J. Bangladesh Agril. Univ. 10(1): 119–123, 2012 ISSN 1810-3030

Socioeconomic impact of rice-cum-fish culture in a selected areas of Bangladesh

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Abstract

The study examines the impact of the rice-cum-fish culture and the rice-mono culture on the rural households at Muktaghachha upazila of Mymensingh district in Bangladesh. Data were collected from 100 farmers of five villages following stratified random sampling technique. Activity budgets were prepared and comparisons were made through the tabular and statistical analyses. Both the rice-cum-fish culture and the rice-mono culture were profitable business for the farmers. However, farmers earned about 3 times higher profits from the rice-cum-fish culture than the rice-mono culture. Per hectare net returns of the rice-cum-fish culture and the rice-mono culture were Tk. 15345.00 and 5389.50, respectively. Rice yield, fish consumption, total cost were increased by 11.4, 14.5 and 48.9 percent respectively while human labour employment was increased by 9.4 percent in the integrated rice-cum-fish culture compared to the rice-mono culture. The study clearly hints that the rice-cum-fish culture provides greater scope for higher returns and employment opportunities of human labour than the rice-mono culture.

Keywords: Rice-cum-fish culture, Rice mono culture, Socio-economic impact

Introduction

Bangladesh is one of the developing countries in the world. Rice and fish are the staple foods in Bangladesh. Given the security of land and the need to meet the demand of the increasing population, alleviating poverty and malnutrition, there is no alternative to the rice-cum-fish culture (Gupta *et al*. 1997). Fish is the main source of animal protein, providing an average 8.4 gm per day, or 13.3 % of the average per capita total intake of protein (63 gm) (BBS, 2010). Not only the adequate supply of carbohydrate, but also the supply of animal protein is significant through rice-fish farming. Fish, particularly small fish, are rich in micronutrients and vitamins, and thus human nutrition can be greatly improved through fish consumption (Larsen *et al*. 2000; and Roos *et al*. 2003).

Integration of fish with rice farming improves diversification, intensification, productivity, profitability, and sustainability (Ahmed *et al*. 2007; and Nhan *et al*. 2007). It can optimize resource utilization through the complementary use of land and water (Frei and Becker, 2005). It is suggested that integrated rice-fish farming is ecologically sound because fish improve soil fertility by increasing the availability of nitrogen and phosphorus (Giap *et al*. 2005; and Dugan *et al*. 2006). The natural aggregation of fish in rice fields inspired the combination of rice farming with fish to increase productivity (Gurung and Wagle, 2005). It is found in several studies that rice-cum-fish culture become able to enhance net benefit by 64.4% and yield by 5% (Purba, 1998). So, it has been proved that the rice -fish integration is quite attractive both in environmental and economic points of view. Though several researchers attempted to study environmental and biological outputs of rice-cum-fish culture, studies on economic output is scant. So, the researchers attempted to undertake the study with the following objectives:

i. to assess the relative profitability of using rice-cum-fish culture compare to rice monoculture;
ii. to determine the effects of the rice-cum-fish culture in changing yields, total costs, fish consumption and labour employment as compared to the monoculture and;
iii. to identify the major problems in conducting integrated rice-fish farming.

Materials and Methods

In this study, 100 farmers who adopted both the rice-cum-fish culture and the rice- mono-culture were randomly selected from five villages namely Goshbari, Satrasia, Rajpur, Kumargata, and Kandapara of Muktagachha Upazila in Mymensingh. The period covered in this study was the whole production of the rice-cum-fish culture and the rice-mono-culture in the boro season of 2009. The required data were collected during the March to May, 2009. A stratified random sampling technique was followed in this study. Survey method was used to collect data and analysis was done to achieve the objectives set for the study. Activity budgets were calculated and statistical comparisons were computed. Multiple regression analysis was used to determine the impact of different independent variables on total household income of the respondents which was specified as:

