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Farmers Participatory Productivity Evaluation of Integrated Rice and Fish Systems in Transplanted Aman Rice

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Abstract: Productivity of integrated rice + fish system was evaluated in farmer's field. Fingerlings of Thai Sharpunti (*Puntius gonionotus*) and Carpio (*Cyprinus carpio*) at a stocking density of 15 fingerlings (7 Thai Sharpunti + 8 Carpio) per decimal were grown with BRRIdhan-31 and BRRIdhan-32. Two more farmers' sole rice fields with the same varieties were also selected for comparative study. Rice + fish system gave higher rice yields and fetched higher gross margin than sole rice cropping system. Farmers prefer more rice + fish system than single t. Aman because of its higher return.

Key words: Farmers participatory, integrated rice + fish system, medium highland-1, resource poor farmers and system productivity

Introduction

In Bangladesh, water bodies estimated an area of about 20,946,694 ha with a total annual production of fish of 13.73 lakh metric ton (Fishery Week, 1998). However, this amount of fish is not sufficient to meet the demand of the people of Bangladesh. On the other hand, the majority of the poor farmers of the country could not afford to eat meat, egg, milk etc. because of their high prices. Available information reveals that 60 percent of the animal protein comes from fish (Fishery Week, 1998). In Bangladesh there is about more than 2.83 mha (million hectare) of seasonal paddy fields where water stands for 4 to 6 months (Anonymous, 1993). This biophysical resource of the farmers could be utilized through rice + fish culture. Under this situation integration of fast growing fish species in t. Aman crop may offer an excellent opportunity to increase the system productivity, farmers income and also to meet the protein demand of farm family. In India, Ghosh *et al.* (1985) reported that integration of aquaculture with agriculture assured more return from unit arable land than cultivated one. It has also been reported by Panda *et al.* (1987) and Lightfoot *et al.* (1990) that concurrent culture of fish within irrigated rice increases nitrogen concentration and uptake by rice plants and rice yield, respectively. The cultivation of fish from rice field has received a great deal of potential in the recent past. However, very little information is available on the performance of farmer's participatory rice + fish production system in transplanted Aman rice. With this view in mind, the

study was undertaken to evaluate the performance of rice + fish system in farmer's fields to increase the total productivity and income of the farmers.

Materials and Methods

The experiment was conducted at the BRR outreach Farming System Research and Development site, Kapasia, Gazipur during the season of t. Aman 1999. Four farmer's rice fields 1418, 1620, 1823 and 405 m² having a small ditch of about 0.5 to 1 m depth owned by the farmers were selected for this purpose. Before planting rice, two diagonal canals of about 30 cm depth were prepared in each field for easy movement of fishes from ditch to field and vice versa. Thai Sharpunti (*P. gonionotus*) and Carpio (*C. carpio*) were grown with BRRIdhan-31 and BRRIdhan-32. Fingerlings of Thai Sharpunti (*P. gonionotus*) and Carpio (*C. carpio*) of about 9-11 and 11-13 g weight were released on August 20, 1999 at a stocking density of 15 fingerlings per 40.5 sqm (7 Thai Sharpunti + 8 Carpio). Thirty-days-old seedlings of rice varieties were transplanted in paired rows at a spacing of 25x20 cm². A fertilizer rate of 80-60-40 kg NPK ha⁻¹ was used in the experiment. All the Phosphorus and Potash were applied at the time of final land preparation while urea was applied in three equal splits at 15, 30 and 45 days after transplanting. Weeding was done whenever found necessary. No additional feeds were supplied to the fish. Two other farmers' rice fields of BRRIdhan-31 and BRRIdhan-32 where fish were not reared were selected to compare the productivity of single rice system with that of rice + fish system. When 80 percent of the grains were ripe, two crop cuts of 5 sqm sampling area were taken from each field. The yield of clean rough rice was expressed in tons per hectare (t ha⁻¹), corrected to the 14 percent moisture content. Fishes were harvested on December 10-15, 1999. All other cultural and management practices adopted by the farmers are presented in Table 1.

A scoring system ranging from 1 to 10 where lower, intermediate and higher numerical values stand for poor, intermediate and good performance, respectively was used to determine farmers' preference on integrated rice + fish and single rice system. In this method, an individual farmer was asked to put a numerical value for each character studied (Table 3) and then it was validated by a group of farmers whether the denoting number of the individual farmer was correct or not.

