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Financial Profitability of Aromatic Rice Production and its Impacts on Farmers' Livelihood in selected areas of Tangail District

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Abstract *The focus of the study was to evaluate the financial profitability of aromatic rice production and its impacts on farmers' livelihood in selected areas of Tangail district. A total of 60 farmers of some selected areas of Tangail district were selected as sample for achieving objectives of the present study. To collect data, a questionnaire was administered through face-to-face interviews. Data were analyzed with descriptive statistics, partial budget analysis, multiple regression analysis and sustainable livelihood approach. The result of descriptive statistics revealed that the average family size of aromatic rice growers was higher than the national average. The undiscounted benefit -cost ratio of aromatic rice production was 1.61 implying that the aromatic rice production was profitable. Moreover, the result of partial budget analysis revealed that aromatic rice producers have higher income and better livelihood than those who are producing non-aromatic rice in the study area. Estimated values of the relevant coefficients of Cobb-Douglas production function revealed that among the included variables human labor, seed, fertilizer, power tiller and irrigation had significant impact and insecticides had insignificant impact on the per hectare output of aromatic rice production. Aromatic rice farmers claimed good health condition, better schooling and education and increasing saving in the study areas. The study also identified some problems faced by the farmers in producing aromatic rice and probable solutions relating to those problems. Finally, some policy recommendations based on the findings of the study were made.*

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Introduction

Agriculture sector of Bangladesh is dominated by rice production. This sector contributes 20.01 percent to the gross domestic product (GDP) of which the crop sub-sector alone contributes 11.32 percent (BBS, 2011).Rice is the main item of food for the people of this country. Although the total land area is the same in each year, the total cultivated area is decreasing year to year due to industrialization. Rice is the principal cereal crop which occupies almost three-quarters of the total crop land. Rice production is vital to the Bangladesh economy. The experience of technological change led by varietals improvement in Bangladesh has significantly contributed to the growth of rice production during the last three decades. There are three seasons of rice grown which are known as Aus, Aman and Boro. The development of high-yielding modern grain varieties of rice, which are highly responsive to inorganic fertilizers and insecticides, effective soil management and water control, helped the country to meet the increasing requirement of food grain. Among the high-yielding varieties, Aman varieties had traditionally large share in the total production. In recent years, however, the share of Boro is increasing.

Fine and aromatic rice is a part of the rice family (*Oryza sativa* L.). Rice is an ancient and venerable grain that has been cultivated since at least 5000 B.C. Rice has a number of varieties. Among the rice varieties, aromatic rice is popular in Asia and gained wider acceptance in Europe and the United States because of their aroma, flavor and texture. Aromatic varieties fetch higher price in rice market than the non-aromatic ones. Demand for aromatic rice in recent years has increased to a great extent for both internal consumption and export (Das and Baqui, 2000).

Nearly 70% of the land area of the country has been brought under rice cultivation. Out of this 70% share, fine and aromatic rice is cultivated in roughly 10% land. This lower coverage is primarily due to the emphasis of government policy and research on food grain production but with low input technology. The government is more concerned about the basic staple rice of the country. As a result, very little support has been found to be on fine and aromatic rice. Consequently, the fine and aromatic rice cultivation accounts for only a marginal fraction of the total rice production in the country (Sarker and Biswas, 2002).

Rice is generally classified by its length, thickness, aroma, and whiteness. The length of long-grain rice is four to five times that of its width. One of the more exotic varieties in the long-grain category is the aromatic East Indian Basmati. Locally adapted varieties are Chiniatop, Kalizira and Kataribhog. BR34 and

BR38 are another two high valued rice varieties released by Bangladesh Rice Research Institute (BRRI), having small grain and pleasant aroma. However, Kalajira rice, although not in the longer category, has the most exotic aroma. The farmers grow fine rice primarily to take the advantage of higher revenue. This is because such cultivation requires very small dose of fertilizer, pesticides and irrigation. The per acre cost of production of fine rice is very low compared to coarse rice.

