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An Analysis of Productivity and Profitability of Rice Farm in Bangladesh: A Study of Sylhet District

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Abstract *The field visits of Sylhet District has shown that only a small fraction of farmers grow four crops per year in their land and most of them grow only one crop in their land in a crop year. Therefore, in this study, an investigation has been made to find out the input productivity and profitability of rice farm in Sylhet District. In total 120 farmers were selected randomly from three thanas of Sylhet District, where equal number of samples were collected from each thana. Data were collected through farm survey by using a suitable pre-tested questionnaire. Cobb-Douglas Production Function and Profit Function and statistical test (t-test) are used for analysis. It is seen from the study that there is profit from two categories of rice on three categories of farm but in the case of power tiller operated farm the inputs cost are very high. For this reason, the profit is less in power tiller operated farm compared to animal operated farm. To find out productivity and resource use efficiency we used Cobb Douglas production function. The use of fertilizers is statistically significant at 1%, 5%, and 10% level of significance for all categories of farms. The use of inputs like human labour, seed, irrigation, insecticides, power tiller/animal power are also statistically significant but not for the two crops.*

Introduction

Agriculture is the most important sector in the economy of Bangladesh as it contributes about 19.68% of the gross domestic product (GDP) and 47.5% of

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overall employment (BBS, 2013). Though the direct contribution of the agriculture sector has decreased gradually, it has indirect contribution to the overall growth of GDP. The growth of broad services sector, particularly the growth of wholesale and retail trade, hotel and restaurants, transport and communication sector, is strongly supported by agriculture sector. In FY 2010-11, Bangladesh earned US$ 1316 million by exporting agricultural products which was 5.74% of total export earnings (US$ 22924 million) (Bangladesh Economic Review, 2011). Bangladesh agriculture consists of two broad sub-sectors namely agriculture & forestry and fishery. In agriculture & forestry there are again three sub-sectors like crops and vegetables, livestock and forestry. Among these sub-sectors crops and vegetables is the largest sub-sector in our agriculture.

The dominant food crop of Bangladesh is rice. Rice accounts for 94% of the cereals consumed, supplies 68% of the carbohydrate in the national diet, accounts for approximately 78% of the value of agricultural output, and 30% of consumer spending (Ahmed *et al.,* 2000). It also accounts for 93% of the total crops produced (Bangladesh Economic Review, 2012) and 76.62% of the cropped area (BBS, 2006). In Bangladesh 88.44% of the total households are located in rural areas and they are more or less dependent on agriculture for a living (Bangladesh Agricultural Census, 2008). Agriculture provides the basic food for the survival of the subsistence farmers in Bangladesh. Subsistence farmer account for the greatest proportion of those engaged in farming. Bangladesh agriculture already operates at its land frontier and there is little or no scope to expand the cultivable land to meet the increasing demand for food requirements for its ever-increasing population. (Rahman, 2003). Moreover, high population growth, frequent crop failures resulting from flooding (*Sidr* in 2007) or droughts put pressure for intensification of land use. So, it is very hard for this country to increase the productivity of its limited 8.44 million hectare arable lands (BBS, 2006).

The *slogan* of Bangladesh Rice Research Institute is “Rice is the lifeblood of Bangladesh”. In Bangladesh, three rice crops are grown during the crop cycle beginning in April – the *Aus* (Spring) crop, the Aman (summer) crop, and the Boro (winter) crop. The monsoon rice Aman harvested in November-December is the main rice crop. It occupied 5.7 million hectares in 2002-03, approximately 53% of the total rice area. On land with shallow flooding depth Aman is transplanted with shorter duration varieties, but on deep flooded land Aman is directly seeded as an upland crop from June to July. Then the plant grows with flood water from June to September, and is harvested in November after the flood water recedes. Bangladesh receives about 400 millimeters of rain during the pre-monsoon months of March to May, which farmers use to grow a short-duration drought-resistant crop known as Aus, which gives a yield of about 1.8 ton/hectare. The crop is mostly directly seeded during March-April and harvested in July-August. In 1969-70 the crop occupied 3.4 million hectares, but the area declined to 1.2 million hectares by 2002-03 as farmers shifted the land to vegetables or dry season irrigated rice called Boro. Boro was used to be grown in very low land (not suitable for growing any crop during the monsoon season), and transplanted in November after the recession of the flood and harvest in April – May. However, with the spread of the ground water irrigation, the area has expanded to all land types, and is now mostly transplanted in January-February and harvested in May-June. The area has expanded from 0.5 million hectares in 1969-70 to 3.8 million hectares in 2002-03, which is 35% of the total rice area.

