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Rice-cum-fish Farming in Selected Areas of Mymensingh District

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Abstract: The study was conducted in three selected villages of Ditpur union under Bhaluka upazila of Mymensingh district to determine the relative profitability of rice production with and without fish in rice-cum-fish farms. A stratified random sampling technique was followed. In total 60 farms were selected for the study. Gross cost of rice production with fish was Tk. 31702 ha^{-1} and without fish was Tk. 29121 ha^{-1} in rice-cum-fish farming. Cash expenses of rice production with and without fish were Tk. 14357 and 15219 ha^{-1}, respectively. Net return above cash expenses of rice production with and without fish was Tk. 35160 and 19776 ha^{-1}, respectively. Net return above full cost was Tk. 18670 and 5011 ha^{-1}, respectively. So, rice production with fish was more profitable than without fish in rice-cum-fish farming. The study showed that lack of institutional credit, higher priced of inputs, lack of marketing knowledge regarding fish and rice cultivation, insufficient water in dry season, attack of diseases and theft of fish are the major problems facing the farmers. If these problems are immediately be solved, the yields of both rice and fish will possibly be increased tremendously.

Key words: Rice-cum-fish farm, profitability, cash expenses, full cost

Introduction

Bangladesh is an agro-based developing country. The future development of the country is very much related with agricultural sector. As an economic activity fisheries rank second to agriculture sector. Fishery as on the major sub-sectors has been playing a very significant role in nutrition, employment, foreign exchange earning, good supply and more importantly socio-economic stability in the rural areas. Bangladesh is a land of rivers and the country is very rich in natural water resources in the form of rivers, reservoirs, lakes, ditches, flood plains, rice-fields etc. In spite of these large resources unfortunately, the per unit area production of fish in Bangladesh is low compared to that of the other advanced countries of the world purring the last ten years over fishing, flood control dam, irrigation barrage, irrational use of chemical fertilizers and pesticides, catching of egg bearing fish, under size fish etc. have substantially depleted the natural stock production statistics suggest that total fish production in Bangladesh has declined at least 10% since 1979 (Anonymous, 1991) and the marine fish production in the meantime has reached maximum sustainable yield. At the same time the demand for fish has increased because of the rapidly expanding population. In order to increase the fish production and to meet the increasing demand of animal protein for the expanding population intensive and semi-intensive cultural practice is necessary to enhance both the quality and quantity of fishes. For the success of intensive and semi-intensive fish culture, use of new technology is a prerequisite.

There are about 2.63 million hectares of inundated rice fields in Bangladesh where water stands for about four to six months (Karim, 1978). The fish culture in rice fields will increase the fish production. At the same time it will also increase the rice production to a considerable extent. Hora and Pillay (1962) observed that the yield of rice increased by approximately 15% in Indo-pacific countries due to adoption of fish culture in rice field. It has also been reported that the introduction of fish in the rice fields increase rice yield because the fishes eat up harmful insects, pests and graze on weeds (Coche, 1967). Alam (1996) observed that farmers got 3-5 of rice and 234 kg of fish from one hectare of rice field. The net benefits obtained from fish and rice were Tk. 1350 and 500, respectively. Fishes have widely been cultivated in the rice field without any care and management from the dawn of rice civilization in Bangladesh just like an open water fishery. The people generally catch fish from rice field before or after harvest. Fish culture in rice-field can provide and adequate means of food for the rural people, since the nutritious grain and a high quality valuable protein is produced on the same piece of land (Schuster, 1955; Coche, 1967). Dewan (1992) pointed out that the fish culture in paddy fields had enormous prospects in Bangladesh and observed that the present low yields of paddy could be increased to a considerable extent by adopting scientific management practices.

The HYV technology was introduced in Bangladesh in the sixty's to increase agricultural production and specially to attain self-sufficiency in food grain and to get higher income. Expansion of modern irrigation facilities during the Rabi season had led to substitution of many enterprises by rice. However, recent trends in agricultural production in Bangladesh show that profitability in rice production is gradually declining. During the year 1992/93, it was reported that due to harvesting of bumper rice crop and the consequent fall in the market price the rice farmers were not even able to realize the cost of production. Therefore, there is a need to adopt other enterprises which fulfil our food requirement, energy and protein and which are also profitable from farmers point of view. So, farmers in some places have already changed their technology from rice mono-culture to rice-cum-fish production.

