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## Availability and Price Volatility of Rice in Bangladesh: An Inter-Institutional Study in 2020

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# Availability and Price Volatility of Rice in Bangladesh: An Inter-Institutional Study in 2020

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## Preface

The unusual sharp price rise of rice, potato and onion in 2020 raises the question of the normal functioning of the market. Many people apprehend the presence of the syndicate in the market. Despite fixation of prices by government and taking initiatives to sell these commodities through Trading Corporation of Bangladesh (TCB) at lower prices, the prices in the market did not go down. Under this situation, Honourable Agriculture Minister in a meeting on 20 October, 2020 instructed to conduct a research headed by Bangladesh Agricultural Research Council (BARC) with the help of agricultural economists of different research institutes to find out the reasons for price hike of these essential commodities after consultation with field level farmers, mill owners, cold storage owners, local consumers etc. and submit a report within one month to the Ministry. Accordingly, in a meeting on 12 November, 2020 at BARC, it was decided to form inter-institutional and multidisciplinary study teams to conduct research and accordingly three study teams were set up for conducting research on three selected commodities. Each team prepared a report within one month based on both primary and secondary data and extensive Focus Group Discussion (FGD) with different stakeholders in different places of the country. Finally, the three draft reports were presented in a workshop held on 24 December, 2020 and after addressing necessary comments made in the workshop final reports were prepared.

In these reports after identifying the causes of price spiral some recommendations were made. Lower production, higher consumption, slow release of stock by different stakeholders, limited control/intervention by government in the market, creation of panic/rumor, misleading data and trade syndication are identified as the main causes of price hike. Recommendations made are: announcement of support prices for major commodities adding at least 20% profit over the cost of production; making available reliable and trustworthy data; increase in domestic production; strong monitoring by government; taking legal actions to the people involved in trade syndication, reduction of import dependency on a particular country; broadcasting the true picture of a commodity with data to counter any rumor in the market; quick procurement from home and abroad to build up sufficient stock of the government; and maintaining a required public stock throughout the year.

I really appreciate Prof. Dr. Jahangir Alam, the Coordinator, Dr. Md. Mosharruf Uddin Molla, Member Director (AERS) as well as Member Secretary and all members of the study teams for conducting the research and preparing the reports within a very short period. I extend my sincere thanks to Agricultural Economics and Rural Sociology (AERS) division, BARC for arranging this research and to Krishi Gobeshona Foundation (KGF) for financing the study. Finally, I am very much obliged to Honourable Agriculture Minister Dr. Md. Abdur Razzak MP for his initiative and inspiration for this study. I am also obliged to the heads of the participating organizations/institutions for their support in conducting this study.

I believe, the recommendations made in the reports will be helpful to policy makers to adopt appropriate policies for stabilizing prices of agricultural commodities in the future.

**Dr. Shaikh Mohammad Bokhtiar**  
Executive Chairman  
Bangladesh Agricultural Research Council

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## Executive Summary

Bangladesh has made remarkable progress in rice production and achieved self-sufficiency for feeding the people of Bangladesh. Total rice production in Bangladesh was about 10 million tons in 1972-73, which increased to 38.72 million tons in 2019-20. It is about four times higher than the previous production. The growth of rice production (2.83%) was much higher than the growth of population (2.04%).

In most recent days, market prices go up unexpectedly that poses threat to farmers and consumers, which is most embarrassing for the government and policy makers. Therefore, this research was recommended to find out the major drivers for rice price hikes in Bangladesh. Primary and secondary data were used in the analyses. The primary data were collected by conducting Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) in Naogaon, Sherpur, Cumilla and Dhaka districts. In addition, a telephonic survey was conducted to get much responses about the reasons for recent paddy and/or rice price hike from different value chain stakeholders. Secondary data were gathered from different organizations and the published sources. Suitable statistical and mathematical tools were employed to analyze the data.

The growth rate of national rice production was always more than 2 percent in 1973-2000 and 2001-2020 while the growth rate over the period of 1973-2020 was 2.83 percent. To drive the growth of rice production upward, a package of intervention such as rapid spread of superior varieties, increment of irrigation areas under rice cultivation, adoption of climate resilient genotype, and better resource management and use of superior technologies, quality seeds and mechanization is required.

During the two intervals of 2011-2015 and 2016-20, a substantial surplus of rice per capita was achieved. Almost 2 million tons remained surplus over the period 2009-2017 and more than 3 million tons over the years 2018 to 2020. The additional stock through import of rice usually increased the national surplus and helped stabilize the market price of rice.

Nominal price of rice increased, on average, at the rate of 4 to 5 percent whereas the real price decreased, on average, at the rate of 2 to 3 percent over the reference years (1972-2020). Even though the slope of nominal price in both T. Aman and Boro seasons was similar at all actor's level, adjustment of inflation in price of T. Aman paddy exhibits the higher market risk compared to that of Boro paddy. Cost of paddy cultivation increased by about 3 percent over the period of 2009–2020 while net profit (Tk/kg) decreased by about 8 percent over that period.

The millers thought that they are the losers in rice processing business but they did not take the value of its by-products in their calculation. With valuation of by-products, millers usually made the profit per kg ranging from Tk. 4.6 in 2019 to 9.5 in 2017 in T. Aman while they made profit, from Tk. 4.7 in 2020 to 8.2 in 2018 in Boro season.

Although market price of paddy usually exists below the procurement price, most of the farmers do not get the benefit of that price and government bought only a small quantity of paddy. However, farmers were happy to receive a good price of T. Aman paddy in 2020. Historical trend of wholesale price was similar to that of procurement price of milled rice. The overall relationship between marketed surplus and price showed that someone might have power to regulate the determination of price in the market instead of market forces of supply and demand. Price spread reveals that midstream actors particularly millers, aratdars, and wholesalers harvested a super normal profit.

In 2016, a reverse trend of price between Bangladesh and neighboring countries was observed. But almost a similar price trend appeared between 2017 and 2018. After that period, rice price in Bangladesh fell down lower than the import parity price of neighboring countries. However, the price increased in 2020.

Public stock of rice drastically fluctuates and highly declines sometimes that gives an important signal of retention of minimum stock and increasing it to a minimum of 2500 thousand tons annually with a retention of at least 1250 thousand tons monthly. The highest prices in wholesale market of T. Aman were recorded in the month of January, February, June and October for the years 2016 through 2020 while for Boro, the highest prices were recorded in January, March, September, October and December.

Based on production situation, import decision, and domestic procurement, the value chain actors (millers and traders) make a gambling role to control price of paddy and rice in the market.

The indices during the period from 2016 to 2020, showed higher and unpredictable trend of paddy price from August to October. To control market prices during that period, the government should always maintain a large reserve of at least 12.5 lac tons of rice each month that would smoothen the impacts of large swings of rice prices.

Almost all of the farmers used to sell major portion of marketable surplus within the first month of harvesting. The pattern of paddy sale changed substantially between the last two consecutive Boro seasons. In Boro 2020, farmers released their paddy stock a bit slowly in the market. The traders and millers, apprehending a panic of food shortage during pandemic, failure of achieving rice procurement target and delay in import by the government, and speculation for higher price, retained a part of their stockpiles of rice, which were the main reasons for the price hike.

The other reasons for price hike in rice market during 2020 includes supremacy and unequal competition of large millers and traders, delayed harmonization of data that led to the panic of shortage of paddy production, delay in rice import decision, increasing cost of paddy cultivation and rice processing, increasing number of seasonal traders and production loss from the disaster. Also the government stayed away from large intervention in the market during the stressed period.

To overcome the seasonal price hikes; an up-gradation of paddy/rice procurement system is necessary. Government should declare separate minimum support prices (MSP) for fine and coarse grains of paddy and rice that will help farmers to get higher price at the harvesting time. The government should procure about 10 percent of total production with no less than 25 lac tons of rice so that intervention in the market can be made effectively. Government should retain at least 12 lac and 50 thousand tons of rice every month as buffer stock. Procurement price should be determined considering at least 20 percent profit over the production cost. Millers and traders should have trust on government data and should adjust their business strategy with the policy intervention of the government. Concerned ministry and department should have a policy to communicate with the rice millers and traders on regular basis so that a fair business environment prevails in this market. Finally, cost minimization strategy, intensive market monitoring, regulation for rice processing industries and timely government interventions are the important factors for ensuring stability in the market.

# 1. Introduction

## 1.1 Importance of rice in Bangladesh

Bangladesh is a densely populated small agrarian country. Agriculture has been the mainstay of Bangladesh economy, contributing 13.38% to the gross domestic product (GDP) and generating employment for about 41% of the total labour force (BER, 2019; Rahman et al., 2020; Rahaman et al., 2020). Rice is the main crop and staple food of people in the country. It supplies about 92% of total food grain production and covers about 76% of the total cropped area in Bangladesh (BBS, 2016). Rice contributed about 7.58% to the national GDP (Khan et al., 2013). The country has made a remarkable progress in agriculture in terms of adoption of modern technologies and rice production after independence in 1971. Bangladesh has a long history of rice cultivation and contribution of rice to the livelihood of rural people is significant. Rice is grown throughout the country except in the southeastern hilly areas. The agro-climatic conditions of the country provide a warm habitat for growing rice year-round. The national average rice yield is much lower (2.96 t/ha) than that of other rice-growing countries (USA: 5.71 t/ha; China: 4.62 t/ha; Vietnam: 3.96 t/ha; Indonesia: 3.22 t/ha) (WRS, 2020). However, Bangladesh has the highest average rice yield in South Asia (Salam et al., 2019). Due to urbanization, food habits tend to change, demanding the cultivation of new crops that must share land used for rice cultivation (Shelley, 2016). Almost all of the 13 million farm families of the country grow rice. Rice is grown on about 11 million hectares which has remained almost stable over the past three decades. About 75% of the total cropped area and over 80% of the total irrigated area is devoted to rice. Thus, rice plays a vital role in the livelihood of the people of Bangladesh (BRKB, 2020, <http://www.knowledgebank-brri.org/riceinban.php> dated on 10/12/2020).

Total rice production in Bangladesh was about 10.1 million tons in the year 1971 when the country's population was only 7.88 million. Moreover, the country is now producing (about 38.72 million tons) more than three times to feed her 170 million people (BBS, 2019). This indicates that the growth of rice production (2.83%) was much faster than the growth of population (2.04%). The increased rice production has been possible largely due to the adoption of modern rice varieties on around 66% of the rice land which contributes to about 73% of the country's total rice production. However, there is no reason to be complacent. The population of Bangladesh is still growing by two million every year and may increase by another 30 million over the next 20 years. During this time total rice area will also shrink to 10.28 million hectares. Rice yield therefore, needs to be increased from the present 2.74 to 3.74 t/ha (BRKB, 2020). To combat the future situation, we will need to consider the following:

- Replacement of traditional and old varieties by superior inbred, hybrid and super high yielding varieties where possible.
- Development of irrigation water management.
- Bring the unexplored areas under cultivation
- Application of superior resource management technologies.
- Ensure quality seed usages.
- Put emphasis on synchronized mechanization of rice cultivation.