Table 1: Management practices for rice + fish culture of four farmers fields

Management factors	Farmer 1	Farmer 2	Farmer 3	Farmer 4
Plot size (decimal)	35	40	45	10
Fish species	Thai Sharpunti (S) & Carpio ^o	S & C	S & C	S & C
Rice variety	BRRIdhan-31	BRRIdhan-32	BRRIdhan-32	BRRIdhan-31
Transplanting date	Aug. 5	Aug. 5	Aug. 5	Aug. 5
TP systems	Paired line	Paired line	Paired line	Paired line
Date of fingerlings release	Aug. 20	Aug. 20	Aug. 20	Aug. 20
Initial length (cm) of Sharpunti, Carpio	10-12, 12-14	10-12, 12-14	10-12, 12-14	10-12, 12-14
Initial weight (g) of Sharpunti, Carpio	9-11, 11-13	9-11, 11-13	9-11, 11-13	9-11, 11-13
Fingerlings release (no./plot)	S-245 C-280 Total (T)-525	S-280 C-320 T-608	S-315 C-360 T-675	S-70 C-80 T-150
Fish harvested (no./plot)	S-217 C-255 T-472	S-258 C-290 T-548	S-275 C-330 T-605	S-60 C-70 T-130
Rice harvesting date	Nov. 20	Nov. 10	Nov. 11	Nov. 18
Fish harvesting date	Dec. 10	Dec. 12	Dec. 15	Dec. 11
Average final wt. (g) of Sharpunti & Carpio	115 & 160	100 & 145	115 & 160	100 & 145

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Table 2: Yield and economics of rice + fish culture in farmers fields

Systems	Yield (t ha ⁻¹)			TVC (Tk. ha ⁻¹)	Gross return (Tk. ha ⁻¹)	Gross margin (Tk. ha ⁻¹)
	Rice	Straw	Fish			
BRRIdhan-31 + Fish (Av. of two farm)	5.03	5.43	0.44	30,375	62,010	31,635
BRRIdhan-32 + Fish (Av. of two farm)	4.46	4.73	0.44	30,375	57,890	27,515
BRRIdhan-31 (sole)	4.20	5.00	-	18,690	30,200	11,510
BRRIdhan-32 (sole)	4.30	5.00	-	18,690	30,800	12,110

Farmgate price (Rice): Tk. 6.00/ kg, (Straw): Tk. 1/kg, (Fish): Tk. 60/kg TVC: Total variable cost

Results and Discussion

BRRIdhan-31 + fish and BRRIdhan-32 + fish systems gave 5.03 and 4.46 t/ha rice yield, respectively in addition to 0.44 t/ha fish yield in each case (Table 2). As sole rice, BRRIdhan-31 and BRRIdhan-32 gave an average yield of 4.20 and 4.3 (t ha⁻¹), respectively. Results also reveal that rice + fish system increased yield of BRRIdhan-31 and BRRIdhan-32 by 20 and 4%, respectively which might be due to the additional supply of manure from fish excreta, control of pest by fishes and availability of different plant nutrients. These results are in agreement with those of Rahman *et al.* (1995), Hora and Pillay (1962) and Haroon *et al.* (1992), Hossain (1993) and Xu and Guo (1992) where they also reported that the integration of fishes in rice fields increased the rice yields.

Table 3: Farmers' preference ranking of rice + fish and single t. Aman cropping system

Factors	Rice-fish system	Single rice system
Extra cost involved	7	8
Cost for insect control	9	5
Cost for weed control	8	4
Damage by rates	9	6
More rice equivalent yield/ Rice yield	10	5
Total	43	28

Range of score: 1 to 10 where, lower, intermediate and higher numerical values stand for poor, intermediate and better performance of the systems.

Similar observations were also reported by Xu and Guo (1992) where they found that the organic matter, nitrogen, available phosphate and potassium levels were higher in fields where rice had been grown with fish compared with rice fields without fish. The availability of these nutrients in the rice fields suggests that fish culture in rice fields stimulate the activities of microorganisms and availability of organic matter increases and the release of other nutrients increases, which favour the rice growth.

Cost and return analysis showed that BRRIdhan-31 + fish and BRRIdhan-32 + fish systems fetched gross margin of Tk. 31,635 and Tk. 27,515 t/ha, respectively which was 175 and 127 % higher than those from sole BRRIdhan-31 and BRRIdhan-32 (Table 2). The higher gross margin in BRRIdhan-31 + fish and BRRIdhan-32 + fish were associated with higher yield of rice and additional fish yield compared with farmers' sole rice.

Farmers preference ranking: Farmers' preference on rice + fish technology is presented in Table 3. It can be seen from the table

that rice + fish system secured higher score (43) compared with single t. Aman system (28). The higher score was associated with higher system productivity and less costs for pests management. The results of the study imply that integrated rice + fish system is highly remunerative and could be extrapolated in similar agro-ecological zones of Bangladesh.

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