So, the objective of this study was to assess the relative profitability of per hectare rice production with and without fish in rice-cum-fish farms.

Materials and Methods

Farmers were selected by applying stratified random sampling technique. In total 60 farms were selected for collecting data for the study. In rice-cum-fish farming, rice and fish are produced in the same field and almost in the same period. Three villages, namely Ditpur, Dhulia and Randi under Bhaluka upazila in the district of Mymensingh were purposively selected for collecting necessary data during December to May 1998-99. The tabular technique of analysis was used. This technique is based on arithmetic mean, percentage ratio etc.

Interest on operating capital (IOC): The amount of money needed to meet the expenses on hired or purchased inputs such as, human labours, animal labours, seedlings, fingerlings, fertilizers, irrigation, insecticides, feed for fish etc. were treated as operating capital. Interest on operating capital was charged @ 9% annually and was estimated for the period during which the operating capital was used.

$$IOC = \frac{\text{Operating capital} \times \text{Rate of interest} \times \text{Time considered}}{2}$$

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Interest on land value: The average value of land was estimated according to the assessment of the farmers. Interest @ 9% per annum was charged for five months on the average value of land. Gross returns ha^{-1} was determined by multiplying the rice and fish yields with their respective farm-gate prices. The net returns above cash expenses were measured by subtracting the cash expenses from gross returns while the net returns above total expenses was estimated by deducting total expenses from gross returns.

Results and Discussion

Cost of rice production: For producing rice the average per hectare gross cost was calculated at Tk. 29121.75. On the other hand, the average per hectare cash expenses was estimated at Tk. 14357.02 (Table 1).

Human labour: For the production of rice; 149.42 man-days ha^{-1} of which 22.24 and 127.18 man-days of human labour were home supplied and hired labour, respectively (Table 2). The maximum human labour was used for weeding and it covered 27.94% of the total human labour cost. The second largest use of human labour was noticed for harvesting, carrying and threshing which covered 24.72% of total human labour cost. Transplanting and land preparation covered 23.02 and 14.81% of total human labour cost.

Animal labour and mechanical power: The per hectare total animal labour use for the cultivation of rice was 10.59 pair-days of which 10.59 pair-days were farm supplied. The total animal labour cost per hectare was Tk. 847.20 and mechanical power cost per hectare was Tk. 571.00.

Seedling: In producing rice, the application of seedlings was estimated at 41.39 kg ha^{-1} of which 39.59 kg was farm supplied and 1.80 kg was purchased. The total cost of seedlings was Tk. 496.68, which covered 7.15% of the total material input cost (Table 3).

Fertilizer: In producing rice, farmers used three kinds of fertilizer. They used urea, TSP and MP @ 126.23, 72.56 and 52.59 kg ha^{-1}, respectively and their respective costs were Tk. 757.38, 1088.40 and 420.72 ha^{-1}. Urea, TSP and MP respectively shared 10.90, 15.67 and 6.06% of the total material input cost (Table 3).

Table 1: Per hectare cost and returns of rice production without fish in rice-cum-fish farms

Items	Quantity	Price per unit (Tk.)	Value (Tk.)
Cash expenses	-	-	14357.02
Human labour (man-days)	127.18	60.00	7630.80
Power tiller	-	-	571.00
Material inputs (kg):			
Seedlings	1.80	12.00	21.60
Cow dung	134.65	0.50	67.32
Fertilizers (kg):			
Urea	126.23	6.00	757.38
TSP	72.56	15.00	1088.40
MP	52.59	8.00	420.72
Water charge	-	-	3556.80
Pesticides	-	-	243.00
Non-cash expenses		-	14764.73
Human labour (man-days)	22.24	60.00	1334.40
Animal labour (pair-days)	10.59	80.00	847.20
Seedling (kg)	39.59	12.00	475.08
Cow-dung (kg)	636.71	0.50	318.35
Interest on operating capital	-		539.70
Interest on value of land	-	-	11250.00
Gross cost (Tk.)	-	-	29121.75
Gross return (Tk.):			34133.10
Rice (kg)	4820.65	6.70	32310.00
By product	-	-	1823.10
Net return above cash cost	-	-	19776.08
Net return above full cost	-	-	5011.35

Irrigation: The per hectare cost of irrigation was Tk. 3556.80 for rice production which occupied 51.18% of total material cost (Table 3).