## 1.2 Justification of the study

Bangladesh has been increasing rice production over many years and is now relatively self-sufficient in rice production. The country's rice imports declined from about 1 million tonne in 1995 to a mere 0.017 million tons in 2009 but increased to 0.66 million tons in 2010. Exports of rice began in the 2000s. Some rice is still imported, however, mainly to control domestic prices. The government to increase production and to reduce imports has implemented many rice policies. Subsidy support for rice producers is provided on different agricultural inputs to keep their price within the purchasing capacity of the rice farmers. In 2010, the equivalent of \$712 million was disbursed for subsidy assistance. The government provided cash subsidies to small and marginal farmers through an input distribution card that could be used to obtain cash subsidies for electricity and fuel for irrigation, fertilizer, and other forms of government support. The government has attempted to stabilize rice prices through open market sales since 2004. This was established when the cost of food in Bangladesh began to increase sharply as a result of global price increases. This allowed people to buy rice



at reduced prices from thousands of centers in district towns and union-level dealers across the country (<http://ricepedia.org/bangladesh>). However, in most recent days, market prices go beyond the control that poses threat to farmers and consumers. There is a scanty of insightful research that highlights on the recent rice price hikes in Bangladesh. Therefore, the piece of this research was undertaken to find out the major drivers of rice price hikes in Bangladesh.

### 1.3 Specific objectives

- Long term trend of production, import and export of rice in Bangladesh;
- Demand and supply situation and price trend over time;
- Cost of productions, profitability and appropriateness of market prices;
- Reasons for price spiral in 2020; and,
- Recommend policy measures for price stability.

## 2. Methodology

### 2.1 Growth rate measurement

The growth rates of area, production, and yield of rice in different seasons (Aus, Aman, and Boro) were estimated by fitting a semi-log function (exponential growth function) of the following type adopted from Islam et al., 2020:

$$y = e^{(\alpha + \beta t)}$$

$$\text{or } \ln y = \alpha + \beta t \dots\dots\dots(1)$$

Where, ln = Natural logarithm;

y = Area in thousand hectare (ha) or production in thousand metric ton or yield (t/ha);

$\beta$  = Regression coefficient, i.e., growth rate (in ratio scale);

t= Time period (year). Considered three different forms of period, such as, 1972-1973 to 1999-2000; 2000-2001 to 2019-2020; and 1972-1973 to 2019-2020.

$\alpha$  = Intercept; and,

e = Euler number used for exponential function.

### 2.2 Demand and supply estimation

The total rice demand was estimated by accounting for human and non-human consumption requirements per annum in Bangladesh using the formula and method from Kabir et al., 2020.

**Table 1: Non-consumption usages of rice in Bangladesh**

Sources	Explanation	Percentages
Seed	Farmers' recommended practices, field loss, damages of seed and additional safety for crisis period	1.52
Feed and other losses	Livestock, poultry and fish feed as well as usages of 'rice starch' in textile industries and tourists' consumption	5.15
Harvest operations	Harvest operations (cutting, field drying & bundling) and transporting from field to farm yard/threshing yard	5.20
Post-harvest operations	Threshing, winnowing, drying, in-store, out-store, transportation, marketing etc.	7.10
Processing	Milling, over-polishing, storage and transportation operations	7.25*
Total non-consumption	Summation of all sources	26.22

\* Ratio of paddy to rice is 0.66 at government calculation but millers calculated at 0.60 rate based on head rice during processing which is considered in this calculation. There is difference of 0.06 which eventually affect national production of milled rice in Bangladesh.

Source: Adopted from BRRI.

The human consumption demand is the sum of per capita annual requirement of the total population of the country. The non-human consumption demand is the sum of the requirement for seed, feed, industrial use, and wastage for harvest operation, post-harvest losses, and processing losses per annum (Table 1).

The total rice demand was estimated based on the equations below:

$$TRD_i = HC_i + NHC_i \dots \dots \dots (2)$$

Where, TRD is total rice requirement, HC is human consumption and NHC is the non-human consumption. Notably the human consumption was calculated from the form of milled rice for daily intake, puffed rice, flattened rice, pop rice, and in some extend making the cake. The rice supply has been estimated by adding the imported amount with domestic total production. The data period for demand and supply estimation is 1991 to 2020.

### 2.3 Profitability equation

To determine per hectare profitability for each of the selected paddy farming from the viewpoint of individual farmers, the following algebraic equation was followed:

$$\Pi_i = \sum Q_{yi} \cdot P_{yi} + \sum Q_{bi} \cdot P_{bi} - \sum_{j=1}^m (X_{ij} \cdot P_{xij}) - TFC_i \dots \dots \dots (3)$$

Where,

- $\Pi$  = Net returns from Aman paddy (Tk/ha);
- $Q_y$  = Total quantity of (paddy) outputs (kg/ha);
- $P_y$  = Per unit prices of the paddy (Tk/kg);
- $Q_b$  = The total quantity of the concerned byproduct (kg/ha);
- $P_b$  = Per unit prices of the relevant byproduct (Tk/kg);
- $X_i$  = Quantity of the concerned  $i^{th}$  inputs;
- $P_{xi}$  = Per unit price of the relevant  $i^{th}$  inputs;
- $TFC$  = The total fixed cost involved in production;
- $i = 1, 2, 3, \dots, n$  (Number of farms)
- $j = 1, 2, 3, \dots, m$  (Number of inputs)

In order to estimate the per kg production cost of paddy, the value of the straw has been deducted from the total costs of cultivation. Moreover, transportation, processing, and milling costs have been considered to estimate the production cost of clean rice in Bangladesh. The profitability was shown for the period of 2009 to 2020 based on the data obtained from FPMU, 2020 and from Agricultural Economics Division, BRRI, 2020.

### 2.4 Seasonal trend and indices

For estimating seasonal price variation, a multiplicative model is considered. Trend was estimated by simple 12 months moving average method and seasonal indices were worked out by averaging the detrended series.

### 2.5 Reasons for rice price hike

The section was covered by Focused Group Discussion (FGD) and Key Informant Interviews (KII). FGDs and KIIs were done in Naogaon, Sherpur, Cumilla and Dhaka districts for identifying the reasons for rice price hike in 2020. Besides, a total of 280 farmers and other value chain actors from 14 agricultural regions were interviewed through a telephonic survey. To get a quick response from different value chain actors of paddy and rice market, sample size and number of FGDs and KIIs conducted were kept limited in selected areas.

## 2.6 Data

The data on total population has been obtained from the Food Planning and Monitoring Unit (FPMU) of the ministry of food. The rice import data has been adopted from Ministry of Food covering the period 1991-2020. The historical season-wise rice production, area, and yield data was available in the various reports of the Bangladesh Bureau of Statistics (BBS) the World Rice Statistics (WRS) and Department of Agricultural Extension (DAE). The information on inputs use, and costs and return of paddy and rice has been obtained from FPMU and the agricultural economics division of the Bangladesh Rice Research Institute (BRRI).

## 3. Results and Discussion

### 3.1 Trend of area, production and yield of rice

Figure 1 shows the increasing trend of rice production and yield, while the area becomes stagnant. Using time-series data, the growth rate of rice area, production and yield in Bangladesh were estimated. At the beginning of the estimation, the whole period of 1972-2020 was divided into three sub-periods such as first period (period-I): 1972-1973 to 1999-2000, second period (period-II): 2000-2001 to 2019-2020 and third period (Period-III): 1972-1973 to 2019-2020.

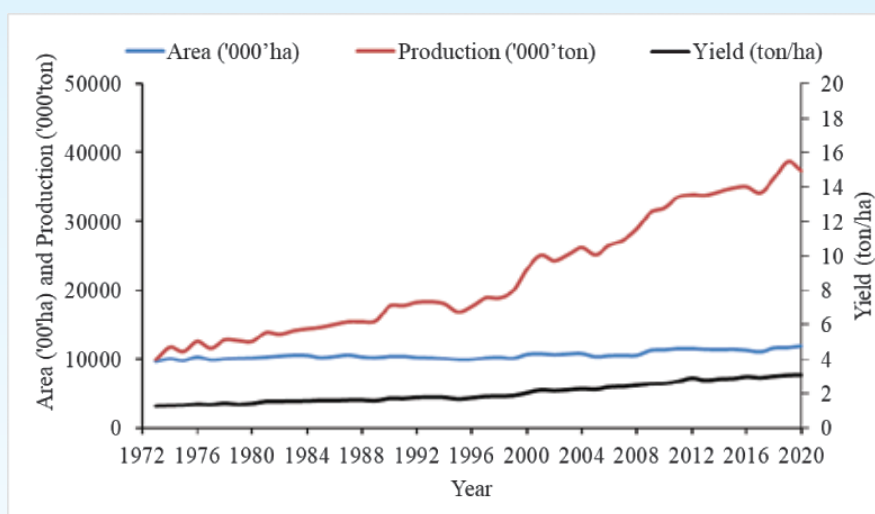


Fig. 1: Scenario of area, production and yield of rice in Bangladesh during 1972 to 2020

**Table 2: Growth rates of area, production, yield and total production of rice for different periods**

Season	Parameter	Period-I 1972-1973 to 1999-2000	Period-II 2000-2001 to 2019-2020	Period-III 1972-1973 to 2019-2020
<i>Aus</i>	Area	-2.92 <sup>***</sup>	-0.62 <sup>ns</sup>	-2.22 <sup>***</sup>
	Production	-1.67 <sup>*</sup>	2.72 <sup>***</sup>	0.05 <sup>ns</sup>
	Yield	1.17 <sup>***</sup>	3.44 <sup>***</sup>	2.39 <sup>***</sup>
<i>T. Aman</i>	Area	-0.11 <sup>ns</sup>	0.13 <sup>ns</sup>	-0.11 <sup>**</sup>
	Production	1.49 <sup>***</sup>	1.83 <sup>***</sup>	1.73 <sup>***</sup>
	Yield	1.63 <sup>***</sup>	1.60 <sup>***</sup>	1.83 <sup>***</sup>
<i>Boro</i>	Area	4.98 <sup>***</sup>	1.38 <sup>***</sup>	3.62 <sup>***</sup>
	Production	6.51 <sup>***</sup>	2.88 <sup>***</sup>	5.36 <sup>***</sup>
	Yield	1.51 <sup>***</sup>	1.52 <sup>***</sup>	1.76 <sup>***</sup>
Total rice	Area	0.14 <sup>ns</sup>	0.55 <sup>***</sup>	0.35 <sup>***</sup>
	Production	2.40 <sup>***</sup>	2.41 <sup>***</sup>	2.83 <sup>***</sup>
	Yield	1.49 <sup>***</sup>	2.02 <sup>***</sup>	1.92 <sup>***</sup>

Source: Authors calculation using semi-log model based on data from various issue of BBS. \*, \*\*, \*\*\* and ns denotes level of significance at 10%, 5%, 1%, and not significant.

To do the growth analysis a semi-log model, which can be obtained from the log transformation of exponential regression model was used. Remedy measure was taken for removal of autocorrelation and heteroscedasticity in order to calculate undisturbed growth rate of area, yield and production. Growth rates of the area, production and yield for Aus, Aman, Boro as well as total rice production are shown for three different aforesaid periods in the Table 2.