Sylhet is a mono cropped area where almost all the farmers cultivate Aman crop due to frequent and heavy rainfall in monsoon. The second highest rice crop grown in Sylhet district is Boro crop. Inspite of the high risk of early flood, farmers cultivate Boro crop in haor area, which is very fertile for siltation. Due to soil type and weather Sylhet district is not suitable for growing other crops like wheat, jute, pulses, sugarcane and vegetables. Large portions of farmers of this district cultivate rice to meet their family need and they are not interested for surplus production. Sometimes, land owners lease their land on contract basis called fixed-rent contract, one in which the landlord charges a sum of money per year or per season for the rental of the land and, in turn, allows the tenant to carry out production. The other type of contract is commonly referred to as sharecropping, which means the sharing of the tenant's output in some pre assigned proportion between the landlord and the tenant. Farmers of the study area are not aware about their input productivity and profitability in rice production. People of this area have a higher tendency to migrate abroad and the remaining family members have no interest in farming. So, labour shortage is a common problem of this district and hiring labour with high wage increased production cost. Three types of farms like animal operated, power tiller operated and animal plus power tiller (pooled) operated farm were shown in the study area but it is very expensive to use animal power in ploughing deep wetland. Using machinery (power tiller, shallow machine and thresher) helps to increase the cropping intensity by providing temporal and partial adjustment in crop production activities so that least time is lost between the crops and the farmer is able to raise more number of crops in a given time and is also able to reduce his cost. The post-harvest operation like threshing is undertaken; using machines not only reduces the losses but also improves the quality of the product. It is known to all that the literacy rate of Sylhet district is very low compared to other districts and the education level of the farmers is not in satisfactory level. Due to the lack of education farmers of this area cannot use High Yield Variety (HYV) seeds, fertilizer and insecticides properly. But we know education has a positive impact on resource use efficiency. So, it is clear that there is a great chance to increase productivity and profitability of rice farm in Sylhet district.

Thus, keeping in view the importance of the study of input productivity and profitability of rice farm, the following objectives were formulated.

- To identify the input productivity of different categories of rice farm;
- To measure the profitability of rice production in different categories of farm;
- Develop some policy suggestions on the basis of findings.

Review of Literature

The problems experienced in this area are mostly location and region oriented, which demands a continuous study on the part of researchers. It is, therefore, not surprising that apart from the massive amount of research work done by individuals and organizations, there have been frequent demands from the policy makers to undertake further specific studies in this area. Hence the important work carried out on this aspect is reviewed comprehensively to understand the direction of research carried out so far and to evolve a possible improvement over such available studies.

Duft (2003) pointed out the reduction of wage employment opportunities in farming due to farm mechanization which diverted labour to other forms of employment in non-farm activities or leisure activities. Pandey (2004) argued that farm equipment are used in farming operations, including immediate post harvest activities, with a view to increasing productivity of land and labour through timeliness of operations, for efficient use of inputs, improvement in quantity of production and safety and comfort of farmers, and reduction in loss of produce and drudgery of farmers. Power tiller mounted implements such as mould board ploughs, disc ploughs, cultivators and other crop-specific equipment are widely being used for seed bed preparation. Seed drills and planters, both animal drawn and Power tiller mounted, have become popular. Mechanization transplanters for rice and vegetables crops are catching up with farmers. Hossain *et al.* (2006) reported that technological progress helped Bangladesh to achieve self-sufficiency in rice production in 2001 from a heavy import-dependence, despite doubling of population and a reduction in arable land since its independence in 1971. As the adoption of modern varieties (MV) of rice is reaching a plateau, particularly for the irrigated ecosystem, an important issue is whether the research system will be able to sustain the growth of production.