Ashrafuzzaman *et al.* (2009) revealed the growth performance and grain quality of six aromatic rice varieties BR34, BR38, Kalizira, Chiniatop, Kataribhog and Basmati grown under rainfed conditions; Raha (2006) performed a study to evaluate the profitability of production and marketing system of aromatic rice; Anik (2003) undertook a study to evaluate the economic and financial profitability of aromatic and fine rice production using both primary and secondary data.

In the past, some works were done about production and marketing of aromatic fine rice, including determination of financial costs and its profitability. However, the present study especially aims to do in depth analysis of profitability of aromatic rice and its impact on farmers' livelihood pattern. Therefore, this study is expected to provide meaningful information that can be of good use by the policy planners to increase the aromatic rice production and to improve farmers' livelihood pattern. The overall goal of the study is to analyze the profitability of aromatic rice production and its impact on farmers' livelihood pattern. The specific objectives are as follows:

i. To document the socioeconomic characteristics of the aromatic rice growers;
ii. To calculate the profitability of aromatic rice production;
iii. To determine the factors affecting the gross return of aromatic rice production;
iv. To assess the impacts of aromatic rice production on farmers' income and livelihood pattern.

Study Methods

The study was conducted in the villages namely, Maista, Nagarbari, Kurua, Tatihara, Tarabari, Maloti and Adabari under Kalihati Upazila of Tangail District. Total 60 farmers on the basis of farm size were selected following stratified random sampling. Among them are 20 farmers producing Kalijira, 10 farmers producing Tulsimala and 30 farmers producing BRRI dhan 34. Data were

collected by the researcher herself in the month of February to April 2013. With a view to collecting primary data from the respondents, field survey was conducted by using a structured questionnaire. Secondary data and information were collected from different reports, publications, handouts, notifications, journals, books etc. having relevancy with this study. Collected data were classified, tabulated and analyzed to achieve the objectives set for the study. Both tabular and statistical techniques were used. Descriptive statistics (i.e., sum, average, percectage, ratios, etc.) were employed to achieve the objectives.

To explore the relationship between production and input, the Cobb-Douglas production function was used as follows:

$$Y_i = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} e^{u_i}$$

This was linearised in the logarithmic form as follows:

$$InY = Ina + b_1InX_1 + b_2InX_2 + b_3InX_3 + b_4InX_4 + b_5InX_5 + b_6InX_6 + U_i$$

Where,

Y =Gross return (Tk./ha);

X_1=Human labor cost(Tk./ha);

X_2=Seed cost (Tk./ha);

X_3= Power tiller cost (Tk./ha);

X_4=Fertilizer cost (Tk./ha);

X_5=Irrigation cost (Tk./ha);

X_6=Insecticides cost (Tk./ha);

Ln=Natural lorgarithm;

a =Constant/Intercept;

b_1, b_2……b_6 = production coefficients of the respective variables; and

U_i=Error term.

The partial budget was used to compare the positive and negative effects of the proposed change on net income. We separate the positive and negative effects and list them in different sections of the partial budget.

To accomplish the objective of profit maximization, i.e., for efficient allocation of resources, one should use more of the resources so long as the value of added product is greater than the cost of added amount of input producing it. The resources are considered to be efficiently used when the ratio of marginal value product (MVP) to marginal factor cost (MFC) approaches one, or in other words,

MVP and MFC for each input are equal. The optimum use of a particular input would be ascertained by the condition of equality of MVP and MFC,

$$\text{i.e., } MVP_{xi} / MFC_{xi} = 1$$

If the ratio is greater than 1, the resource is sub-optimally used and the gross return could be increased by using more of the resource and it is less than the resource is over used and the excess use of resource should be decreased to minimize the loss.

The sustainable livelihood framework was used to improve our understanding of livelihood, particularly the livelihood of the poor. The livelihood framework identifies five core asset categories or types of capital upon which livelihoods are built. A sustainable livelihood is the outcome of inter and intra relationship between the components of the capitals. Increasing access which can take the form of ownership or the right to use these assets is a primary concern for Department for International Development (DFID) in its support of livelihoods and poverty elimination.

