

## Changes in Input Cost Structure of Boro Rice Production in Bangladesh Over Time

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**Abstract:** *The present study was undertaken with a view to examine the changes in the share of different inputs in production cost of HYV Boro rice over time. For computing the changes of share of different cost components in total cost, three sub-periods were considered: Period I (1979-1990), Period II (1991-2003) and Period III (2004-2013). From the results, it was observed that the share of labour cost in total cost has increased significantly over time while share of animal labour/power tiller cost has decreased over time. Share of seed cost and pesticides cost were not significant as compared to the other cost items. Human labour cost occupied the major portion of total cost followed by power tiller and irrigation cost. In period I (1979-1990), human labour cost occupied 21 percent while animal labour/power tiller cost and irrigation cost occupied 16 percent and 9 percent of total cost, respectively. In period II (1991-2003), human labor cost occupied 27 percent while animal labour/power tiller and irrigation cost occupied 14 percent and 18 percent, respectively. In period III (2004-2013), share of human labour and animal labour/power tiller cost were 39 percent and 7 percent, respectively whereas share of irrigation and fertilizer costs were 15 percent and 11 percent, respectively. The analysis showed that there have been significant changes of different cost items as well as total cost over time which have greater impact on the production of Boro rice in Bangladesh.*

**Key words:** *Inputs, Production Cost, Boro Rice, Time*

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## **1. Introduction**

In spite of major contribution of rice to agricultural economy, any traditional rice producers are incapable of producing at the frontier level to contribute to food security and satisfy household consumption in Bangladesh. Boro is the most important and single largest crop in Bangladesh in respect of volume of production. It has been persistently contributing to higher rice production in last successive years. Total area under Boro crop has been estimated 47,90,305 hectares in Fiscal Year 2013-2014 as compared to 47,60,055 hectares of the previous year (2012-2013). The harvested area for Boro crop has increased by 0.64 percent for the year 2013-2014. The average yield rate of Boro rice in FY 2012-13 was estimated at 3.945 metric tons per hectare which was 1.16 percent higher than that of previous year. Total Boro production in FY 2012-13 was estimated at 1,87,78,154 metric tonnes. The production was estimated at 1,90,07,206 metric tonnes in the following year (2013-14) (Bangladesh Bureau of Statistics, 2014). The rate of growth of rice production in the country is lower than the rate of growth of demand for rice in the country. To meet additional demand, the country has to import rice almost every year in the previous decades (Nargis and Lee, 2013).

Now a days the cost of production of cultivating paddy is very high than that of before. In an effort to maintain productivity growth, the Bangladesh Rice Research Institute (BRRI) has developed over 30 HYVs for different seasons and agro-ecological zones. The rapid growth of minor irrigation equipment has inspired the farmers to make a progressive shift from high-risk, monsoon dependent agriculture to low-risk, irrigation-based agriculture. Over the last three decades, the technology of the 'green revolution'— of High Yielding Variety seeds, irrigation, fertilizer and pesticide have enhanced rice production by mainly enhancing irrigated areas and yields. Farmers' acceptability of hybrid rice technology in the country is found very much encouraging with few exceptions. In this perspective, The fluctuation of the cost of different inputs has a great economic impact in terms of rice production, lead to an uncertainty in the income of the producers. The uncertainty retards investment in agriculture resulting in slow growth of agricultural output. Therefore, it is an urgent to examine the changes of cost structure of Boro rice production over time. Therefore, the present study aimed to examine the changes in cost structure of Boro rice production over time.

## **2. Materials and Methods**

The present study is based on secondary data of different cost components of HYV Boro rice over a period of 1979-1990, 1991-2003 and 2004-2013 in whole

Bangladesh. Time series data has been used in the analysis. A time series is a collection of observations of well-defined data items obtained through repeated measurements over time. To attain the objectives of the study, time series data for major cost items such as human labour, animal labour/power tiller, seed, fertilizers, irrigation and pesticides costs of Boro rice production in Bangladesh were collected for the period of 1979 to 2013. For computing the share of different cost components in total cost, the whole time period mentioned above was divided into three sub-periods in order to understand the changing pattern of cost components of HYV Boro in different time periods. The sub-periods that were considered for this purpose are:

- a) Period-I: 1979-1990.
- b) Period-II: 1991-2003.
- c) Period-III: 2004-2013.