Majumder *et al.* (2009) attempted to measure and compare resource use efficiency and relative productivity of farming under different tenure conditions in an area of Bhola district. The study explored the difference in the efficiency and productivity among owner, cash tenant and crop share tenant. Total cash expenses as well as total gross costs for producing HYV Boro rice was the highest in owner farms and lowest in crop share tenant's farm. When individual inputs were considered it was observed that expenses on human labour shared a major portion of expenses in the production of HYV Boro rice where owner operators used more hired labour in comparison to other groups. However, the cash tenant farmers were more efficient than owner and crop share tenant farmers. Due to poor resource base the crop share tenants were unable to invest on modern farm inputs. It may be mentioned that in Bangladesh the predominant tenancy arrangement is share cropping, which is an inefficient form of tenure arrangement compared to cash tenancy.

Methodology

A micro-level study based on primary cross-section data was designed to attain the objectives of this study. The methodology of the study is mainly about the sampling procedure, collection of data and analytical framework used.

Sampling

This study was conducted in Sylhet District. It comprises of twelve thanas – Sylhet Sadar, Gowainghat, Fenchuganj, Bishwanath, Balagonj, Beanibazar and South Surma, Zakigonj, Golapgonj, Jaintapur, Companigonj and Kanaighat. For collecting data, a three-stage stratified random sampling design was used. In the first stage, three thanas were selected from the list of all thanas in the Sylhet District. In the second stage, two unions were randomly selected from each selected thana. In the third stage, two villages were selected from each selected union using random sampling technique. To collect data on land area, production of rice, and costs and returns of rice production, 10 farmers were selected from each village. To select the village, priority has been given to those areas where large numbers of farmers were engaged in rice production.

Since the study focuses on input productivity in a predominantly rice grown area, attempt was made to choose the villages, which had an average level of agricultural performance in their respective sub-regions. Relevant information was collected from thana agricultural office.

Data Collection

Following the conventional survey techniques, primary data on resource availability and their use, input-output levels, prices of farm production and inputs as well as some other relevant information were collected by interviewing the farmers personally using a suitably designed and pre-tested questionnaire.

Secondary data on location, climate, soil, irrigation, major crop enterprises, population, land utilization pattern, insecticides and fertilizer consumption of the study area were compiled from several publications such as Statistical Year Book of Bangladesh (2010), Report of the Household Income & Expenditure Survey (2010), Bangladesh Economic Review (2012), Report on Labour Force Survey (2010) etc.

Analytical Framework

Resource Productivity

Cobb-Douglas production function was used to estimate the effects of various inputs employed for the production of rice in three categories of farms (animal operated farms, power tiller operated farms, animal plus power tiller operated farms). Six independent variables, namely human labour cost, seed cost, fertilizer cost, irrigation cost and land preparation cost were taken into consideration, which are likely to have an impact on production of two varieties of rice (Aman and Boro). All variables were expressed in monetary terms. The land use cost as a variable has not been considered, because this cost was fixed per hectare for all farmers for producing rice. To determine the contribution of the most important variables in the production process, the following specification of the model was applied:

$$Y_{ij} = a \quad X_{ij1}^{b1} \quad X_{ij2}^{b2} \quad X_{ij3}^{b3} \quad X_{ij4}^{b5} \quad X_{ij5}^{b5} \quad X_{ij6}^{b6}$$

In log-linear form the above function can be written as:

$$lnY_{ij} = lna + b_1 \, lnX_{ij1} + b_2 \, lnX_{ij2} + b_3 \, lnX_{ij3} + b_4 \; X_{ij4} + b_5 \; X_{ij5} + b_6 \; X_{ij6}$$