In Aus season, the area growth rate was estimated to be -2.93 for the period of 1972-1973 to 1999-2000 implying that area under Aus shifted to other crops at the rate 2.93 percent. After first period growth rate of Aus area was enormously improved to -0.62 for the second period of 2000-2001 to 2019-2020. The area under Aus rice has been declining at the rate -2.22 percent over the entire period of 1972-1973 to 2019-2020. The growth rate of Aus yield (T/ha) was relatively low (1.17 percent) in the first period (1972-1973 to 1999-2000) and that was 3.44 in the second period (2000-2001 to 2019-2020) and 2.40 over the entire period (1972-1973 to 2019-2020). The second period was dominated by wider spread of green revolution technologies. Production of seasonal rice was contributed by area and yield multiplicatively. Therefore, growth rate of Aus production decreased by -1.67 percent for the first period and after that, substantially improved at 2.72 percent with the advancement and up-scaling of the modern rice cultivars as well as improved agronomic practices during second period. However, the growth of Aus production (0.05) is not much satisfactory over the entire period of 1972-1973 to 2019-2020 that was happened due to the declining trend during first period.

In Aman season, the growth rate of area was -0.12 percent for the first period of 1972-1973 to 1999-2000 and increased to 0.14 percent for the second period of 2000-2001 to 2019-2020. The growth rate was negative (-0.11 percent) over the entire period of 1972-1973 to 2019-2020. On the other hand, growth rate of production was 1.49 percent for the first period of 1972-1973 to 1999-2000 and increased to 1.83 percent for the second period of 2000-2001 to 2019-2020. The overall growth rate of Aman production during the whole period of 1972-1973 to 2019-2020 was 1.73 percent. The growth rate of yield was almost similar for both first and second period (1.63 and 1.61 percent, respectively) that led to positive growth rate (1.83 percent) in the whole period of 1972-1973 to 2019-2020.

In Boro season, the growth rate of area rapidly attained at 4.98 percent for the period of 1972-1973 to 1999-2000 because area from Aus season and other crop shifted to Boro rice cultivation but drastically decreased to 1.38 percent for the second period of 2000-2001 to 2019-2020. The growth rate of Boro area (3.62 percent) was almost adequate over the whole period of 1972-1973 to 2019-2020. On the other hand, growth rate of Boro production was much higher (6.51 percent) compared to that in two other rice seasons for the first period of 1972-1973 to 1999-2000 and decreased to less than half (2.89 percent) for the second period of 2000-2001 to 2019-2020. The lower growth indicated that improvement of production growth in Boro season needs intensive intervention now but the overall growth rate of Boro production appeared to be impressive (5.36 percent) during the period of 1972-1973 to 2019-2020. Besides, the growth rate of yield (t/ha) was almost the same (1.51 and 1.53 percent, respectively) for both first and second period and a slightly higher growth (1.76 percent) appeared in the whole period of 1972-1973 to 2019-2020.

The growth rate of total rice area was lower but positive (0.14 percent) for the first period and increased to 0.55 percent for the second period but growth rate in the whole period of 1972-1973 to 2019-2020 was lower (0.35 percent) than that appeared during the two periods. Growth rate of yield was 1.49 and 2.02 percent for the first period and second period, respectively and 1.92 percent in the whole period. The growth rate of total rice production was always more than two percent for both the first period (2.40 percent) and the second period (2.41 percent) but the growth rate in the whole period appeared to be satisfactory (2.83 percent). While comparing growth estimation in three different periods, growth under the second period in particular yield and production appeared to be higher in all seasons than the first and the whole period. The second period received most intervention, and technological advancement and up scaling of the modern rice cultivars as well as modern agronomic practices. To drive up the growth of rice production upward, a package of intervention such as rapid spread of superior inbred, hybrid and super high yielding varieties, increment of irrigation areas under rice cultivation, adoption of climate smart and stress resilient genotype, application of superior resource management technologies, use of more quality seeds and rapid adoption of mechanization is required.

### 3.2 Supply and demand situation of rice

Major pillar of agriculture policies of the government of Bangladesh is to increase rice production and reduce the expenditure of foreign currencies for rice imports (FAO, 2014). To ensure food security of the people, there is no alternate way other than availability of food through domestic production as well as import. However, historical evidences showed that adequate supply of foodgrain through domestic production or import does not eventually achieve food security for all people. Easy access to food through income or purchasing power or social access in the form of public distribution or private charity must be provided (Talukder, et al., 2019). As discussed in growth analysis, during the period of 2001-2019, rapid advancement and dissemination of modern technologies paved the way of the attainment of self-sufficiency in rice production in this country. Appendix table 2 shows the surplus/deficit situation of rice production and requirement in Bangladesh over the period of 1991-2020.

Domestic production, rice import, and exports records and per capita consumption over the periods are considered to calculate the supply and demand balance or surplus or deficit. After 2008, implementation of structural policies headed the country to achieve a good amount of surplus of rice production up to the year 2019-20. Figure 2 shows the five year average of per capita availability and requirement of rice. During the two interval of 2011-2015 and 2016-20, substantial surplus of rice per capita was achieved. The share of rice import to rice surplus created ambiguity that can be clarified only through calculation of domestic production and requirement without import amount. Only slight shortage (0.75 million ton) was appeared in 2008. Almost 2 million tons remained surplus over the period 2009-2017 and more than 3 million tons over the years 2018 to 2020. The additional import of rice usually increases the national surplus of rice figures. Therefore, rice import is not necessary for current balance of domestic production and requirement.

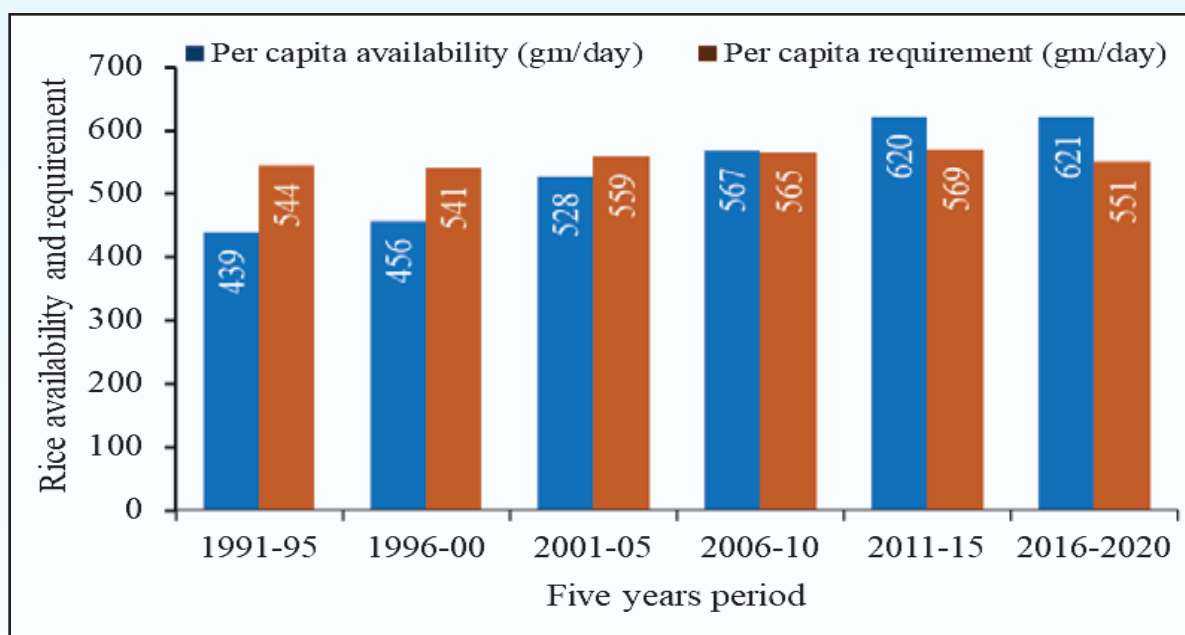


Fig. 2: Per capita rice demand supply situation over the five years intervals.  
Source: Authors' calculation based on appendix table 2 from FPMU

### 3.3 Economics of paddy production: producer perspectives

#### 3.3.1 Input use pattern in T. Aman and Boro season over the years of 2009-2020

According to Ministry of Agriculture, application of input level per acre in Aman cultivation remains almost the same from 2009 to 2017. As for example, application of seed, chemical fertilizer, and human labour are the same over that period. Slight increase of seed and chemical fertilizers was reported after 2018 but the increase is not so much per acre. Farmers' rate of nitrogen application as Urea and DAP was moderately higher than the recommended dose. Similarly, application of MoP, TSP and DAP was also higher than

the recommendation. However, use of organic fertilizer especially manure decreased in rice field after 2010 due to reduction of homestead cattle rearing and its unavailability (Appendix Table 4).

Moreover, application of chemical fertilizer and human labour had been in same line in Boro season from 2009 to 2020. Slight change in use of hired labour was appeared in Boro season in 2020. Fertilizer application in this season, such as Urea, TSP, MoP and DAP was also higher than recommendation. Extensive subsidy on chemical fertilizer enabled the farmers to use more fertilizer in rice cultivation (subsidy of Tk. 10 to 20 per kg fertilizers). Providing continuous subsidy after 2009 over the price of Urea, TSP, MoP and DAP was expected to sustain rice production as well as reduce the cost of rice cultivation and increase the farm profit (Appendix Table 8).

### 3.3.2 Profitability of T. Aman and Boro paddy over the years of 2009-2020

Even though constant pattern was observed in quantity of input, per acre cost of rice cultivation varied over the period due to input price. The growth of nominal cost of rice cultivation in Aman season was 2.92 percent meaning that cost of production (Tk/kg) increased by 2.92 percent over the period of 2009–2020 though government used to provide more subsidy on production inputs. The nominal growth of net profit (Tk/kg) from Aman season was negative 7.7 percent meaning that farmers used to suffer a loss of Aman rice cultivation by 7.7 percent over the period (appendix table 6 and Figure 4). Similarly, the growth of nominal cost of Boro rice cultivation (Tk/kg) was positive 3.15 percent and the growth of net profit (Tk/kg) was negative 8.50 percent over the period (Figures 3 and 4).

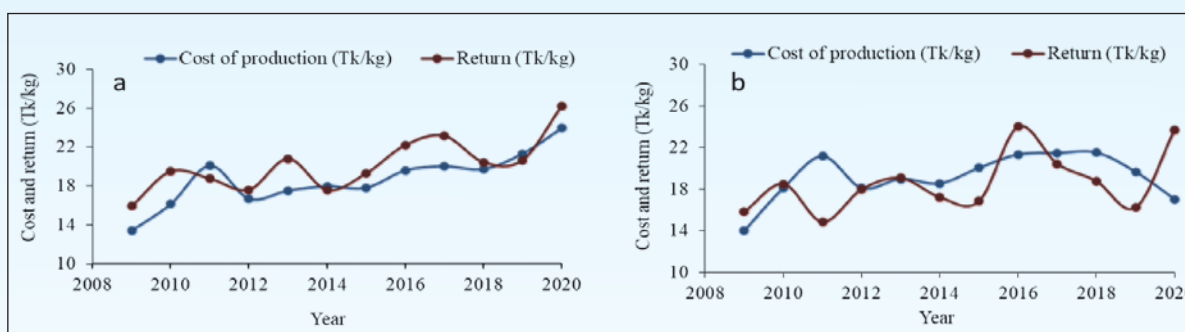


Fig. 3: Unit cost of production and return from paddy in both *T. Aman* and *Boro*.