Cow dung: Farmers used both farm supplied and purchased manure's. The per hectare total amount of cow dung used was 771.36 kg of which 636.71 and 134.65 kg were farm supplies and purchased respectively (Table 3). The per hectare total cost of cowdung was Tk. 413.60. It occupied 5.55% of total material input cost.

Interest on operating capital: Interest on operating capital for rice production was estimated at Tk. 539.70 ha^{-1} (Table 1). It constituted 1.85% of the total cost (Table 1).

Interest on land value: The value of land was estimated at Tk. 300000 ha^{-1}. The interest @ 9% per annum was calculated for the

Table 2: Operation wise distribution of human labour for rice production without fish in rice-cum-fish farms

	Family labour		Hired labour		Total	
Operations	Quantity man-days	Cost (Tk.)	Quantity man-days	Cost (Tk.)	Quantity man-days	Cost (Tk.)
Land preparation	9.14	570.64 (42.77)	12.99	779.40 (10.21)	22.13	1327.80 (14.81)
Transplanting	2.64	158.40 (11.88)	31.77	1906.20 (24.99)	34.41	2064.60 (23.02)
Weeding	2.04	122.40 (9.18)	39.71	2382.60 (31.22)	41.75	2505.60 (27.94)
Fertilizer used	3.49	209.40 (15.69)	-	-	3.49	209.40 (2.33)
Insecticides used	1.57	94.20 (7.05)	-	-	1.57	94.20 (1.05)
Harvesting, threshing and carrying	1.44	86.40 (6.48)	35.50	2130.00 (27.91)	36.94	2216.40 (24.72)
Drying and storage	1.92	115.20 (8.69)	6.13	367.80 (4.81)	8.05	483.00 (5.39)
Others	-	-	1.08	64.80 (0.84)	1.08	64.00 (0.71)
Total	22.24	1334.40 (100)	127.18	7630.80 (100)	149.42	8965.20 (100)

Table 3: Per hectare material inputs cost for rice production without fish in rice-cum-fish farms

Input items	Farm supplied (kg)	Purchased (kg)	Total (kg)	Cost (kg)	% of total cost
Seedling	39.59	1.80	41.39	496.68	7.15
Fertilizers (kg):					
Urea	-	126.23	126.23	757.38	10.90
TSP	-	72.56	72.56	1088.40	15.67
MP	-	52.59	52.59	420.72	6.06
Cowdung	636.71	134.65	771.36	385.67	5.55
Insecticides	-	-	-	243.68	3.50
Irrigation	-	-	-	3556.80	51.18
Total	-	-	-	6949.23	100.00

Source: Field survey 1999

Table 4: Per hectare cost and returns of rice production with fish in rice-cum-fish farms

Items	Quantity	Price per unit (Tk.)	Value (Tk.)
Cash expenses	-	-	15219.46
Human labour (man-days)	127.00	60.00	7620.00
Power tiller	-	-	794.70
Fertilizers (kg):			
Urea	159.64	6.00	957.84
TSP	68.52	15.00	1027.80
MP	41.24	8.00	329.92
Insecticides (Tk.)	-	-	238.57
Fingerlings (No.)	4263.95	0.90	3837.55
Oil cake (kg)	62.18	6.00	373.08
Rice bran (bag)	0.5	80.00	40.00
Non-cash expenses	-	-	16489.36
Human labour (man-days)	32.59	60.00	1955.40
Animal labour (pair-days)	10.59	80.00	847.20
Seedling (kg)	36.04	12.00	432.48
Cow-dung (kg)	1656.49	0.50	828.24
Rice bran (bag)	6.28	80.00	502.40
Duck weed (kg)	567.70	0.50	283.85
Poultry drop (kg)	75.71	0.50	37.85
Interest on operating capital	-	9.00	351.94
Interest on value of land	-	9.00	11250.00
Gross cost (Tk.)	-	-	31708.82
Gross return (Tk.):	-	-	50379.56
Rice (kg)	4192.14	6.70	28087.34
By product	-	-	2045.72
Fish (kg)	404.93	50.00	20246.50
Net return above cash cost	-	-	35160.10
Net return above full cost	-	-	18670.74

period of the five months, which amounted to Tk. 11250. The period of five months covered the operations starting from land preparation to harvest for rice production.