Where,

Y_{ij} = per hectare output of ith crop on jth type of farm,

X_{ij1} = human labour used (work days) per hectare for ith crop on jth type of farm

X_{ij2} = value of manures and fertilizers per hectare for ith crop on jth type of farm

X_{ij3} = value of seed per hectare for ith crop on jth type of farm,

X_{ij4} = cost of irrigation per hectare for ith crop on jth type of farm

X_{ij5} = cost of animal or power tiller or both per hectare for ith crop on *jth* type of farm,

X_{ij6} = cost of insecticide per hectare for ith crop on jth type of farm,
a = technical efficiency coefficient,
$b_1, b_2, \ldots$ = production elasticity of the corresponding inputs

Profit Function

Profits for each of the individual crops in the three categories of farms (power tiller, animal and animal plus power tiller operated / pooled) were calculated separately. The activity budget as suggested by Dillon and Hardaker (1980) was employed for deriving the profit equation. The profit equation of the following from was used:

$$\pi_1 = P_{yi}.Y_i + Pb_i.B_i - \sum_{j=i}^{n} (P_{xji}.X_{ji}) - TFC$$

Where:

Π_1 = profit per hectare from ith output,
P_{yi} = per unit price of ith output,
Y_i = total quantity per hectare of ith output,
P_{bi} = per unit price of ith by-product,
B_i = total quantity per hectare of ith by-product,
P_{xji} = per unit price of jth input used in producing ith output,
X_{ji} = total quantity of jth input used for the production of per hectare ith output,
TFC = total fixed costs involved in producing per hectare ith output,
i = the number of individual crops produced by the farmers,
j = the number of individual inputs used for producing the relevant product
n = 1, 2, 3, ... n.

For the lack of exact information, the value of by-product and the fixed cost of land are omitted in the case of profitability analysis. T-tests are performed to examine significance of mean difference whenever necessary. To test mean difference of profit the t statistic as shown below was used

$$t = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

With, $$v = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}}$$

degree of freedom.

Where, X_1, X_2 are the sample mean profit, S_1 and S_2 are corresponding standard deviations and n_1 and n_2 are sample size. By applying the above formula, the calculated values were compared with tabulated values to test whether the results were statistically significant or not.

Results and Discussion

Input Productivity

The input productivity for important crops grown on different categories of farms was examined with the help of production function analysis. Linear regression equation was estimated through ordinary least squares method, where the human labour, fertilizers, seed, insecticides, irrigation and land cultivation were regressed upon yield. Production functions on per hectare basis were estimated for Boro and Aman Paddy.

The estimated regression coefficients are presented in Table 1. It may be observed from table that the inputs, namely human labour, fertilizers, seed, insecticides,

Table 1 : Production Functions for Selected Corps on Power tiller, Animal Operated Farms and Pooled Farms, Sylhet Region, 2008

Category	Mechanical Power		Animal Power		Pooled	
Variables	Boro	Aman	Boro	Aman	Boro	Aman
Constant in log	2.0756	1.89	1.92	1.49	2.66	1.82
Human labour	0.104*** (0.055)	0.082** (0.032)	-0.044 (0.046)	0.010 (0.013)	0.052 (0.040)	0.023*** (0.013)
Fertilizers	0.060** (0.025)	0.168* (0.036)	0.078*** (0.041)	0.126** (0.050)	0.061* (0.020)	0.105* (0.030)
Seed	0.181* (0.053)	0.033 (0.031)	0.146** (0.061)	-0.003 (0.013)	0.206* (0.038)	0.015 (0.012)
Insecticides	0.033 (0.034)	0.007 (0.015)	0.043 (0.054)	0.008 (0.007)	0.042 (0.028)	0.023 (0.006)
Irrigation	0.024 (0.025)	-0.059 (0.009)	0.052 (0.098)	0.011 (0.072)	0.005 (0.021)	-0.036 (0.052)
Tillage	0.021 (0.033)	0.282* (0.053)	0.277** (0.110)	0.692* (0.060)	0.045 (0.029)	0.504* (0.046)
R^2	0.313	0.91	0.86	0.95	0.45	0.89
F Value	5.40	68.13	25.93	57.69	14.32	94.8
Returns to scale	0.423	0.513	0.552	0.844	0.41	0.634