Notes: ‘a’ indicates *T. Aman* and ‘b’ indicates *Boro*.

Source: AED, BRRRI (various issues)

In this decade, continuous declining trend of profit impoverish the famers and pushed them to shift their acreage to non-rice crops. It can be noted that producer price of paddy had been higher than unit cost of production from 2016 to 2018 but the net unit cost (Tk/kg) was observed higher than producer price in 2019 and thereby resulting in negative profit (Figure 4). It appears in the Figure 3 that per unit return from both *T. Aman* and *Boro* could not compensate per unit cost of production due to unpredictable pattern of paddy price during peak harvest over the years 2009-2020.

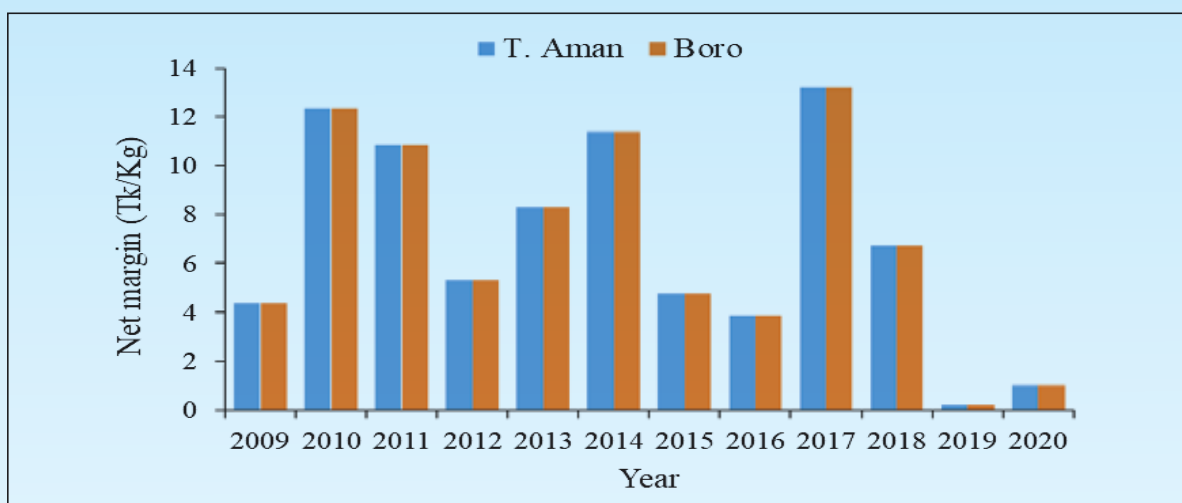


Fig. 4: Net margin in T. Aman and Boro cultivation over the years of 2009-2020.

Source: Authors' calculation based on data from FPMU

### 3.3.3 Disposal pattern and marketable surplus in 2019 and 2020

Average marketable surplus of paddy at the farmers' level during Boro season was about 60 percent of total paddy production in 2019 while it decreased to 54 percent in 2020 due to panic of future food crises in the wake of COVID-19 pandemic (Figure 5).

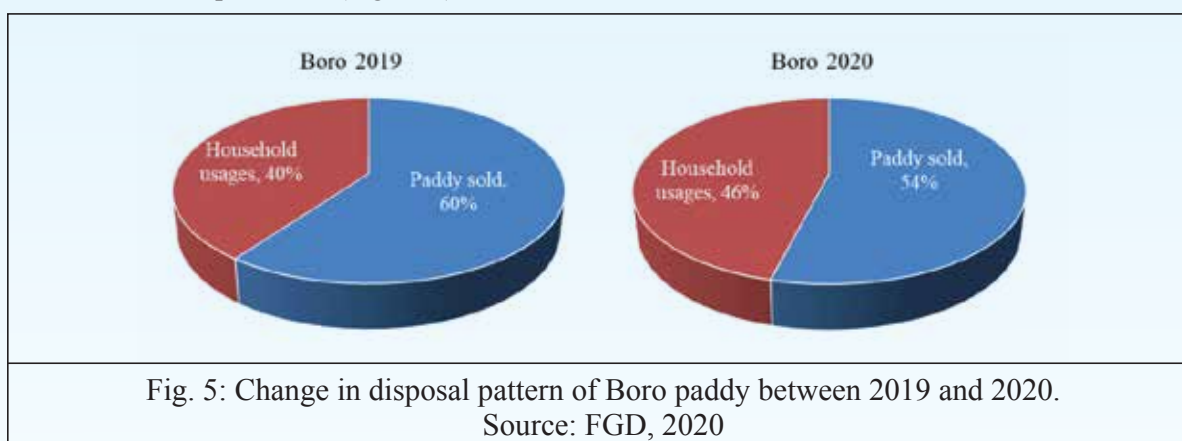


Fig. 5: Change in disposal pattern of Boro paddy between 2019 and 2020.

Source: FGD, 2020

Almost all of the farmers used to sell major portion of marketable surplus within the first month of harvesting. Pattern of paddy sale changed substantially between two consecutive Boro seasons. In Boro 2020, farmers released their paddy stock slowly in the market (Table 3). The traders, apprehending the panic of food shortage during COVID-19 pandemic, failure of achieving rice procurement target and delay in import by the government speculated for higher price, retained their stockpiles of rice that reduced the volume of market supply resulting in increased prices.

Table 3: Selling behavior at farm level in 2019 and 2020

Months	Paddy sold (% of marketable surplus)	
	Boro 2019	Boro 2020
Within one month of harvesting	65	52
Two months after harvest	20	25
Three months after harvest	13	18
Four months or above after harvest	2	5

Source: Field survey, 2020

### 3.4 Economics of rice production: processors and traders perspective

#### 3.4.1 Cost of rice processing at mill gate over the period of 2009-2020

Figure 6 shows the increasing trend of rice processing cost over the period of 2009-2020. Increase in cost of transportation, higher price of spare parts, labour wages and electricity cost were the main factors to increase the processing cost of rice. To hire the labor during peak season, millers have to pay in advance to the labor as security money.

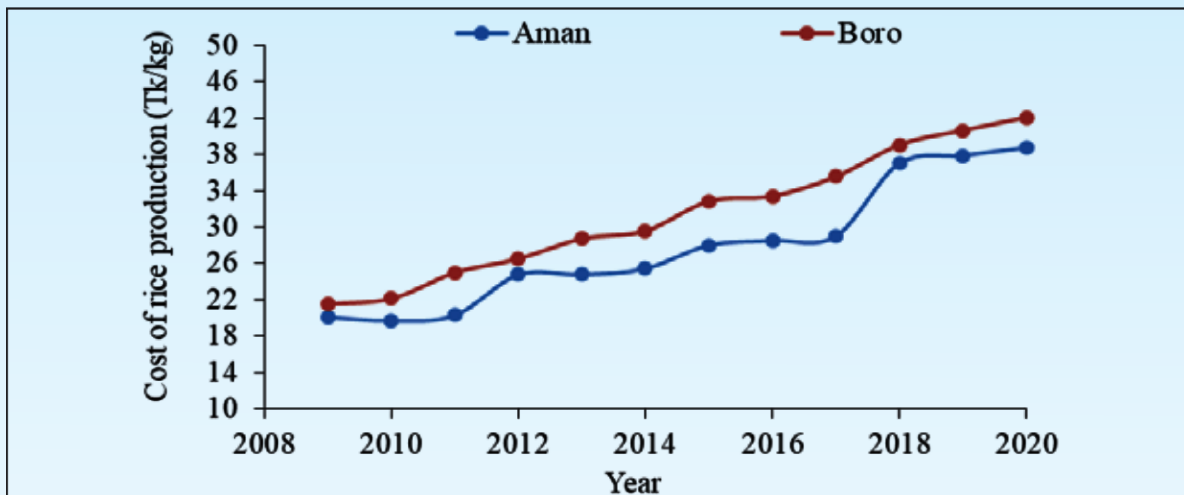


Fig. 6: Cost of rice production in T. Aman and Boro over the year of 2009-2020.

Source: Authors' calculation based on data from FPMU

#### 3.4.2 Margin of millers from rice processing over the period of 2017-2020

Figures 7 exhibits that valuation of rice production with the by-products using procurement price of rice is profitable and magnitude of the profit per unit ranges from Tk. 4.6 in 2019 to Tk. 9.5 in 2017 in T. Aman. In same situation, profit per unit of rice production ranges from Tk. 4.7 in 2020 to Tk. 8.2 in 2018 in Boro season. Moreover, the millers gained more profit at market price since it was always higher than procurement price. On the other hand, the millers thought they incurred loss of rice production, but the fact was that they did not take into account the value of by-products in calculating profit.

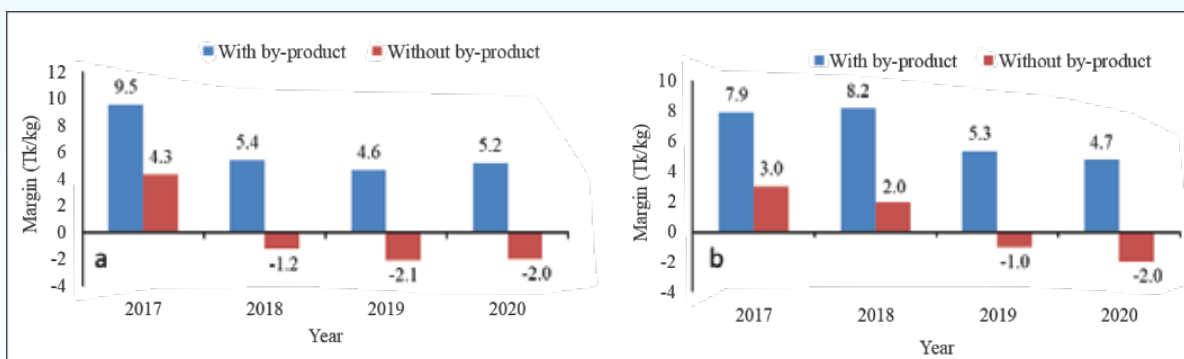


Fig. 7: Return from per unit rice production at millers' level in T. Aman and Boro.

Notes: 'a' indicates T. Aman and 'b' indicates Boro. By-product includes husk, bran, broken rice, dead rice, etc.

Source: Field survey, 2020



### 3.4.3 Marketing margin among midstream actors over the period of January 2016 to June 2020

The price data of rice from January 2016 to June 2020, depicting marketing margin from wholesale to retail shows consistent trend while the CV of price spread from farm gate to wholesale is higher followed by that of farm gate to retail. It seemed that midstream actors particularly millers, aratdar and wholesalers harvested super normal profit over the period.

However, the recent price hike of rice mainly happened due to stockpiling affinity of the millers that truncated the marketed surplus or disrupted the smooth market supply (Figure 8).