The required data for the present study were collected from different secondary sources. The data for different cost components of HYV Boro production in Bangladesh were collected mainly from the Handbook of Food Planning and Monitoring Unit (FPMU), Ministry of Food, Government of the People's Republic of Bangladesh. This data set was supplemented by the data collected from the Year Book of Agricultural Statistics of Bangladesh for different years. Percentage share of each cost components in total cost was calculated to see the share changes of different inputs for three different periods.

### **3. Results and Discussion**

Human labour is the most important factor (input) in the production process of HYV Boro rice. When individual inputs were concerned it was observed that expenses on human labour shared a major portion of expenses in the production of HYV Boro rice. Both family and hired labour are used in production of HYV Boro. Family labour includes the farmer and his family members while the hired labour includes permanent hired labour, labour employed on contract basis and casual labour. Table 1 presents the structures of total cost and human labour cost in different time periods as well as change in percentage share of human labour cost in total cost over time. The comparisons of costs and change in factor share have been made based on three time periods: 1979-1990 (Period I), 1991-2003 (Period II) and 2004-2013 (Period III). All the cost items discussed in this section were estimated at nominal price.

*Table 1: Per hectare change in share of human labour cost in total cost over time*

Year	Total cost	Human labour cost	(Cost in Taka)
			Share in total cost
1979-1990	22,990	4,818	21%
1991-2003	32,904	8,919	27%
2004-2013	83,421	32,384	39%

It can be seen from Table 1 that the share of human labour cost in total cost was 21 percent in period I. The respective share was increased to 27 percent in period II. The share was further increased to 39 percent in period III, which is much larger compared to period I and II. Therefore, it can be said that share of human labour cost in total cost has substantially increased in the last decade for Boro rice production.

Animal labour or power tiller is mostly used for land preparation. These are also used for land leveling and in some cases for threshing and carrying of paddy as well as other inputs and outputs of paddy production. In recent years the use of animal power is greatly replaced by the power tiller because of the scarcity of draft animal power. The main advantage of using power tiller in land preparation is that a power tiller can in principle work 24 hours a day at the same level of efficiency. Table 2 presents the structures of total cost and animal power/power tiller cost in different time periods as well as change in percentage share of animal power/power tiller cost in total cost over time.

*Table 2: Per hectare change in share of animal labour/power tiller cost in total cost over time.*

Year	Total cost	Animal labour/power tiller cost	(Cost in Taka)
			% of Total cost
1979-1990	22,990	3,749	16%
1991-2003	32,904	4,741	14%
2004-2013	83,421	6,191	7%

From Table 2, it can be seen that the share of animal labour/power tiller cost in total cost was 16 percent in period I. The respective share was decreased to 14 percent in period II. The share was further decreased to 7 percent in period III, which is about half compared to period I and II. Therefore, it can be said that share

of animal labour/power tiller cost in total cost has decreased in the last decade for Boro rice production mainly because of replacement of animal power by power tiller.

Seed is the most basic and crucial input for Boro rice production. Supply of quality seed is very important to ensure rice production. Hossain (2002) have shown that Bangladesh can increase its rice production to the tune of 20 lakh tones alone by ensuring supply of quality seeds of the same varieties to the farmers. Several modern rice varieties are available for cultivation in the Boro season. Some of the varieties of Boro rice that farmers grow include BRRI Dhan 28, BRRI Dhan 29, BRRI Dhan 25, BRRI Dhan 36 and BRRI Dhan 47. BRRI Dhan 47 has been developed for cultivation in the salinity affected southern-coastal region. Farmers use both home supplied and purchased seeds for Boro production. The cost for both purchased and home supplied seeds has been estimated on the basis of prevailing market price.

Table 3: Per hectare change in share of seed cost in total cost over time.  
(Cost in Taka)

Year	Total cost	Seed cost	% of Total cost
1979-1990	22,990	965	4%
1991-2003	32,904	2,195	7%
2004-2013	83,421	1,413	2%

From Table 3, it can be seen that seed cost occupies a small percentage share in total cost although it is the most crucial input for any production practices. The percentage share of seed cost in total cost was 4 percent in period I. The respective share was increased to 7 percent in period II. However, the share was decreased to only 2 percent in period III, probably because of rise in other factor shares in total cost.