Source: *Author's calculation*
*1 % Significance,** 5% Significance, *** 10% Significance
Figure in the parenthesis show standard error of the respective co-efficient.

irrigation and land cultivation were jointly responsible for explaining about 31 to 95 percent variations in the yield of major crops between the animal and power tiller operated farms. In the case of log linear Cobb-Douglas type of production function, the estimated parameters gave the production elasticity of factors included in the model. The elasticity of an input indicates the percent increase / decrease in the quantity of that input for any specified level of use of other inputs.

The coefficients of partial elasticity of production of all the six inputs (human labour, fertilizers, seed, insecticides, irrigation and land cultivation) were less than unity with positive signs at all the levels of mechanization implying diminishing marginal productivity of factor inputs. In other words, by holding the other inputs constant at their geometric mean levels, and increasing any of them, the yield would increase at a diminishing rate. The coefficients of partial elasticity of production of inputs were greater or less than unity with negative sign indicates that any increase in these inputs will have negative impacts on total production of crops. The intercepts of the estimated equations were positive in the case of Boro and Aman Paddy on Power tiller and Animal operated farms.

Human Labour

It can be seen from Table 1 that the human labour use in the crop production process was statistically significant for the crops of Boro and Aman Paddy under Mechanized farm. The effect was significant at 10% and 5% level, respectively for Boro and Aman paddy on power tiller operated farms. The elasticity coefficients of human labour for Aman and Boro paddy indicate that the higher human labour use would surely increase the yields and returns of Boro and Aman paddy of all categories of farms, especially power tiller operated farm.

The insignificant effects of human labour use on output were found to be in the case of Aman paddy of animal power operated farms. The regression coefficient -0.044 indicates that for a unit increase of human labour in Boro paddy under animal operated farm the output will result in a 0.044 unit decrease. In the case of pooled farm the effect was statistically significant at 10% level for Aman paddy and the effect was statistically insignificant for Boro paddy under pooled farms. The comparison of elasticity coefficients of human labour use among the different categories of farms for different crops shows that for the crop of Boro, the elasticity coefficient was maximum for power tiller operated farms. This indicates that the increase of the output will be maximized of the power tiller operated farms by increasing one unit of human labour use on such farms compared to other categories of farms.

Fertilizers

The production elasticity coefficients of fertilizers were statistically significant at 1% level in the case of Aman on power tiller operated farms. The coefficients were statistically significant at 5% level for Boro and Aman paddy on power tiller and animal operated farms, respectively. The coefficients were significant at 10% level for Boro paddy on animal operated farms. In the case of pooled farm the production elasticity coefficients were statistically significant at 1% level for both Boro and Aman paddy.

The comparison of elasticity coefficients indicates that in the case of both animal operated farms and power tiller operated farms, it was highest in Aman paddy production. Thus, the use of fertilizers would significantly increase the output of the Aman crop among various categories of farms.

Seeds

It can be seen from Table 1, that the seed used in the production process was statistically significant for the Boro Paddy under power tiller operated and pooled farms. The effect was statistically significant at 1% level for Boro Paddy on power tiller operated and pooled farms and 5% level for Boro Paddy on animal operated farms. The insignificant effects of seed use on output were found to be in the case of Aman Paddy on the power tiller operated farms. The production elasticity coefficient of -0.003 indicates that for a unit increase of the seed cost will result in a 0.003 unit decrease in the output of Aman paddy under animal operated farm. In pooled farm, 1% level of significance was found for Boro Paddy where as the effect was insignificant in the case of Aman paddy.