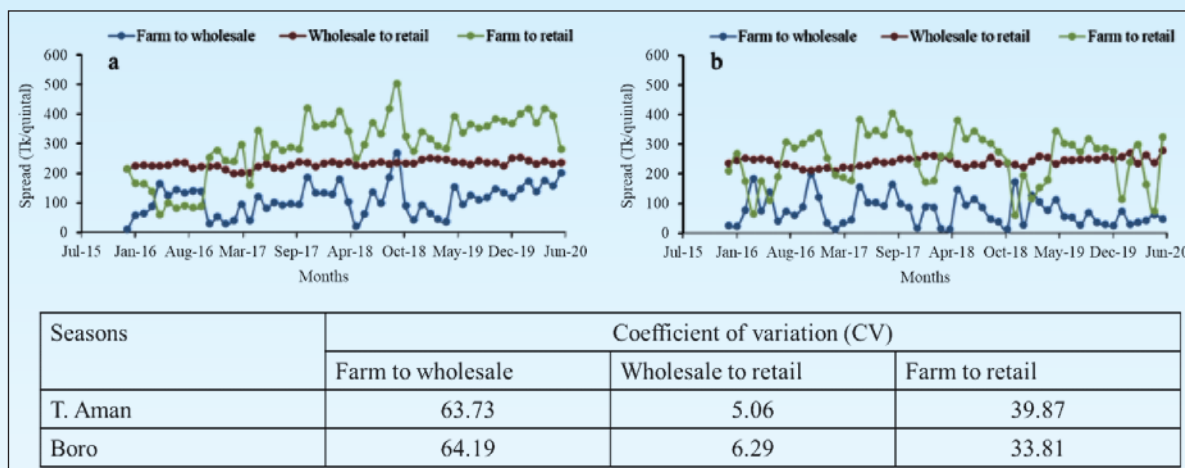


Fig. 8: Trend of price behavior in T. Aman and Boro season during January 2016 to June 2020

Notes: 'a' indicates T. Aman and 'b' indicates Boro.

Source: Authors' estimation based on data from DAM

## 3.5 Price variation of paddy and rice

### 3.5.1 Annual trend and growth of nominal and real prices

Average market price of paddy was deflated using consumer food price index (CPI) of the base year 2005-06 in order to obtain the real price. It appears that nominal average market price at the farm level was in upward trend whereas real price in both T. Aman and Boro paddy was in declining trend at all actors level (Figures 9a-c).

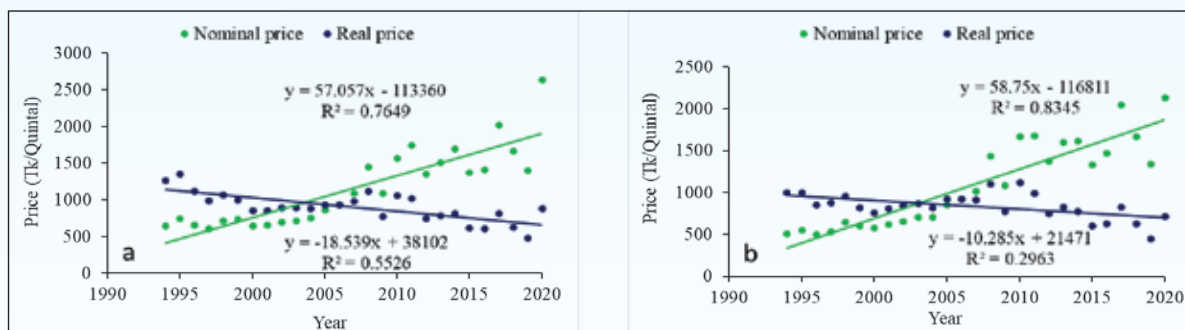


Fig. 9a: Nominal and real price of paddy

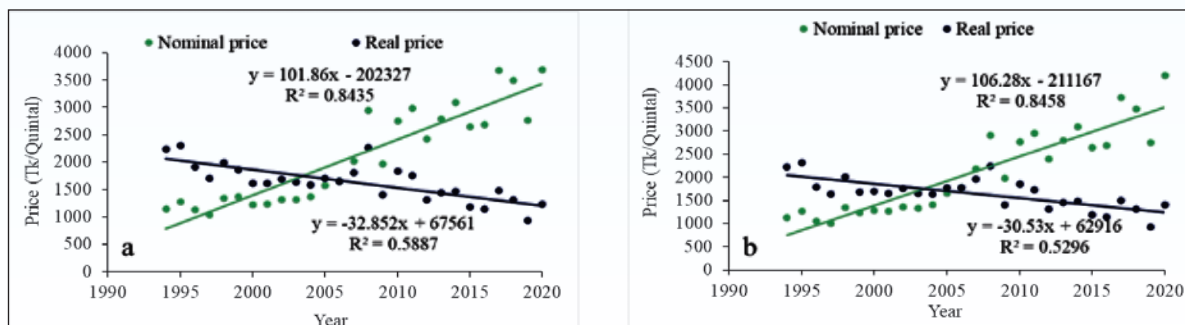


Fig. 9b: Nominal and real price of rice at wholesale level

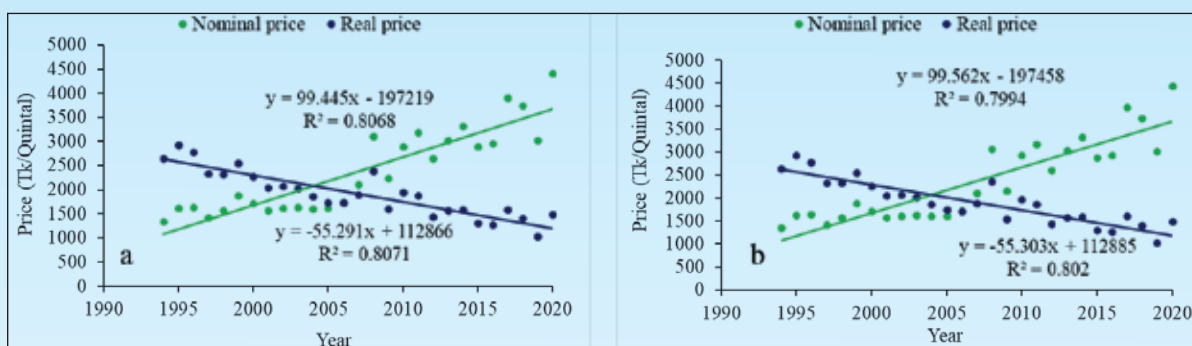


Fig. 9c: Nominal and real price of rice at retail level  
 Notes: 'a' indicates T. Aman and 'b' indicates Boro  
 Source: Author calculation based on data from DAM

Negative trend of real paddy price implied that farmers continued losing resources entitlement over the period of 1990-2020 even though nominal price was increasing. Nominal price increased on average at the rate of 4 to 5 percent whereas real price decreased on an average rate of 2 to 3 percent in the market (Table 4). Even though the slope of nominal price in both T. Aman and Boro season was similar at all actor's level, adjustment of inflation in price of T. Aman paddy exhibits the higher market risk compared to that of Boro paddy.

**Table 4: Growth rate of nominal and real price of rice (farm gate, wholesale and retail levels)**

Seasons	Nominal price			Real price		
	<i>Farm Price*</i>	<i>Wholesale price **</i>	<i>Retail price **</i>	<i>Farm price *</i>	<i>Wholesale price **</i>	<i>Retail price **</i>
<i>T. Aman</i>	4.9	5.03	4.18	-2.2	-2.1	-3.0
<i>Boro</i>	5.7	5.18	4.18	-1.4	-2.0	-3.0
Average	5.3	5.11	4.18	-1.8	-2.05	-3.0

*Source: Authors' calculation based on data from Department of Agricultural marketing (DAM)*  
*Note: '\*' and '\*\*' denotes price of paddy and rice, respectively*

### 3.5.2 Seasonality of prices over the period of 2016-2020

To analyse the seasonal trend and indices of domestic and international prices of rice, 5 years of period (January 2016 to October 2020) was selected for the study. The data were collected from department of agriculture marketing. Widest using method of measuring seasonal fluctuations was moving average that was applied to calculate more useful seasonal indices. To figure out the insight of the price behavior, seasonality was measured as any single month deviation from the average value of 100. The analysis of seasonal variations of rice markets was portrayed. It indicated that, the values of Grand seasonal index (GSI) of all the calendar months for the rice prices had a deviation from hundred (100) implying that seasonality existed in the paddy market. These indices described the recurrent seasonal pattern in the original prices. The Grand seasonal index (GSI) represents the typical seasonal behavior of time series. A Grand seasonal index for January (2016–2020) was found to be 98.626, which means that the price in this month on an average is 1.374 percent lower than the average of the entire period. Figure 10 showing GSI+SE (upper line) and GSI-SE (lower line) indicated that fluctuations are irregular and random. The indices for the month of January to February, April to June and October to December had been above the annual average of 100 while March, July, August and September (2016–2020) were below the 100 annual averages. The GSI of Boro season indicated that the trend in seasonal prices uncovered an evident, but not constant at all.

The indices for the month of February to March and July to October had been above the annual average of 100 while January, April to June, November to December (2016–2020) were below the 100 annual average (Figure 10). During the whole period of 2016 through 2020, higher and unpredictable trend of paddy price was observed from August to October which will have important policy implication for the governments to keep and manage larger reserves (at least 25 lac tons of rice) that would smoothened the impacts of large swings on rice prices in domestic market. Special consideration for one or two month before and after harvest must also be given to stabilize price within consumers’ ability and also ensure price above cost of producers. To do the same, government must procure paddy from domestic market (at the rate of 10% of national rice production) and continue to retain at least 12.5 lac tons stock every month. During harvest time, discussion regarding rice import was rejected even from media; traders and millers to protect fall of paddy price. Highly rigid policy or conservative policies should be taken for imports to save both farmers and millers inside country (Appendix Tables 15 & 16).

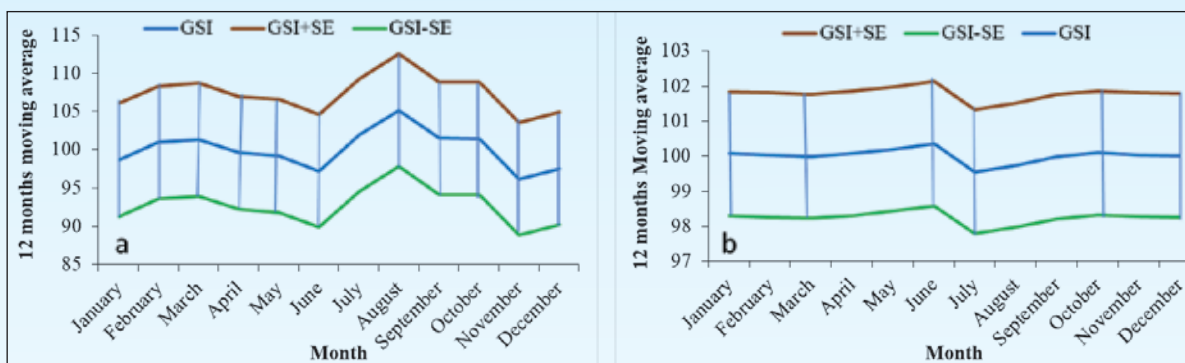


Fig. 10: Seasonal index in T. Aman and with lower and upper limit.