Result and Discussion

Socioeconomic Profile of Aromatic Rice Growers

Average size of family consisted of 4.9 of which 2.6 were male and 2.3 were female for all farmers (Table 1). Thus, the average family size of the sample farms was higher than the national average of 4.53 (HIES, 2010). The family members were classified into three groups i.e. (i) 0 to 14 years, (ii) 15 to 64 years, and iii) above 64 years (HIES, 2010). Thus, the majority of family members in all the farm categories were in the working age group of 15 to 64 years. The literacy rate for the family members of aromatic rice production is even higher in the national context, where the statistics of literacy is claimed to be 57.51 percent (HIES, 2010).

Table 2 shows that average farm size of aromatic rice growers was 0.95 hectare which could be considered as small farm size. On an average, the respondents owned highest proportion of cultivable land (63.2%).

Costs and Returns of Aromatic Rice Production

Gross cost was calculated by adding all costs incurred for variable inputs and fixed inputs. On the basis of gross cost per hectare, production costs for Kalijira, Tulsimala and BRRI dhan 34 rice were estimated at Tk. 50280.1, Tk. 48669.8 and Tk. 54948.6, respectively. Thus, the average total costs for aromatic rice was estimated at Tk. 51299.5 per hectare.

Table 1 : Family Size, Age Distribution and Education Levels of Family Members of Aromatic Rice Growers

Particulars	Male		Female		Total	
	No.	%	No.	%	No.	%
			Age group			
0-14	30	19.3	45	33.1	75	25.6
15-64	122	78.2	85	62.5	207	70.9
Above 64	4	2.5	6	4.4	10	3.5
Total	156	100.0	136	100.0	292	100.0
Average	2.6		2.3		4.9	
			Literacy level			
Illiterate	12	8.8	17	13.2	29	10.9
Primary	25	18.4	34	26.4	59	22.3
Secondary	46	33.8	62	48.1	108	40.8
Higher secondary	29	21.4	15	11.6	44	16.6
Graduation and above	24	17.6	1	0.7	25	9.4
Total	136	100.0	129	100.0	265	100.0

Source: *Field survey, 2013.*

Table 2 : Average Land Holdings of Aromatic Rice Growers According to Utilization Pattern

Types of land	Aromatic rice	
	Area (ha)	Percentage
Homestead area	0.09	9.5
Area under pond	0.03	3.2
Owned cultivable land	0.6	63.2
Area under aromatic rice	0.1	10.5
Leased/Mortgaged-in	0.05	5.3
Leased/Mortgaged out	-	-
Shared-in	0.09	9.5
Shared-out	0.01	1.0
Total cultivated land	0.95	100.0

Source: *Field survey, 2013.*

Per hectare gross returns were calculated by multiplying the total amount of product and by-product with their respective farm gate prices. The average per hectare gross return of Kalijira, Tulsimala and BRRI dhan 34 rice were Tk. 80979.5, Tk. 77453.4 and Tk. 89566.4, respectively. Thus, the average per hectare gross return of aromatic rice was Tk. 82666.4.

Benefit cost ratio (BCR) was calculated by dividing gross return by gross cost (Table 3). BCR (undiscounted) of Kalijira, Tulsimala and BRRI dhan 34 rice production emerged as 1.61, 1.59 and 1.63, respectively, implying that Tk. 1.61, Tk. 1.59 and Tk. 1.63 would be earned by investing every Tk. 1.00 in Kalijira, Tulsimala and BRRI dhan 34 rice production.

Table 3 : Production Cost and Returns of Aromatic Rice Production

Items	Varieties (Tk./ha)			Average (Tk./ha)
	Kalijira	Tulsimala	BRRI dhan 34	
A. Gross return	80979.5	77453.4	89566.4	82666.4
Variable cost				
Human labor	25786.7	25983.7	27528.0	26432.8
Power tiller	6269.6	6414.2	6269.3	6317.7
Seed	1432.0	1412.0	1436.0	1426.7
Irrigation	6753.1	5366.9	7572.3	6564.1
Fertilizer				
Urea	2710.0	2578.0	2846.0	2711.3
TSP	574.2	387.2	1632.4	864.6
MP	229.5	193.5	978.0	467.0
Insecticides	605.4	595.9	636.7	612.5
B. Total variable cost	44360.5	42931.4	48898.7	45396.9
Fixed cost				
Interest on operating cost	878.4	847.2	958.7	894.8
Land use cost	5041.2	4891.2	5091.2	5007.9
C. Total fixed cost	5919.6	5738.4	6049.9	5902.6
D. Gross cost(B+C)	50280.1	48669.8	54948.6	51299.5
E. Gross margin(A-B)	36619.0	34522.0	40667.7	37269.6
F. Net return(A-D)	30699.4	28783.6	34617.8	31366.9
G. Benefit cost ratio (A/D) (undiscounted)	1.61	1.59	1.63	1.61