The comparison of elasticity coefficients of seed use among the different categories of farms for different crops showed that for the Boro crops, the elasticity coefficient was the maximum for power tiller operated farms. This indicates that the increase in the output would be maximized in the power tiller operated farms by the one unit increase seed use on such farms, than on the other category farms.

Insecticides and Irrigation

The production elasticity coefficient of insecticides and irrigation was statistically insignificant for Boro paddy on power tiller and animal operated farms. In the pooled farm the production elasticity coefficients of insecticides were statistically insignificant for both Boro and Aman paddy where as the irrigation has negative impact on production of Aman under pooled farm.

Power tiller or Animal Power

The production elasticity coefficients of power tiller and animal power were statistically significant at 1% level in the case of Aman Paddy. The coefficient was statistically significant at 5% level for Boro Paddy on animal operated farms. The insignificant effects of power tiller use on output were found to be in the case of Boro Paddy on the power tiller operated farms. The production elasticity coefficient of Aman Paddy was statistically significant at 1% level under pooled farm where the coefficient is insignificant for Boro paddy in the case of pooled farm.

Returns to Scale

The returns to scale explain the behavior of change of yield when all inputs are changed simultaneously in the same proportion. This is indicated by the sum of individual elasticity coefficients of factors include in the Cobb-Douglas production function. Increasing, constant or decreasing returns to scale were said to exist, accordingly as the sum of coefficients was greater than, equal to, or less than unity. Based on this criterion, the sum of elasticity of the factors (Table 1) showed that there is no increasing return to scale in the case of Boro and Aman on power tiller, animal operated and pooled farms. Irrespective of the crops, returns to scale of all the crops was less than unity indicating the decreasing returns. Put in another way, unit increase of these factors of production would result in diminishing returns in all these cases.

Profitability of Rice Production

In order to calculate profits, comparative profitability of different cropping patterns, costs and returns of Aus, Aman and Boro paddy have been considered. To calculate profit we have considered total return from output and by-products minus total variable cost and fixed costs involved in producing per hectare output. In the survey, farmers are unable to give exact price of by-products because they use the by-products for feeding animals. So in this study, the return from by-products is omitted.

For the lack of perfect information about rental and mortgage rate of land, the total fixed cost is also excluded from the model. In this model we have only considered the variable cost, including labour, fertilizer, seed, insecticides, irrigation and power tiller or animal cost. The production cost per hectare of Boro paddy under power tiller is Tk. 31165 where the market value is Tk. 89715 and the profit is Tk. 5854. The gross value, total variable cost and profit of Boro paddy under animal operated farm are almost same compared to the Boro paddy under power tiller operated farm (Table 2).

In the case of Aman Paddy under power tiller operated farm, the gross return is Tk. 90765per hectare where the total cost is Tk. 33004 and the profit is Tk. 57761. Under animal operated farm, the gross value (per hectare) of Aman paddy is Tk. 85039, where the total variable cost is Tk. 26918 and the profit of the production of Aman is Tk. 58120 per hectare. There is very little irrigation cost in the cultivation of Aman but the seed cost is high compared to the Aman Paddy under power tiller operated farm. The total input cost (Tk. 23067) of the production of Aus is low compared to the other crops and the net return (Tk.69057) is higher than Boro and Aman because there is no irrigation cost.

Table 2 : Profitability of Individual Farmers (in Taka)

Farm Category	Gross value (ha)	Labour cost	Fer. cost	Seed cost	Ins. cost	Irr. cost	Tillage cost	Total cost (ha)	Profit (ha)
Boro-PT operated Farm	89715	14921	2197	1876	749	6632	4787	31165	58549
Boro-animal operated farm	87598	14945	1595	1665	822	4491	4565	28086	59512
Aman-PT operated farm	90765	16369	1884	1742	761	7606	4639	33004	57761
Aman-animal operated farm	85039	15103	1377.86	2339	1457	6233	4073	26918	58120
Boro-Pooled	89113	14928	2026.28	1816	770	6023	4724	30289	58823
Aman Pooled	88831	15941	1713	1944	996	6157	4448	324737	56358
Aus-Pooled farm	92124	13064	2741	3305	662		3293	23067	69057