Notes: ‘a’ indicates T. Aman and ‘b’ indicates Boro, GSI denotes grand seasonal index and SE denotes standard error.

Source: Authors calculation based on data from DAM.

### 3.5.3 Monthly price trend over the period of 2016-2020

Paddy price increased due to damage of paddy in Haor areas during 2017 but delayed implementation of rice import in large quantity decreased the paddy price in 2018 and 2019. Delay in rice import during COVID-19 pandemic and damage of paddy by prolonged flood led the rice price to go up in 2020 (Figure 11).

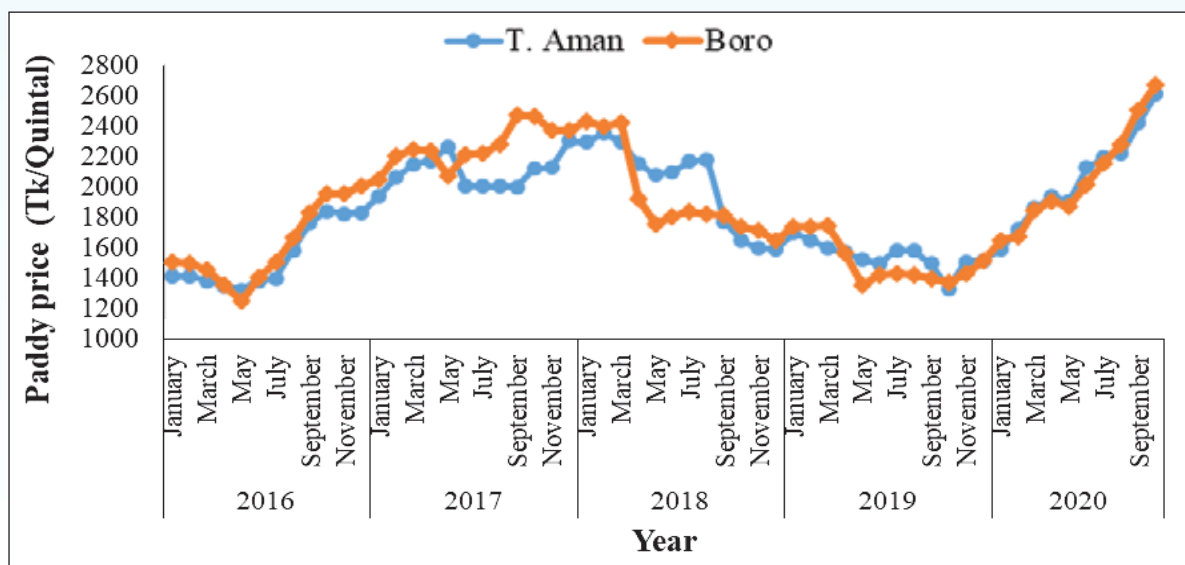


Fig. 11: Monthly price trend of Aman and Boro from 2016 to 2020.

Source: Authors’ calculation based on the data from DAM

### 3.5.4 Examination of price fluctuation of paddy and rice over the period of 2016-2020

An analysis of the farmers' price of paddy displaying the coefficient of variations as well as the month of lowest and highest point is presented in Table 5. It can be viewed that, coefficients of variation of the paddy price at farmers' level were higher in the years 2016, 2018 and 2020 and were relatively low in the years 2017 and 2019. The higher price variations of rice were observed between the harvest and the lean periods in each year. Simply, the level of fluctuation was computed between peak and lean period price of paddy over the years. The result indicated that price variability had been irregular and unpredictable throughout the 2016 through 2020. This was happened due to the fluctuation in production of rice for the floods and plenty of import due to lowering import duty in 2017. The severe outbreak of blast disease was also a disaster to rice production in 2018 as well as holdings huge stock of rice by farmers, traders and millers and no import of rice during pandemic period in 2020 ultimately affected the market price of rice.

The law of demand applied wherein, prices fall during the harvest season and rises during the lean period (Makama et al, 2016). The exception is happening during Aman, 2020 due to lower yield from frequent flood and irregular heavy rainfall, which led to competitive buying of paddy by the millers, and pushed the market price to be high. The uprising situation of paddy price and inflexible fixation of procurement price, which remains lower than the market price, may again affect the achievement of the paddy and rice procurement during Aman, 2020.

Even though the years of 2017 and 2019 showed relatively low fluctuations in price of Boro paddy as compared to other periods, the magnitude of fluctuation remained beyond the normal value. The maximum and minimum price of paddy showed reversing within the period of 2016 through 2020. As for example, maximum price was recorded in January 2019 but minimum price was identified in January 2020. The opposite was happened in October during 2019 and 2020. In both Aman and Boro season, price fluctuation and coefficient of variation was noticed higher in 2016, 2018 and 2020. Price of paddy became higher in January, September, October, and December during the period of 2016 through 2020. Lowest price was recorded in May in Boro season when farmers started or were about to start harvesting and was high in the month of September or October or when the season was lean (Table 5 and 6).

Since upstream transmission of price in rice market was a common phenomena, change in paddy price directly affected the wholesale price of cleaned rice. Reverse change in price from rice market to paddy market was very slow and sometimes was not observed at all. That is why, the pattern and trend of price variation in wholesale market of rice was similar to paddy market. Moreover, the prices showed instable pattern and unpredictable over the period of 2016 through 2020 (Tables 7 and 8). Highest prices in wholesale market during Aman were recorded in the month of January, February, June, and October for the years 2016 through 2020 (Table 7) while in the same period of Boro, highest prices were recorded in January, March, September, October, and December (Table 8). Lowest prices were however mostly recorded in January, May, and December in the years of 2016 through 2020 for both Aman and Boro season (Tables 7 and 8). Based on production situation and government policies of import and domestic procurement of both Aman and Boro, market players, in particular millers and paddy Aratdar made a gambling role to control price level in paddy and rice market.

**Table 5: Fluctuation of paddy price in T. Aman season during 2016 to 2020**

Year	Fluctuation (%)	Coefficient of variation	Maximum	Minimum	Maximum	Minimum	Average	STD
2016	38.76	13.17	1840	1326	October	May	1543	203
2017	18.65	5.18	2303	1941	December	January	2097	109
2018	48.02	13.66	2352	1589	February	December	2020	276
2019	26.91	5.64	1693	1334	Janury	October	1545	87
2020	64.80	14.61	2617	1588	October	January	2060	301

Source: Authors' calculation based on the data from DAM.

**Table 6: Fluctuation of paddy price in Boro season during 2016 to 2020**

Year	Fluctuation (%)	Coefficient of variation	Maximum	Minimum	Maximum	Minimum	Average	STD
2016	60.66	15.37	2005	1248	December	May	1616	248
2017	21.09	5.73	2475	2044	September	January	2266	130
2018	47.96	14.57	2431	1643	January	December	1943	283
2019	28.76	9.55	1746	1356	March	May	1511	144
2020	62.20	15.80	2673	1648	October	January	2056	325

Source: Authors' calculation based on the data from DAM.

**Table 7: Fluctuation of wholesale price in Aman season during 2016 to 2020**

Year	Fluctuation (%)	Coefficient of variation	Maximum	Minimum	Maximum	Minimum	Average
2016	41.43	13.24	3233	2286	October	May	2678
2017	24.11	10.04	3989	3214	June	January	3677
2018	28.75	7.05	3780	2936	February	December	3486
2019	14.85	5.63	3032	2640	January	October	2745
2020	53.99	13.84	4153	2697	October	January	3464

Source: Authors' calculation based on the data from DAM.

**Table 8: Fluctuation of wholesale price in Boro season during 2016 to 2020**

Year	Fluctuation (%)	Fluctuation (%)	Maximum	Minimum	Maximum	Minimum	Average	STD
2016	48.60	48.60	3299	2220	December	May	2680	402
2017	24.30	24.30	4113	3309	September	January	3718	258
2018	26.15	26.15	3816	3025	January	December	3469	249
2019	19.61	19.61	3080	2575	March	May	2745	155
2020	108.20	108.20	4139	1988	October	January	3320	649

Source: Authors' calculation based on the data from DAM.

### 3.5.5 Price change and volatility in 2019 and 2020

Figure 12 indicates the rate of paddy and rice price change in 2020 over 2019. Trend of paddy price change increased from March onward but speed of price increase was higher from September onward. A similar pattern was observed in rice market. The paddy price volatility was noticed to be 32% in 2020, higher than in 2019 (28%) (Table 9).

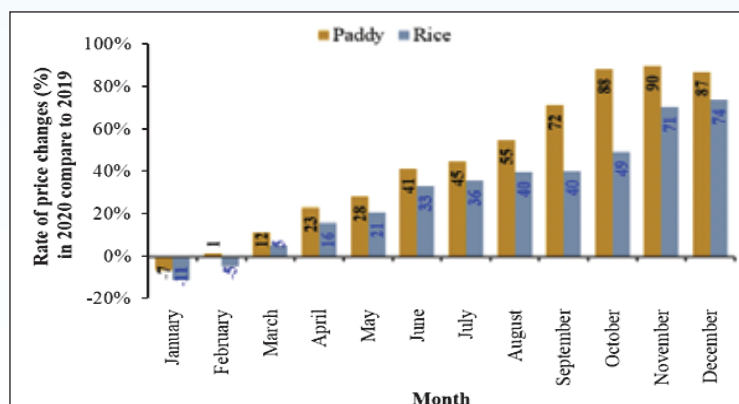


Fig. 12: Percentage change in monthly price of paddy and rice in 2020 compare to 2019.

Source: Authors' calculation based on the data from DAM

**Table 9: Price volatility of paddy and rice (Standard deviation) in 2019 and 2020**

Types	Volatility (%)	
	2019	2020
Paddy	28	32
Rice	11	37

Source: Authors' calculation based on the data from DAM

### 3.5.6 Comparison of domestic and world market prices of rice over 2016-2020

The trend of actual price of rice in domestic market was compared with the price in rice markets of neighboring countries (Figure 13). It is noted that price of rice in domestic market in the years 2016 and 2019 was relatively low than their international price whereas domestic price of rice in 2020 was higher than neighboring countries. But almost similar price trend appeared between 2017 and 2018 among the countries. After that period, rice price in Bangladesh and Vietnam gradually fell down lower than the import parity price in neighboring countries. The major reasons of downward movement of rice price in Bangladesh were the effect of delayed and unauthorized import quantity (about 38.9 lac ton) (FPMU, 2019) and good harvest in Aman and Boro 2019. Once more, rice price in Bangladesh surges upward from April 2020, which has been more than import parity price of rice of India and Pakistan. Indian price showed almost average trend among the rice markets of neighboring countries. To articulate policy choice, level of rice production and price behavior throughout the year with a seasonal diversity in Bangladesh played an important role. Variation between international and domestic price of rice is a driving key that regulates domestic production, import and export policy. The pattern of variation in price within a year is revealed by absolute value in Bangladeshi currency for both domestic and neighboring countries, computed for each month from 2016 to 2020. The extent of seasonal variations in prices for both domestic and international prices is presented in Appendix Table 17.