Source: *Field survey, 2013.*

If farmers replace non-aromatic rice with aromatic rice they can obtain additional Tk. 11787.0 from the same one hectare of land (Table 4). It is likely that the positive impact of aromatic rice production on farm household's income is

significant. So, it is evident from the partial budget analysis that farmers that produce aromatic rice are more profitable than those that produce non-aromatic rice.

Table 4 : Partial Budget Analysis for the Replacement of Per Hectare Non-Aromatic Rice with Aromatic Rice

Items	Debit (Tk.)	Items	Credit(Tk.)
Additional cost for aromatic rice cultivation	51299.5	Additional revenue for aromatic rice cultivation	82666.4
Revenue forgone for not producing non aromatic rice	83126.0	Cost saved for not cultivating non aromatic rice	63546.1
A. Total	134425.5	B. Total	146212.5
Net change in profit = (B-A) =11787.0			

Source: *Authors' calculation based on field survey, 2013.*

Functional Analysis

Production function analysis was carried out to explore the productivity of the individual inputs (Table 5). To determine the effect of the variable inputs, Cobb-Douglas form of production function was estimated for aromatic rice production. Six independent variables namely, human labor, seed, power tiller, fertilizer, irrigation and insecticides were selected to explain the production of aromatic rice. The regression result shows that the estimated values of the relevant coefficients among the included variables human labor, seed, fertilizer, power tiller and irrigation had significant impact and insecticides had insignificant impact on the per hectare output aromatic rice production**.**

The value of coefficient of determination, R^2, is 0.663 for aromatic rice production, which means that the explanatory variables included in the model explained 66.3 percent of the aromatic rice production. Return to scale for aromatic rice (0.760) is less than unity. It implies that aromatic rice growers are operating in decreasing return to scale.

Resource Use Efficiency

Table 6 reveals the ratios of marginal value product (MVP) and marginal factor cost (MFC) for aromatic rice production. The ratios of MVP and MFC of seed, power tiller, fertilizer and irrigation were greater than unity indicating that there was scope for more use of the inputs to increase the profit. The ratio of MVP and MFC of human labor was less than one but positive, which indicated that farmers

Table 5 : Estimated Values of Coefficient and Related Statistics of Cobb-Douglas Production Function of Aromatic Rice Production

Explanatory variable	Estimated coefficients	Standard errors	t-value
Intercept	4.521	0.808	5.594
Human labor cost(X_1)	0.138**	0.060	2.311
Seed cost (X_2)	0.106**	0.057	1.859
Power tiller cost (X_3)	0.132*	0.077	1.714
Fertilizer cost (X_4)	0.120***	0.035	3.410
Irrigation cost (X_5)	0.277***	0.049	5.678
Insceticide cost (X_6)	-0.019	0.035	-0.548
R^2		0.663	
F-value		17.410	
Return to scale		0.760	

Source: *Authors' estimation, 2013.*
*Note: *** Significant at 1 percent level; ** Significant at 5 percent level; and *Significant at 10 percent level.*

should limit the use of these inputs. The ratio of MVP and MFC of insecticides was negative, which indicated that farmers might have made excessive use of these inputs.