Source: *Author's Own Calculation*

The profit variations with variety were found to be significant (through t-test) for all crops (Table 3). From table 3 it is seen that the observed t' value is greater than the tabulated t value at 1 percent level of significance for all the crops. In the case of Boro paddy under animal and power tiller operated farms, the profit under animal operated farms is greater than power tiller operated farm on the basis of the evidence available. For Aman paddy, the profit under power tiller operated farms is higher than animal operated farms.

Major Problems in Input Productivity and Policy Suggestions to Overcome the Crisis

Our farmers are very poor and illiterate. They are not conscious about modern technology. 60.83% of farmers cannot use modern technology because of money problem. 16.67% of farmers cannot buy power tiller, power pump, hybrid seeds as the market price is very high. The supply of hybrid seed is not available in the

Table 3 : Profit Variation Due to Varietal Differences of Different crops

Crops/ Variety	Power tiller Profit (tk/ha)	Animal Power	Differences in profit (in Tk.)	T-values	Degrees of freedom	Remarks
Boro Paddy	58549.96	59512.73	962.77	4.54	48	*
Aman Paddy	57761.24	53607.70	4153.54	2.98	25	*

Source: *Author's Own calculation*. Note: * Means significant at 1 percent level

cropping season. Farmers collected hybrid seeds from thana agriculture office, which is at a distance of 2 to 3 kilometers from some villages. So, in most of the cases farmers are unable to collect hybrid seeds from the agriculture office.

In the production of rice, the major problem is inadequate supply of inputs. In the cropping season farmers do not get enough urea fertilizer. Sometimes the farmers buy fertilizer from black markets at a high price and this increases their production cost. If farmers do not use fertilizer in time, the plants cannot grow properly and the rate of production decreases. From the past decade government gave license to some dealers to sell fertilizers in a market price where the price was fixed by government. But in most of the cases farmers did not get fertilizers from the dealers at fair price. The government agents sell the fertilizers in the black market or give facility to their relatives or well wishers. In the present time another major problem in mechanization in our country is high market price of fuel. Diesel is needed to run the power tiller and power pump. The price of diesel in the local as well as international market has increased, so, the cost of production also increases. Mechanization has also created unemployment problem. If the modern technology is adopted, less labour is needed for ploughing, irrigation, weeding and threshing.

The Ministry has undertaken a number of policy reforms in recent years for which it has received considerable recognition from development partner. Agro sector by this time has already achieved the cherished long term goal of self sufficiency in the production of rice. The major success of the Ministry is its unquestioned success in spurring the growth of crop agriculture while saving considerable amount of local currency through eliminating the subsidies on fertilizers and also allowing private trade in fertilizers, minor irrigation equipment and seeds. As a development strategy, the present government has accorded highest priority to the agriculture sector. The commitments in this respect are reflected in the National Agriculture Policy that includes:

- Timely supply of agricultural inputs at affordable prices,
- Appropriate action plan for agricultural credit and marketing of agricultural products,
- Set up deep tubewell in the study area to give irrigation facility to the farmers.
- Government should take steps to improve the seed quality or supply hybrid seed at reasonable price,
- Import if agro-machines, including power tiller, was liberalized – resulting in the positive effect on import of power tiller.
- Enhanced rate of private sector-participation in supply of agro-machinery,
- Greater coordination between the government, NGOS and private sector,

Bangladesh agriculture is now in the process of transformation from subsistence farming into commercial farming. Bangladesh has already entered into the European Market for export of vegetables and other high value crops. The process opens a vista to private sector investment in the areas of production of high value crops, production of seeds, especially hybrid seeds, chemical and blended fertilizers, agro-processing enterprises, etc. The policy reforms that have taken place offer greater scope and opportunities for private sector participation and have created a suitable environment for promoting agro-business and investment.