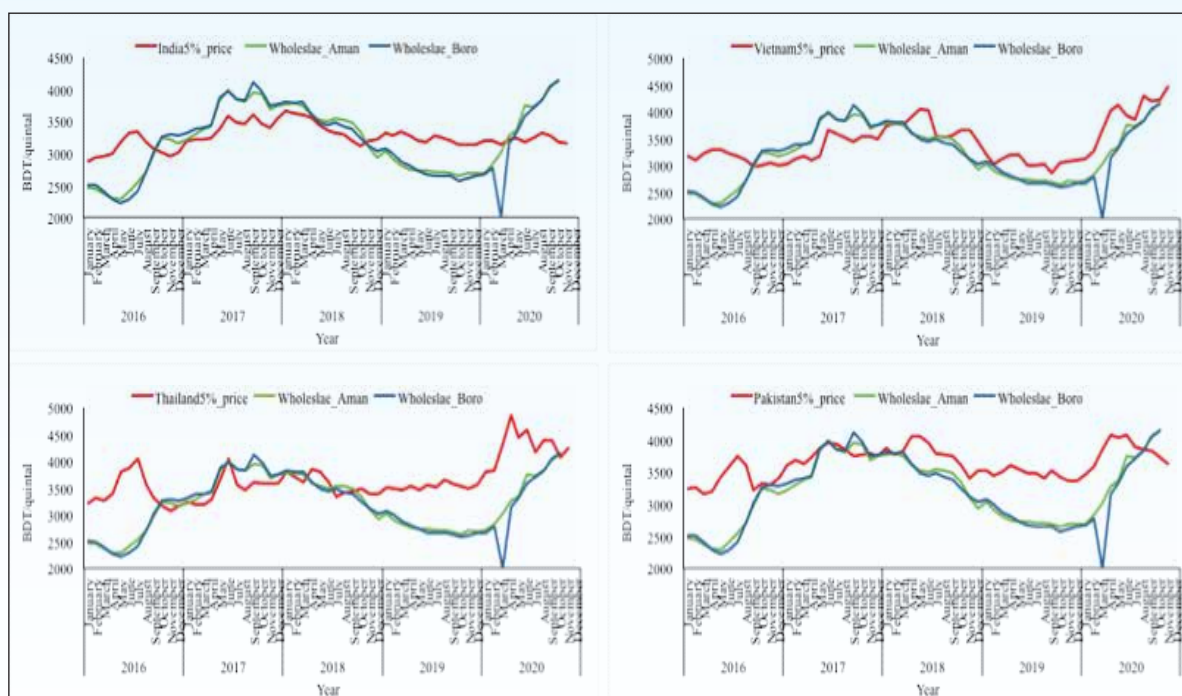


Fig. 13: Import parity price of rice between Bangladesh and neighboring countries.

Source: Authors' calculation based on the data from DAM and WASDE

### 3.6 Does the marketable surplus influence the market prices?

In theoretical notion, interactions of supply and demand lead to fix the farm-gate price under the perfect market condition. To support this common phenomena, we analyzed the historical relationship between marketed surplus and market price. In the period of 1991-2009, there has been inverse relationship between marketed surplus and price, meaning that 1% increase in marketed surplus led to decrease the market price at 0.123% per annum. After 2010, a reverse scenario existed in the market where marketed surplus did not have influence on the determination of price in the market (Table 10). The similar scenario was found in the trend line assessment where the relationship between marketed surplus and price has been in the same direction (Figure 14). The analysis proved the misperception of conventional phenomena because someone from behind scene regulated the determination of price in the market instead of market forces of supply and demand.

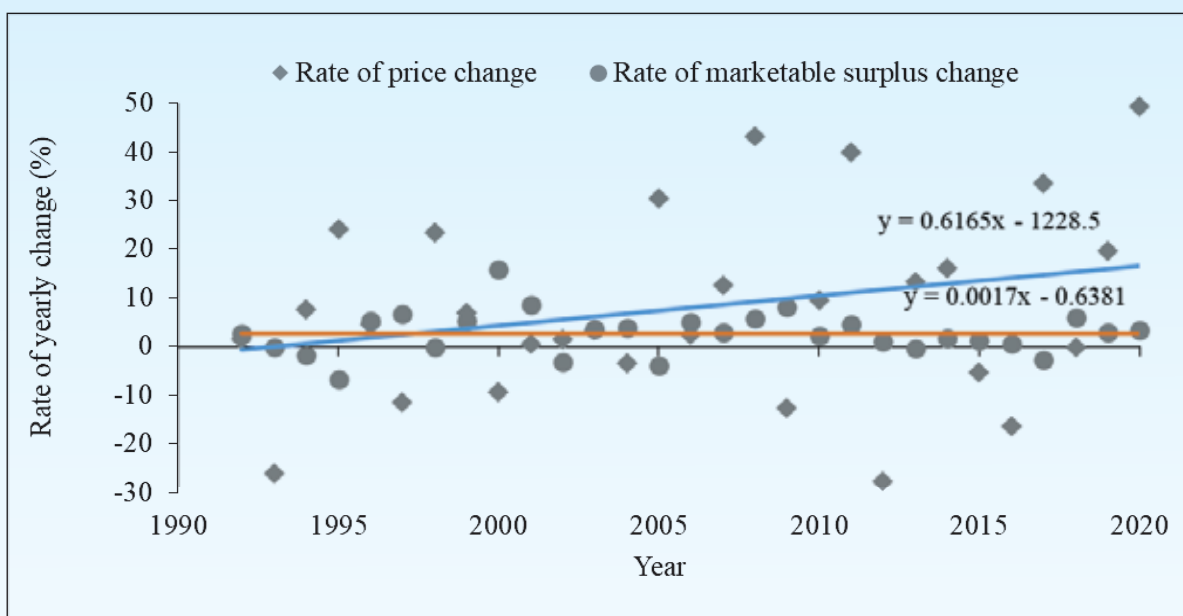


Fig. 14: Relationship between change in marketable surplus and market price of rice over the years 1991-2020. Source: Authors' calculation based on the data from DAM and FPMU

**Table 10: Cause and effect relationship between marketed surplus and price during 1991 to 2020**

Equation	Period	
	1991-2009	2010-2020
Price	-0.123*marketed surplus	0.055*marketed surplus

Source: Authors' estimation.

### 3.7 Procurement and its effect on value chain actors

#### 3.7.1 Procurement price of paddy and rice

The main purpose of procurement price declaration is to ensure price incentive to farmers so that they are not affected by the frequent market price fall during full swing harvest. The historical comparison exhibits that farmers used to obtain the benefit of the higher procurement price from 1990 to 2010. After that, market price of paddy below procurement price shows pivotal divergence meaning that farmers did not touch the ceiling of the incentive prices until 2019. As procurement price of paddy in T. Aman and market price converged, farmers were happy to receive the good price of paddy in T. Aman, 2020 whereas they did not get a good price during Boro harvest, 2020. After two or three months of Boro harvest, paddy price in the market was higher than procurement price (more than Tk. 26 per kg) when most of the farmers did not have marketable

surplus (Table 3). That is the reason behind the failure of achieving government procurement target from Boro 2020 (Figure 15).

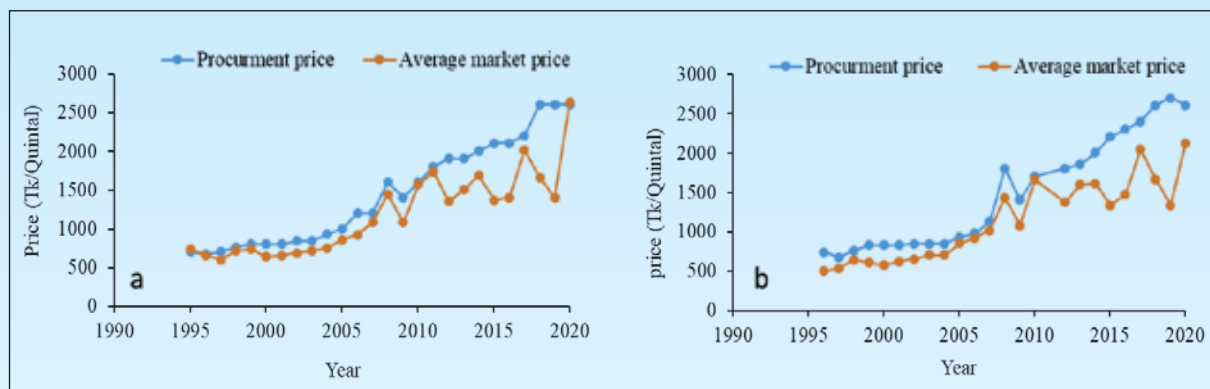


Fig. 15: Procurement and average market price of paddy over the years of 1996-2020.

Notes: 'a' indicates T. Aman and 'b' indicates Boro.

Source: Authors' calculation based on the data from FPMU and DAM.

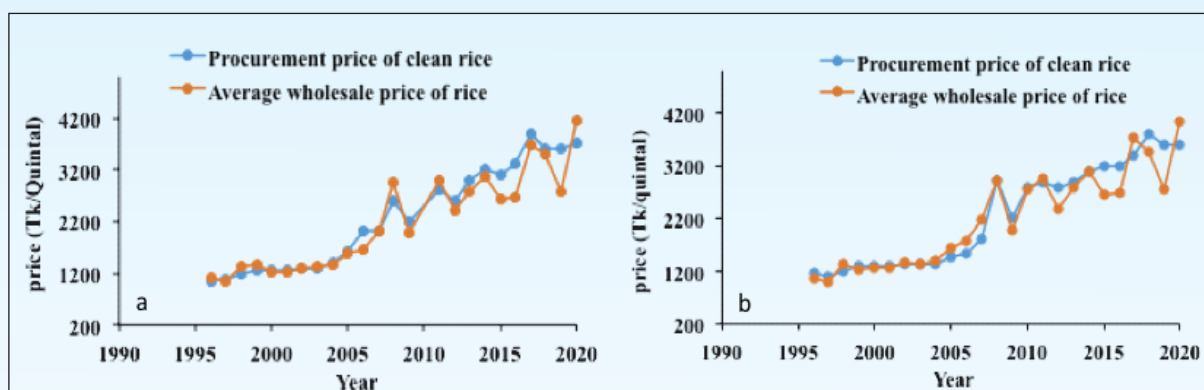


Fig. 16: Procurement and average wholesale price of rice over the years of 1996-2020

Notes: 'a' indicates T. Aman and 'b' indicates Boro

Source: Authors' calculation based on the data from FPMU and DAM

Historical trend of wholesale price was similar to that of procurement price of rice whereas an opposite direction appeared in paddy market. It implied that procurement price of paddy could not achieve the main purpose to benefit the paddy farmers (Figures 15 and 16). On the other hand, setting procurement price of rice is business orientated since all benefits go in favour of millers and traders. Rationality of price setting was not achieved with the fullest extent in paddy market but government performed rationalized behavior in the fixation of price of rice market.

### 3.7.2 Historical scenario of the procurement

Figure 17 indicates that government could not achieve the procurement targets in most of the years over the period of 1996-2020. Public procurement achieved only 37.57% of the target in 2020. Due to this the government was not able to play a role as a potential actors in the market. With this opportunity, some unscrupulous traders and millers were controlling the market.