Fertilizer is one of the most important inputs in producing HYV Boro rice. The expansion of cultivation of HYVs witnessed a tremendous use of chemical fertilizer in the country. Farmers mostly use Urea, Triple Super Phosphate (TSP), Muriate of Potash (MOP) and sometime a few other fertilizers. Table 4 presents the structures of total cost and fertilizer cost in different time periods as well as change in percentage share of fertilizer cost in total cost over time.

Table 4 shows that the share of fertilizer cost in total cost was 6 percent in period I. The respective share was increased to 11 percent in period II. The share remained same to 11 percent in period III although the cost was increased in

Table 4: Per hectare change in share of fertilizer cost in total cost over time.

Year	(Cost in Taka)		
	Total cost	Fertilizer cost	% of Total cost
1979-1990	22,990	3,673	6%
1991-2003	32,904	3,702	11%
2004-2013	83,421	9,652	11%

nominal term. It indicates that the use of fertilizer as well as cost of fertilizers in producing HYV Boro was more or less constant over the years.

Irrigation is the leading input in producing HYV Boro rice. Among all the operating expenses, cost of irrigation occupies major share of total cost for the production of HYV Boro. Irrigation is a major challenge for farmers growing crops in the dry season. Majority of the farmers purchase water from pump owners. Three modes of payment of water charge are currently in place. These are: crop sharing arrangement, fixed charge on per acre basis, and machine rental system where the farmers directly supply diesel. Table 5 presents the structures of total cost and irrigation cost in different time periods as well as change in percentage share of irrigation cost in total cost over time.

Table 5: Per hectare change in share of irrigation cost in total cost over time.

Year	Cost in Taka)		
	Total cost	Irrigation cost	% of Total cost
1979-1990	22,990	2,170	9%
1991-2003	32,904	5,884	18%
2004-2013	83,421	12,487	15%

Table 5 represents that for producing Boro rice, the share of irrigation cost in total cost was 9 percent in period I. The respective share was increased to 18 percent in period II. The share was slightly decreased to 15 percent in period III though the cost was increased almost double between these periods. This indicates that compare to irrigation cost, other costs were increased more rapidly (e.g. labour cost) and captured the major share of total cost.

The pesticides market has a rather different history than fertilizers, with relatively little public sector involvement. In the last few years most of the farmers used pesticides in producing HYV Boro for ensuring high yield. The Ministry of Agriculture did play a role, however and limited the imports to specified brands

and also required dealers to be licensed. Table 6 presents the structures of total cost and pesticides cost in different time periods as well as change in percentage share of pesticides cost in total cost over time.

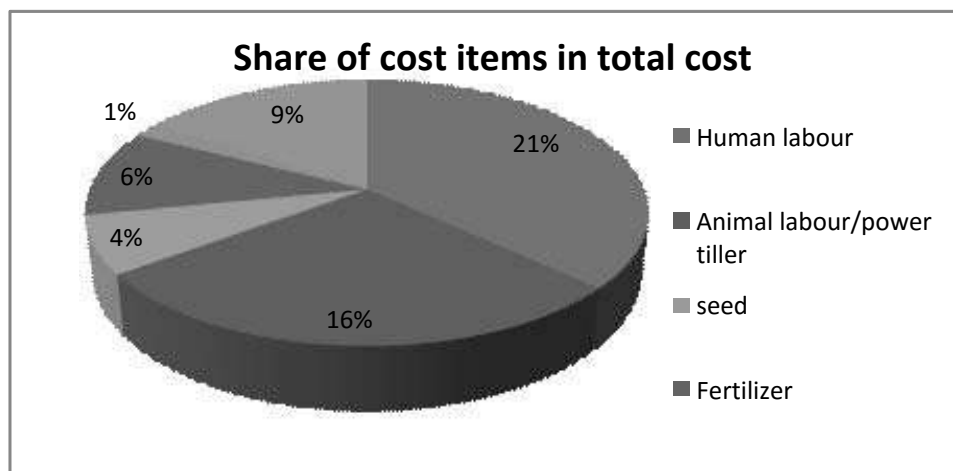
Table 6: Per hectare change in share of pesticide cost in total cost over time.

Year	(Cost in Tk)		
	Total cost	Pesticide cost	% of Total cost
1979-1990	22,990	240	1%
1991-2003	32,904	657	2%
2004-2013	83,421	1,688	2%

From Table 6, it can be seen that the share of pesticide cost in total cost was 1 percent in period I. The respective share was increased to 2 percent in period II. The share was remained same to 2 percent in period III although the cost was increased in nominal term.