Table 6 : Ratio of Marginal Value Products (MVPs) and Marginal Factor Costs (MFCs) of Different Inputs Incurred in the Production Function of Aromatic Rice

Inputs	Geometric Mean	Coefficient	MVP_{xi}	MFC_{xi}	MVP/MFC
Return	87073.48				
Human labor cost	18586.10	0.138	0.64	1	0.64
Seed cost	1361.00	0.106	6.78	1	6.78
Power tiller cost	6307.95	0.132	1.82	1	1.82
Fertilizer cost	4095.89	0.120	2.55	1	2.55
Irrigation cost	10609.01	0.277	2.27	1	2.27
Insceticide cost	543.03	-0.019	-3.05	1	-3.05

Source: *Author's calculation, 2013.*

Livelihood Pattern of Aromatic Rice Growers

Income Level and Sources of Income

The annual gross income of the sample households was estimated by adding the earnings from all income generating activities of the households during the reference year, 2012. It is evident from Table 7 that average annual income of aromatic rice farmers was Tk. 177606.6. It can be concluded that sampled farmers generated more than one-third of their income from crop farming.

Table 7 : Average Annual Income of Aromatic Rice Growers

	Aromatic rice	
Sources of Income	Value (Tk.)	Percent (%)
A. Farm Income		
Crop	61766.7	34.8
Fisheries	10183.3	5.7
Homestead	3518.3	2.0
Livestock	442746.7	24.1
B. Off-farm Income		
Service	36650.0	20.6
Business	17583.3	9.9
C. Others	5158.3	2.9
Total (A+B+C)	177606.6	100.0

Source: *Field survey, 2013.*

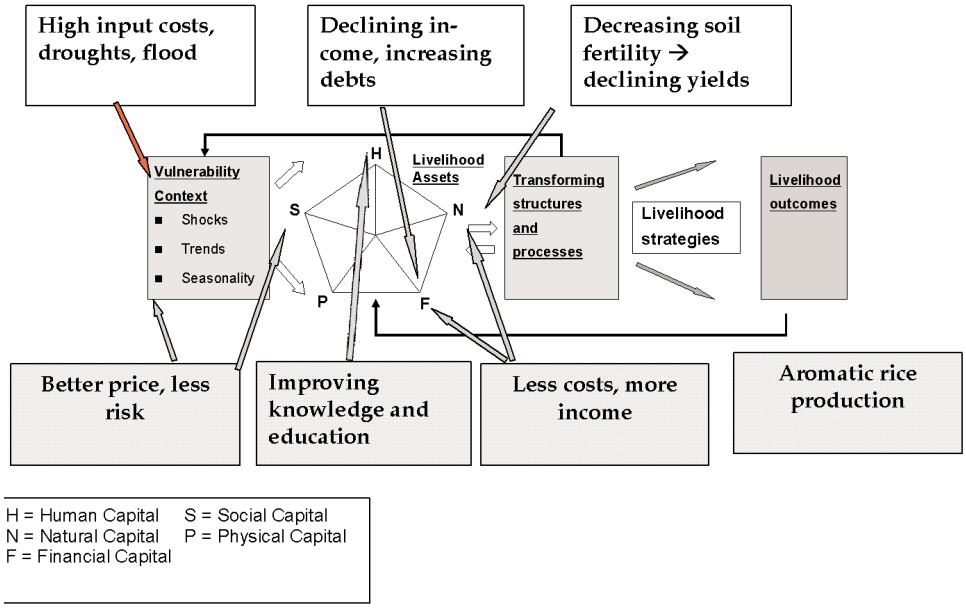
Sustainable Livelihood Framework

The sustainable livelihood framework includes the asset pentagon, which is composed of five types of capital namely human capital, social capital, natural capital, physical capital and financial capital (DFID, 1999). Changes in the asset position during one year are discussed as the transformation and improvement of the livelihood of the farmers.

The framework, which is presented in schematic form below, has been developed to help understand and analyze the livelihoods of the aromatic rice farmers. The asset pentagon lies at the core of the livelihood framework, 'within' the vulnerability context. The pentagon was developed to enable information about people assets to be presented visually, thereby bringing to life important inter-relationships between the various assets. An increase in the natural capital may

increase the income and revenue (i. e. financial capital) by means of selling products, which in turn improve the purchasing power and standard of living (i. e., social and physical capital). Health status is directly related to income/food security (with relevant knowledge). Assets are both destroyed and created as a result of the trends, shocks and seasonality of the vulnerability context. Livelihood outcomes are the achievements or outputs of livelihood strategies (DFID, 2001).