$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + e$

Where, Y = Total annual income of the household
a = Constant term
X_1 =Age of the respondent
X_2 =Number of members in the family
X_3 =Number of working persons in the family
X_4 =Education level of the respondent
X_5 = Size of the total cultivable land
X_6 = Distance of the district headquarter market
X_7 =Lengths of Katcha road from houses to the nearest highway
e = Error term

Activity budgets (Dillon and Hardaker, 1993) of the rice-cum-fish culture were prepared using the following algebraic equation:

$$\pi_J = P_{yj}..Y_j + Pb_j..B_j - \sum_{i=1}^{n}(Pxi.Xi) - FC$$

Where,
π_J = per hectare net return or profit of the jth product (Tk/ha);
Y_j = total quantities of the j^{th} main product per hectare (kg/ha);
Py_j = per unit price of the j^{th} main product (Tk/kg);
B_j = total quantities of the by product per hectare (kg/ha);
Pb_j = per unit price of the by product (Tk/kg);
X_i = total quantities of inputs used for producing per hectare product;
Px_i = per unit price of the i^{th} inputs;
FC = amount of fixed cost per hectare involved in producing the products;
j = 1 and 2 (Rice and Fish)
i = 1, 2, 3 ...n (i.e., human labour, fertilizers, seed/seedlings, irrigation water, power tiller/draught animal, etc.)

Apart from the profitability analysis, undiscounted benefit-cost ratio (BCR) was calculated dividing per hectare gross return by gross cost.

Results and Discussion

Relative profitability of the rice-cum-fish culture compared to the rice mono culture

The integrated rice-cum-fish culture (considering home supplied labours were paid) per hectare gross return, gross cost and net return were calculated Tk. 83235.00, 67890.00, and 15345.00, respectively and undiscounted BCR was 1.23. In the case of rice-mono culture, these are appeared to be Tk. 50989.50, 45600.00, 5389.50, and 1.12, respectively. Considering home supplied labours were not paid, the corresponding figures were Tk. 83235.00, 59071.5.00, 24163.5.00, and 1.41 for the integrated rice-cum-fish culture and Tk. 50989.50, 38439.00, 12550.50, and 1.33 were for rice-mono culture, (Table 1).

Table 1. Per hectare profitability of integrated rice-cum-fish culture and rice-mono-culture

Item	Considering home supplied labours were paid		Considering home supplied labours were not paid	
	Rice-cum-fish culture	Rice mono culture	Rice-cum-fish culture	Rice mono culture
Gross return(Tk/ha)	83235.00	50989.50	83235.00	50989.50
Gross cost(Tk/ha)	67890.00	45600.00	59071.50	38439.00
Net return(Tk/ha)	15345.00	5389.50	24163.50	12550.50
BCR(Undiscounted)	1.23	1.12	1.41	1.33

Source: Field Survey, 2009

Effect of the rice-cum-fish culture technology on households

Net return, yields of paddy, total cost, fish consumption, and labour employment of per hectare of rice-cum-fish culture were Tk.165345.00, 4900 kg, Tk.67890, 245.5 gm/day, and 170.00 man-days, respectively. On the other hand, net return, yields of paddy, total cost, fish consumption, and labour employment of per hectare of rice-mono culture were Tk.5389.50, 4400 kg, Tk.45600.00, 214.40 gm/day, and 155.41 man-days, respectively. Effect of the rice-cum-fish culture on the per hectare net return, yields, total costs, fish consumption and labour employment were (+) 184.72%, (+) 92.53%, (+) 11.36%, (+) 48.88%, (+) 53.67%, (+) 14.52%, and (+) 09.37%, respectively (Table 2).

Table 2. Effect of the rice-cum-fish culture technology on households

Item	Rice-cum fish culture	Rice mono culture	Change (%)
Net return (Tk/ha)	15345.00	5389.50	(+) 184.7
Yields (Kg/ha)	4900.00	4400.00	(+) 11.4
Total costs (Tk/ha)	67890.00	45600.00	(+) 48.9
Fish consumption (gm/day/family)	245.50	214.40	(+) 14.5
Labour employment (man-days/ha)	170.00	155.41	(+) 09.4

Source: Field Survey, 2009

The estimated coefficients and related statistics of the multiple regression analysis was done to measure the impact of different, influencing variables on total household income, are summarized in Table 3.

