesh is the most populated country per unit geographical area in the world, having about 140 million people most of whom lack adequate access to food, health care and other basic needs. About 77 percent of the people live in rural areas and suffer from extreme poverty, malnutrition, ill health and illiteracy, which are regarded as barriers to poverty alleviation and development in Bangladesh (HKI 2002).

The promotion of integrated farming systems is thus recognized as a developmental strategy that may help alleviate the impending food crisis (Edwards 1986) and improvements of people’s livelihoods. But integrated aquaculture is not promoted as much as fish polyculture alone in Bangladesh (Ali 1990). Integrated fish farming, however, offers the opportunity for taking up diversified farming activities with optimum utilization of available resources for food production, thus increasing the household income of small farmers.

Raising rabbits on fish ponds is a comparatively new notion in the course of integrated farming in Bangladesh as a small enterprise for the resource poor farmers. This integration might hold promise and importance in other developing countries where resource poor farmers have to make a serious effort to integrate their various farming activities (Woynarovich 1980, Engle 1987, Gupta 1991) so as to improve their livelihoods by creating self-employment opportunities.

Researchers from Bangladesh Agricultural University (BAU) and a non-government organization (NGO) – Jalal Nagar Development Project (JNDP) introduced rabbit farming in rural households of Mymensingh, Bangladesh in 1998. Subsequently, the Department of Animal Nutrition of BAU has carried out research on rabbit farming, nutrition and health and hygiene. As established with other livestock and poultry, it was thought that integrated rabbit-fish farming would also be technically feasible and suitable for comparatively resource-poor farmers. Therefore, the Department of Fisheries Biology and Genetics, at BAU undertook research to investigate technical and economic viability of integrated tilapia-rabbit farming. Acceptability of rabbit meat as a halal5 food by the Muslim community of Bangladesh was also assessed.

The Research

Two treatments with three replications were involved. Monoculture of sex reversed tilapia, Oreochromis niloticus (individual weight 2.5 g; at 30,000 fingerlings/ha) and integrated tilapia-rabbit farming at 30,000 fingerling tilapia/ha plus 1000 rabbits/ha (350 g and 410 g individual weight in the laboratory and on-farm). The study was carried out for a period of 152 days in 2004 and 2005, initially at the BAU Field Laboratory of the Faculty of Fisheries and, subsequently, at on-farm ponds at nearby Muktagacha Upazilla, Mymensingh.

The average area of the selected ponds was 80 m² with an average depth of 1.25 m. Ponds were initially treated with lime at the rate of 250 kg/ha followed by organic (cowdung 3,000 kg/ha) and inorganic fertilization (urea and triple superphosphate at 100 kg/ha each). No followup fertilizers were supplied in the control pond.

Low cost and locally available materials were used for constructing rabbit sheds on the pond embankment and the
rabbits were kept in bamboo cages (Figure 1). The cage size was 0.42 m³ (1.2 m x 0.7 m x 0.5 m) set on a double tier. The space for one rabbit was 0.14 m². All rabbits were vaccinated before starting the experiment. Soft green grasses and seasonal vegetables were made available as food for the rabbits 24 hours a day (Figure 2). In addition, a mixture of broken rice (50 percent), polished rice (48 percent) and salt (two percent) were provided at two percent body weight daily. Chick-pea was provided at one percent of body weight for the lactating does and young bucks. All rabbits were weighed individually every month to determine growth rates.

The dung and urine of the rabbits were collected in earthen jars every morning, a slurry was made, water was added and the mixture was distributed over the entire pond surfaces under the rabbit-fish treatment ponds every 3 days. No other organic and inorganic fertilizer was applied. Locally available rice bran was applied to the ponds at a rate of 3-5 percent of the tilapia biomass and all the ponds were subjected to the same regime of feeding. Every 15 days, tilapia were sampled using a seine to determine their growth, FCR and SGR. A range of water quality parameters, including temperature, Secchi disc depth, pH, DO, NO₃⁻N, NH₄⁺-N, PO₄⁴⁻-P and chlorophyll a, were determined but not reported in this article.

Since it is not a conventional food item, consumers might have been confused about rabbit meat and, therefore, a group discussion followed by a test panel for rabbit meat was organized to discern consumer perception of the acceptability of rabbit meat. A total of 46 persons were invited for the test panel of cooked rabbit meat, of which 22 were university teachers, 12 journalists and 12 students. Cooked chicken meat and rabbit meat along with a questionnaire were distributed to the attendees.