Conclusions

There is an ample scope to increase the net returns to fixed factors among all the categories in the study district, especially on power tiller operated and animal plus power tiller operated farm where the impact of mechanization on net returns was highly positive, indicating better profitability conditions existing in such farms. Apart from this, the farmers of the study area need to be provided with timely and adequate quantum of credit, especially for the purchase of small machinery and small farm equipments. Hence, better credit planning and disbursal is required from the concerned government agencies.

References

1. Ahmed, R., Haggblade, S. and Chowdhury, T. (2000). Out of the Shadow of Famine; Evolving Food Markets and Food Policy in Bangladesh. Baltimore, Md. USA and London; The Johns Hopkins University Press.
2. BAU. (2001). Socio-economic impact of mechanized cultivation on livelihoods of rural labourers in Bangladesh. A PRA report of four selected villages in Bangladesh, PEFPI project, Dept. of Farm Power and Machinery, BAU, Mymensingh.
3. Bangladesh Agricultural Census, (2008). Ministry of Agriculture, Government of the People's Republic of Bangladesh.
4. BBS, (2006). Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics, Ministry of Planning and Development, People's Republic of Bangladesh.
5. BBS, (2013). Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics, Ministry of Planning and Development, People's Republic of Bangladesh.
6. Bangladesh Economics Review (2013). Planning Division, Ministry of Planning, Government of the People's Republic of Bangladesh.
7. Duft, B. (1986). Some consequences of agricultural mechanization in Philippines, Thailand and Indonesia. In. Small Farm Equipment for Developing Countries. Proceedings of the international conference on small farm equipment for developing countries.
8. Dillon, J. and Hardaker, B. (1980). Farm management research for small farmer development, FAO (n. 4 1), Rome 1980.
9. Hossain, M., BOSE, M. L. and Bazlul A. A.MUSTAFI, B.A.A. (2006). Adoption and Productivity Impact of Modern Rice Varieties in Bangladesh. The Developing Economies, XLIV-2 (June 2006): 149–66.
10. Household Income and Expenditure Survey, (2012). Bangladesh Bureau of Statistics, Ministry of Planning and Development, People's Republic of Bangladesh.
11. Labour Force Survey, (2009). Bangladesh Bureau of Statistics, Ministry of Planning and Development, People's Republic of Bangladesh.
12. Mahendran K. (1995). An Economic Study of Farm Mechanization in South Arcot District of Tamil Nadu. Indian agricultural Research Institute, New Delhi.
13. Majumder, M.K., Mozumder, L. and Roy, P.C. (2009). Productivity and Resource Use Efficiency of Boro Rice Production. J. Bangladesh Agril. Univ. 7(2): 247–252, 2009 ISSN 1810-3030.

14. Miah, M. A. M. (2002). Socio-economic Impact of Mechanization on livelihoods of Rural Labourer in Bangladesh; Some Cases Study. Workshop Proceedings on Socio-Economic Impact of Mechanization on livelihoods of Rural Labourer in Bangladesh, IDB Bhoban, Sher-e-Bangla Nagar. Dhaka, Sept.2002.

15. Pandey, M. M. (2004). Present Status and Future Requirement of Farm Equipment for Crop Production. Project Coordinator, AICRP on FIM, Central Institute of Agricultural Engineering, Bhopal.

16. Rahman, S. (2003). Profit Efficiency among Bangladeshi Rice Farmers. Proceedings of the 25th International Conference of Agricultural Economists, ISBN Number: 0-958-46098-1, (IAAE) 16 – 22 August 2003, Durban, South Africa.

17. Talukder, M.S.U., Adham, A.K.M., and Ahmed, M. (2004). Maximizing The Productivity of Shallow Tubewell By Upgrading The Management Practices*, Bangladesh J. Agril. Sci*. 31(2): 175-180, July, 2004.