Figure 1 presents percentage share of different cost items in three distinct time periods.

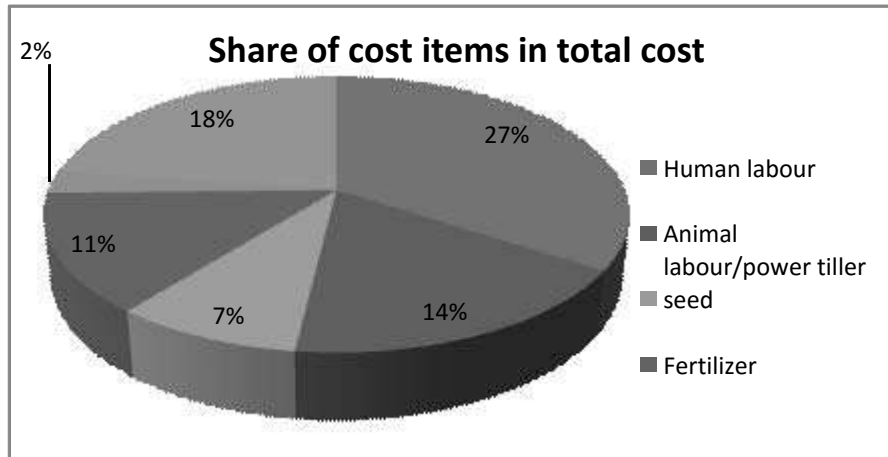
Figure 4.1: Percentage share of different cost items in three distinct time periods



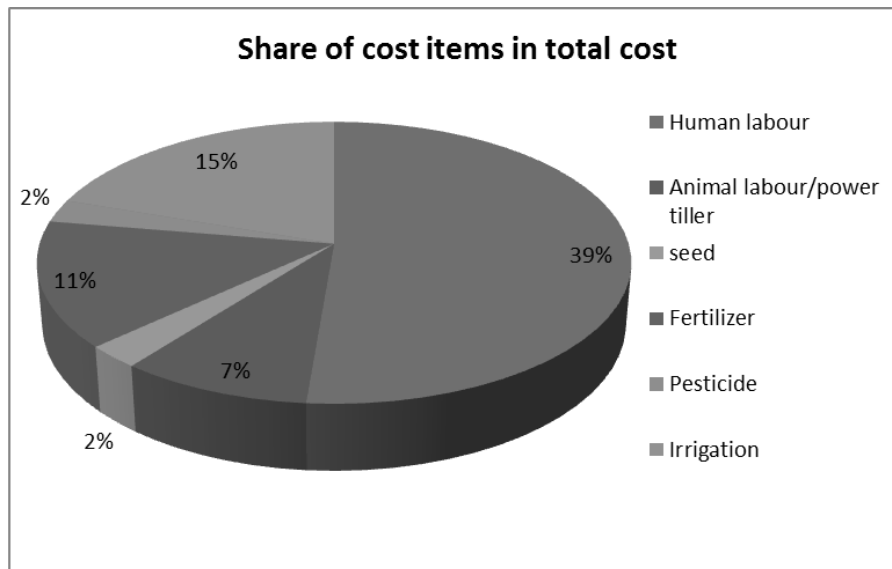
Period I: 1979-1990

#### 4. Conclusion

The analysis showed that there have been significant changes of different cost items as well as total cost over time. There was a significant increase in share of human labour cost in total cost which indicates that the production of Boro rice become more labour intensive. Since, human labour, animal labour/power tiller



Period II: 1990-2003



Period III: 2004-2013

and irrigation cost occupied the major share of total cost, the increased share of these cost items have considerable impact on Boro rice farmers' profitability. On the basis of the results of this study some recommendations are made as follows:

1. Labour cost is the major element in HYV Boro production. High labour cost affects the profitability. So for increasing production, the labour cost can be minimized by using modern technology.



2. Expansion of irrigation facilities can contribute to the adoption or expansion of improved varieties as well as significantly increase the yield of traditional varieties. Diesel and electricity price need to be controlled to minimize the irrigation cost.
3. Government organizations should play an active role to ensure farmers' profitability either by output price support or by input subsidy.

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