Table 3. Estimated coefficients and related statistics of the multiple linear regression analysis

Independent variables	Coefficient	| t | values
Age of the respondent	- 505.00**	2.7
Number of members in the family	2902 .00	1.5
Number of working persons in the family	3061.00	1.8
Education of the respondent	1110.00	2.1
Size of the total cultivable land	5216.00 **	4.0
Distance of the district head quarter market	-12137.00**	3.4
Lengths of Katcha road from houses to the nearest highway	-10533.00**	4.8
R^2	0.83	
F	67.94	

** Significant at 1 percent level.

Table 3 shows negative effect of farmer's age on annual income – pointing out that old farmers' income is relatively less than young aged farmers. The reason could be, the elders are less willing to adopt new technology including rice-cum-fish farming. According to Hossain (1989), older farmers are less likely to have contacts with extension agents and are less willing to adopt new practices and modern inputs. Furthermore, younger farmers are likely to have some formal education, and therefore might be more successful in gathering information and understanding new practices, which in turn will improve their technical efficiency. The result also shows that farm size is positively related to annual income which indicates better managerial ability of larger farms. Distance of the district head quarter market and lengths of katcha road from houses to the nearest highway are negatively related to annual income. These two variables are the indicator of infrastructure and the result tells that lack of infrastructural facility reduces respondents' income. There is no suspect about the positive role of infrastructure to increase farm income as well non-farm income. The modern rice producer benefits significantly from better infrastructure; and badly developed infrastructure leads to negative effects on both productivity and income Rahman (2003).

Problems of the rice-cum-fish culture

Farmers were asked to rank the problems they encountered in culturing fish in the rice fields. Major problems were diseases, high labour demand, unexpected mortalities, high cost in general, and high cost of plot preparation in particular. Eighty seven percent farmers claimed that diseases were a major problem, 69% farmers identified higher labour requirement a major problem for them and 65% found unexpected mortalities as a constraint in rice-cum-fish culture. Again, 57% and 55% of the respondents mentioned about high cost in general and high cost of plot preparation in particular as problem for running their enterprise.

Table 4. Problems for integrating fish culture with rice farming as ranked by farmers (Percentages are in parentheses)

Problem	No. of times problem was ranked				
	First	Second	Third	Fourth	Total (n=100)
Water logging	07	09	04	06	26 (26)
Insufficient water	05	07	02	02	16(16)
Disease	21	23	25	18	87(87)
Predators	00	00	00	02	02 (02)
Theft	00	00	02	04	06 (06)
Unexpected mortalities	18	20	12	15	65 (65)
Small stocking size	00	00	05	06	11 (11)
Non availability of seed fish	00	00	00	03	03 (03)
Cannot use pesticide	00	00	01	02	03 (03)
High labour demand	23	16	18	12	69 (69)
High costs in general	15	12	14	16	57 (57)
High cost of plot preparation	11	13	17	14	55 (55)

Source: Field Survey, 2009

Conclusion

The rice- cum-fish culture is an innovative farming system in which, rice is the main enterprise and fish fingerlings are taken as additional means to secure extra income. Rice-cum- fish culture is not only reducing income poverty of the farmers but also improves the yield of paddy, create employment opportunity, and increase nutrient intake which brings food security for them. The farm-specific variables used to explain income indicate that farmers, who are of young aged, with larger farm size and better infrastructural facility – are able to earn more income. Despite of some problems which are facing in rice-cum-fish farming, Proper policy and planning, positive attitude of administrators and extension workers, free access to information/training facilities for the farmers, required size of fingerlings at reasonable prices at the appropriate time will encourage the farmers to practice rice-cum-fish culture largely.

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