Cost of rice-cum-fish production: For the production of rice and fish, the per hectare gross cost was Tk. 31708.82 (Table 4). The per hectare cash expense was estimated at Tk. 15219.46 (Table 4). Thus the cash expense shared 47.99% of the gross expenses.

Human labour: Human labour share a major portion of total expenses of rice-cum-fish production. The per hectare family supplied and hired labour were estimated at 32.59 and 127.00 man-days (Table 5). The per hectare total cost for human labour was Tk. 9575.40, of which Tk.1955.40 were shared by family supplied labour and Tk. 7620.00 by hired labour. It is evident from the data that the land preparation occupied 18.09% of total human labour cost.

Animal labour and mechanical power: Total animal labour required for rice-cum-fish production was 10.59 pair-days ha^{-1}. Mechanical power was also used for the cultivation of rice with fish. The total animal labour cost ha^{-1} was Tk. 847.20 and mechanical power cost ha^{-1} was Tk. 794.70 (Table 4).

Seedling/fingerling: For rice-cum-fish production, farmers used both farm supplied and purchased seedlings. The total amount of seedlings used for rice was 38.32 kg ha^{-1} of which 36.04 kg were farm supplied and 2.28 kg were purchased (Table 6). The total cost of seedlings was Tk. 459.84 per ha^{-1}, which occupied 5.91% of the total material input cost. For rice-cum-fish production, the farmer used mainly purchased fingerlings. The number of fingerlings used ha^{-1} by the farmers stood at 4263.95 and its cost was Tk. 2385.70. The fingerling cost covered 30.67% of the total material input cost (Table 6).

Fertilizer: Farmers used three kinds of fertilizers in rice-cum-fish production. They used urea, TSP and MP @ 159.64, 68.52 and 41.24 kg ha^{-1} for rice-cum-fish production, respectively and their respective costs were Tk. 957.84, 1027.80 and 329.92 ha^{-1}. Urea, TSP and MP respectively covered 12.31, 13.21 and 4.24% of total material input cost (Table 6).

Feed: Rice-cum-fish farmers used four kinds of feeds, viz., oil cake, rice bran, duck weed and poultry drop. They used oil cake, rice bran, duck weed and poultry drop @ 62.18, 16.78, 567.70 and 75.71 kg ha^{-1}, respectively. Their respective costs were Tk. 373.08, 542.40, 304.40 and 40.60 ha^{-1} which represented 4.79, 6.97, 3.91 and 0.51% of total material input cost (Table 6).

Cowdung: In the study area, farmers used both farms supplied and purchased manure's for rice-cum-fish production. The per hectare use of cowdung was 2082.45 kg, of which 1656.49 kg

Table 5: Operation wise distribution of human labour for the per hectare rice production with fish in rice-cum-fish farms

	Family labour		Hired labour		Total	
Operations	Quantity (man-days)	Cost (Tk.)	Quantity (man-days)	Cost (Tk.)	Quantity (man-days)	Cost (Tk.)
Land preparation	8.60	516.00 (26.39)	20.26	1215.60 (15.96)	28.87	1732.20 (18.09)
Transplanting	2.38	142.00 (7.26)	33.92	1994.40 (26.18)	35.62	2137.20 (22.31)
Weeding	1.19	71.40 (3.66)	31.92	1915.20 (25.13)	33.11	1986.60 (20.74)
Fertilizer use	3.58	214.80 (10.99)	-	-	3.58	214.80 (2.24)
Insecticides use	1.20	72.00 (3.69)	-	-	1.20	72.00 (0.76)
Harvesting, threshing and transplanting	4.23	253.80 (12.98)	37.08	2224.80 (29.14)	41.31	2478.60 (25.89)
Drying and storage	5.96	357.60 (18.29)	4.50	270.00 (3.54)	10.47	628.20 (6.57)
Feeding and other	5.43	325.80 (16.67)	-	-	5.43	325.80 (3.40)
Total	32.59	1955.40 (100)	127.00	7620.00 (100)	159.59	9575.40 (100)

Table 6: Per hectare material inputs cost for rice production with fish in rice-cum-fish farms