Growth performance of animals. The individual harvest weights of tilapia were 181g and 150 g in the tilapia-rabbit integration system recorded in laboratory and on-farm ponds; the same were, 136 g and 100 g in tilapia monoculture (Figure 3). This indicated that the size of tilapia was much higher in tilapia-rabbit culture than in tilapia monoculture. In rabbit-tilapia culture, the net production of tilapia was 3,494 kg/ha in laboratory ponds and 3,270 kg/ha in on-farm ponds during the 152-day culture period. In the case of tilapia monoculture, the recorded net productions were 2,454 kg/ha and 2,120 kg/ha in laboratory and on-farm ponds (Table 1). Therefore, net fish production was about 40 percent higher in integrated farming than in tilapia monoculture. The survival rates of tilapia in tilapia-rabbit integration were 66 and 73 percent in laboratory and on-farm ponds, whereas, in tilapia monoculture, the survival rates were 62 and 72 percent.

The initial average weight of rabbits was 350 g and 410 g and the final weights were 2,200 g and 2,120 g in laboratory and on-farm locations during the culture period. In both sites a total of 1,000 rabbit ha⁻¹ were reared that resulted in 2,200 kg/ha and 2,100 kg/ha in the laboratory and farm locations. In addition 2-4 rabbit kids/rabbit were produced in five months.

Quantity and Quality of rabbit dung as manure. A total

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of 2 kg and 3 kg waste/week were produced by three and six month old rabbits and the waste might have produced sufficient primary production in the pond (Figure 4). The nitrogen (N), phosphorus (P) and potassium (K) compositions of rabbit dung were compared with goat and cow dung in (Table 2). These findings indicate that the nutrient compositions and moisture content of rabbit dung are better than those of other livestock.

**Economics.** Fish were sold BDT 75/kg and rabbit BDT 150/kg. The results appearing in Table 3 indicate that rabbit-fish integration is a profitable business resulting 52 percent net profit as compared to 24 percent in tilapia monoculture. However, total investment and return in tilapia rabbit integrated culture was 3.3 and 4 times higher than in tilapia monoculture.

**Consumer Perception**

The majority of the Bangladesh people are Muslim and restricted by religious laws in the foods they can eat. Therefore, one religious cleric, Mufti Md. A.K.M Fazlul Haque, was invited to present the religious evidence regarding rabbit meat consumption by Muslims. After reciting several *hadiths*, he concluded that rabbit meat is totally acceptable if properly slaughtered (Figure 5).

After having rabbit meat, 74 percent of the participants reported that rabbit meat was tasty; the remaining 26 percent opined the meat as medium tasty. No participant ranked the meat as not tasty. About 43 percent of the participants expressed rabbit meat as tender and 57 percent as medium soft. None reported rabbit meat as tough.

The participants were asked whether they had tried rabbit meat before. About 20 percent (9 persons) had tried it once, 15 percent (7) had tried more than once and the rest 65 percent (30) had never tried rabbit meat. Among the participants, 98 percent (45 persons) were eager to eat rabbit meat again.

**The Prospects of Integrated Rabbit-Fish Farming**

All participants in the group discussion were positive about the future prospects of integrated rabbit-fish culture in Bangladesh. According to the participants, this type of integrated culture would be highly profitable for the rural poor. Rabbit-fish culture would definitely contribute to reducing protein deficiency among the people of Bangladesh. The initial investment is comparatively lower and affordable by resource poor farmers. Most of the participants also said that they were willing to buy rabbit meat from the market regularly if the meat was available (Reza 1999). Some also opined that effective training and dissemination of information is a prerequisite to popularize the rabbit-fish integration.

Although no health problems with rabbits were noticed in the present study, special care should be taken in disease pre-

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viation. Rabbits are susceptible to cold attacks with fever and severe skin disease. Cold attack should be prevented by housing them in a warm environment. Skin disease can be prevented by cleaning and disinfecting the cages on a regular basis. Bio security compliance should be maintained in the rabbit sheds.

Notes
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5 Halal: Halal is an Arabic term meaning “permissible”. In the English language it most frequently refers to food that is permissible according to Islamic law. In the Arabic language it refers to anything that is permissible under Islam. (www.wikipedia.org)
6 Hadith: Hadith are oral traditions relating to the words and deeds of Prophet Muhammad. Hadith collections are regarded as important tools for determining the Sunnah, or Muslim way of life, by all traditional schools of jurisprudence. (www.wikipedia.org)

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