Flow Chart 1: The Sustainable Livelihood Framework



Source: *Adapted from DFID, 2001.*

Majority of the farmers reported that quality of the components of human capital has increased over the periods through gaining education and knowledge, improving health condition, more access to nation, better training and development of skill in all the selected areas. Almost all farmers' involvements in different social groups, their managerial capacity through aromatic rice production had improved in the study areas.

Farmers' income had increased and they were able to have more cash savings and liquid assets through production of aromatic rice along with crop farming, livestock rearing, and fisheries. The condition of other major components of

housing as well as safe sanitation such as drinking water and paka toilet also developed considerably.

Table 8 : Changes in Human Capital, Social Capital, Natural capital, Financial Capital and Physical Capital of Farm Household

Asset category	Increase	Decrease	Constant
	Human capital		
Health	73.3	11.7	15.0
Education	85.0	3.3	11.7
Knowledge/Efficiency	10.0	3.3	86.7
Access to information	78.3	5.0	16.7
	Social capital		
Involved in social group	23.3	5.0	71.7
Political involvement	11.7	10.0	78.3
Self managerial capability	51.7	1.7	46.6
Social access	53.3	3.3	43.4
	Natural capital		
Cultivable land	31.7	11.7	56.6
Using open water resources	23.3	16.7	60.00
Forests	-	-	100.0
	Financial capital		
Cash in hand	91.7	-	8.3
Cash at bank	46.7	25.0	28.3
Remittance	-	-	100.0
	Physical capital		
Building	11.7	3.3	81.6
Tin roof	33.3	6.7	50.0
Tube well	8.3	5.0	86.7
Paka toilet	26.7	-	73.3
Kacha toilet	73.3	-	26.7
Electric fan	78.3	-	21.7
Bicycle/Motorcycle	28.3	5.0	66.7
Radio/TV	25.0	8.3	66.7
Mobile phone	73.3	1.7	25.0
Fridge	10.0	1.7	88.3
Shop	25.0	3.3	71.7

Source: *Field survey, 2013.*

Problems Faced By the Farmers and Their Probable Solutions

Aromatic rice farmers have been facing some major problems. Sample farmers were asked by the researcher to report major problems and provide their suggestions regarding probable solutions to those problems.

Table 9 : Problems Faced By the Farmers and Their Probable Solutions for the Production of Aromatic Rice

Items	No. of respondents	Percentage (%)
Problem faced by farmers		
Lack of capital	26	43.3
Lack of quality seed	14	23.3
Seed collection problem	21	35.0
High wage rate	39	65.0
High price of fertilizer	29	48.3
Lack of rainfall	11	18.3
Lodging of rice plants	15	25.0
Problem of insect attack	20	33.3
Low price of product	27	45.0
Low Production	38	63.3
Lack of extension service	17	28.3
Storage problem	8	13.3
Probable suggestions		
To ensure easy provision of loans from the financial institutions	24	40.0
To supply the good quality seed	34	56.7
To provide modern technology	30	50.0
To provide subsidy on fertilizer from the government	20	33.3
To fix up the proper price of product by the government	25	41.7
To promote extension services	16	26.7
To improve the production system of crop	18	30.0
To find out the causes of low crop production by sufficient research works	15	25.0
To build up sufficient storage for preserving rice	12	20.0
To provide training facilities	10	16.7
To improve marketing facilities	20	33.3

Source: *Field survey, 2013.*
Note: Percentage has been done based on sample size.

Conclusion and Policy Recommendations

Aromatic rice is a profitable farming venture for farmers and a good source of livelihood. From the study, it was evident that farmers who produce aromatic rice are more profitable than those who produce non-aromatic rice. The regression coefficients among the included variables, human labor, seed, fertilizer, power tiller and irrigation were positive and statistically significant except insecticides cost. The findings revealed that households producing aromatic rice have higher income and better livelihood status.

The following recommendations are made on the basis of the present study:

- Government and non-government research institutes should strengthen their human resources for rice research and seed production;
- Pure seed should be supplied at reasonable price;
- The price of fertilizer and pesticides should be regulated strictly by the government;
- In order to improve profitability of the aromatic rice production, measures are essential to reduce the cost of production;
- Research work should be strengthened to address the issues of low yield; and
- Government may provide short term training programs for better management practices of aromatic rice production.

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