Input items	Farm supplied	Purchased	Total	Cost (Tk.)	% of total cost
Seedling(kg)	36.04	2.28	38.32	459.48	5.91
Fertilizers (kg):					
Urea		159.64	159.64	957.84	12.31
TSP		68.52	68.52	1027.80	13.21
MP		41.24	41.24	329.92	4.24
Cow-dung (kg)	1656.49	425.96	2082.45	1116.00	14.35
Oil cake (kg)	-	62.18	62.18	373.08	4.79
Rice bran (kg)	6.28	0.50	16.78	542.40	6.97
Duck weed (kg)	567.70	-	567.70	304.40	3.91
Poultry drop	75.71	-	75.71	40.60	0.51
Insecticides	-	-	-	238.57	3.06
Fingerlings (No.)	-	4263.95	4263.95	2385.70	30.67
Total	-	-	-	7776.84	100.00

Source: Field survey 1999

were farm supplied and 425.96 kg were purchased (Table 6). The total cost of cow dung was Tk. 1116.60 ha^{-1}. It occupied 14.35% of total material inputs cost.

Pesticides: Farmers used a little amount of pesticides for rice-cum-fish production. The pesticides cost stood at Tk. 238.57 ha^{-1}.

Interest on operating capital: Interest on operating capital was estimated at Tk. 351.94 ha^{-1} for cultivation of rice with fish (Table 4). It constituted 1.15% of the total cost.

Interest on land value: In the study area, the average value of land was estimated at Tk. 300000 ha^{-1}. The interest @ 9% per annum was calculated for the period of five months, which amounted to Tk. 11250 (Table 4). For the cultivation of rice with fish, five months are needed to the entire production process i.e. land preparation to harvest operations.

Gross and net returns: When rice is produced with fish, the yields of rice and fish stood at 4192.14 and 404.93 kg ha^{-1}, respectively in rice-cum-fish farms. But when rice is produced without fish, the yield of rice is estimated at 4820.65 kg ha^{-1}. Gross returns were Tk. 50379.56 and 34133.10 ha^{-1} when rice is produced with fish and without fish, respectively. Net returns over full cost were estimated at Tk.18670.74 and 5011.35 ha^{-1} for rice with fish and without fish, respectively. On the other hand, the net returns over cash expenses stood at Tk. 35160.10 and 19776.08 ha^{-1} for rice production with and without fish, respectively.

Kohinoor *et al*. (1994) found that the additional net benefit from fish was Tk. 3256 ha^{-1}. Gross income from Thai Sharputi obtained by the farmers was Tk. 3570 ha^{-1}. Ghosh's (1992) study in West Bengal, India reveals that the farmers obtained rice yield ranging from 2000 to 4200 kg ha^{-1} while the average yield of fish stood at 11000 kg ha^{-1}, net income from rice-cum-fish culture ranged from Tk. 22000 to 43000 ha^{-1} in different plots. Thongpan *et al*. (1992) in their experiment in Thailand found that when rice is produced with fish, rice yields were consistently higher than monoculture rice production. The per hectare net income from the integrated rice-fish culture ranged from US $ 113 to 128. Sevilleja (1992) conducted experiment on rice-fish farming in Philippines. Production of rice was 5150 kg ha^{-1} while for fish was 208 kg ha^{-1}.

Problems and constraints in rice-cum-fish farm: In the study area, about 66% farmers reported that they had not adequate amount of operating capital. So, farmers had to borrow money from the non-institutional sources with high rate of interest. Most of the farmers did not get institutional credit. Attack of diseases hampered the production of rice-cum-fish, which they term as one of the major problems. Most of the rice-cum-fish farmers had to sell their products at home or local market at low price owning to the transportation problem.

Rice-cum-fish farm will be a media of development of Bangladesh if it is spread at the applicable areas over the country efficiently by extension workers. With a view to improving rice-cum-fish farming the following policy recommendations are given:

1) Application of scientific method in rice-cum-fish farming should be ensured. The modern practices need to be popularized among the farmers in order to take advantages of the additional monetary benefits obtainable from such practices,
2) Provision of training should be made,
3) Institutional credit should be made available on easy terms and condition and
4) Reasonable prices of fingerlings and other inputs should be ensured.

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