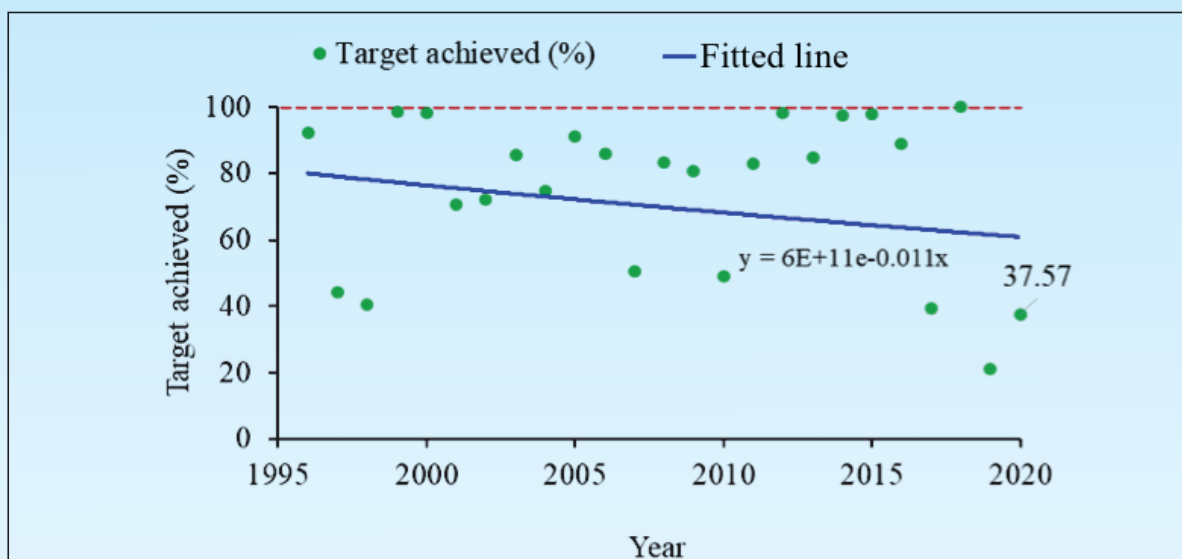


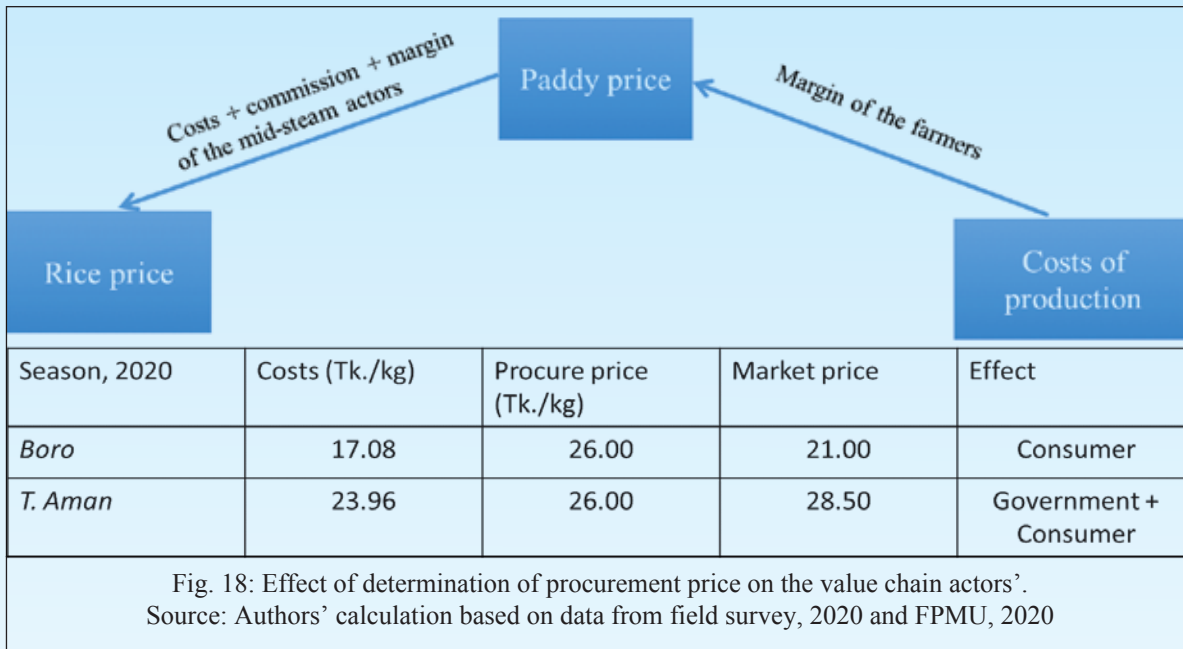
Fig. 17: Target and achievement of rice procurement in Bangladesh.  
Source: Authors' calculation based on the data from FPMU

### 3.7.3 Constraints to procurement

According to farmers, they experienced several problems to supply paddy to government procurement center, which include the percentage of moisture contents, number of unfilled grain per fist of paddy and giving illegal money (about Tk. 50 per mound of paddy) to the local officials engaged in procurement. According to millers, they are forced to be enlisted in the procurement program and 2% security payment is a burden for rice processing.

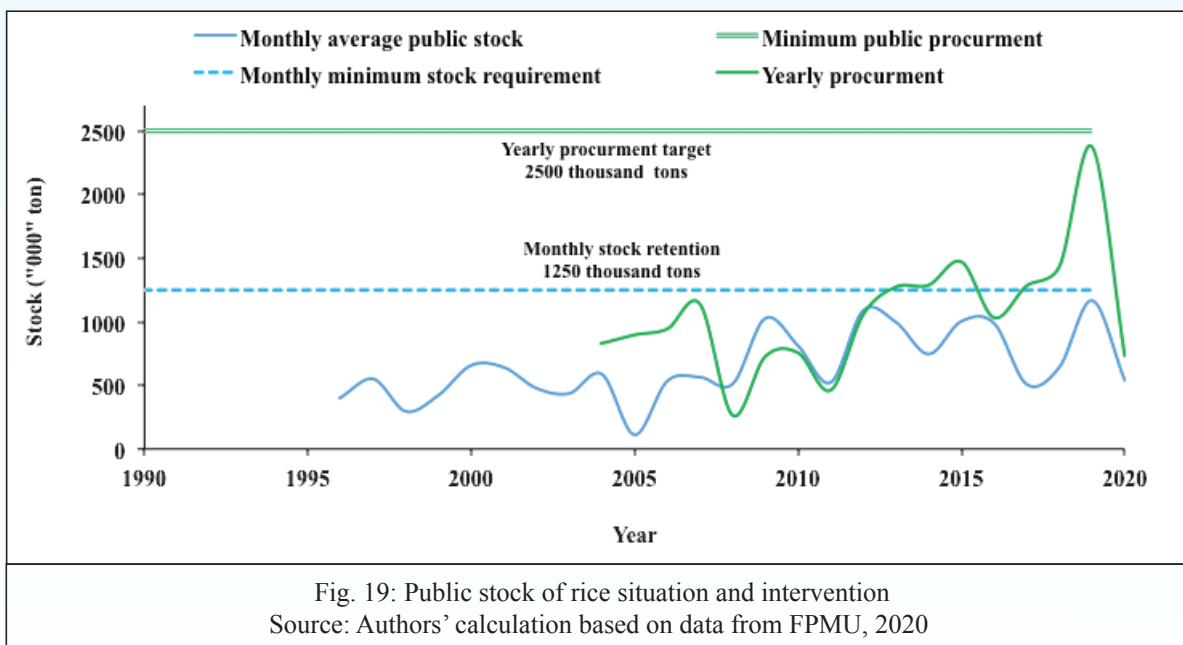
### 3.7.4 Effect of procurement price on the value chain actors

The determination of rice price is the basis of paddy price with market margin (transportation costs, processing cost, commission as well as profit) of the actors in the chain. Paddy price is also fixed considering the cost of cultivation with considerable margin of the producers (Figure 18). Looking at the Boro and T. Aman, 2020 as a case study, the cost of Boro and T. Aman cultivation is Tk. 17.08 and 23.96 per kg paddy, respectively. Procurement price was determined irrationally over the cost of Boro cultivation whereas market price per kg was Tk. 21. Upward market price and over pricing of the procurement was caused by rumors of the supply shortage, which gave the rice growers an incentive profit in this year. Trader and millers were buying paddy from the market at lower prices, but showed higher point of paddy price when determining the rice price. This type of rice pricing makes the super normal profit to them. Eventual consequences of the price hikes declined the purchasing power of the consumers (Figures 18). In T. Aman season, unit cost of production was comparatively high due to re-transplanting and significant losses of production for five to six spell of floods. Besides, trend of higher market price and information of production losses in *T. Aman* resulted in higher paddy price in the market during November-December, 2020. On the other hand government declared procurement price was lower than the market price. As a result, both consumers and public procurement were adversely affected. To minimize such market anomalies, government should play a rational role for the fixation of procurement price and make necessary market intervention.



### 3.8 Public stock situation of rice in Bangladesh

Historical stock of rice highly fluctuated and declined in some years that gives an important signal for retention of minimum stock accounting for 12.5 lac tons and increasing the procurement to a minimum of 25 lac tons annually. Minimum stock capacity of rice should immediately be developed at 38 lac tons with a view to procure at least 10 percent of the total rice production each year (Figure 19). Similar findings have been shown by Salam et al., 2016.



### **3.9 Reasons for price hike in paddy and rice market during 2020**

#### **i. Supremacy and unequal competition of large millers and traders**

- According to small rice mill owners, large millers and Aratdar hoarded huge quantity of paddy and rice in their storage and thereby disrupting supply flow in both paddy and rice market. Fearing food shortages, they stockpiled the purchased paddy in the name of various warehouse keepers and traders. In return, stockiest and paddy traders were getting fixed rates of profit from auto rice mill owners.
- The rice market power is entirely under the control of large millers and traders who are controlling the rice market in any way for ensuring higher profits. Moreover, the large stockiest and millers are manipulating the market price by applying the policy of supply contraction. As a result, an artificial supply crisis or supply bottleneck exists in the market.

#### **ii. Delayed harmonization of data**

- According to traders and auto millers, there are substantial data gap in the estimation of area, production, population and demand for rice among DAE, BBS, Ministry of Food and millers and traders. The delayed harmonization of BBS data lost the trust of the actors in the value chain (especially millers and traders).
- The millers and traders said that the supply of rice was less due to lower harvest during the Boro season. A rumor has been spread over the country after the flood that all the paddy production in 35 districts has been damaged. But during the cross check in FGD, the farmers opined that the harvest was better in Boro season 2020 than the previous year.
- Influential actors in the market take the advantage of data error to create artificial crises in the paddy and rice market in order to exploit the super normal profit.

#### **iii. Delayed implementation of rice import decision**

- According to all traders and millers the price of paddy increased in the domestic market due to delay in rice imports in 2019-2020.
- Time lapse between policy decision and implementation provides an opportunity of price volatility. Millers generate the information about an artificial deficit when government announces the import decision. For an example, import decision in 2017 was implemented in far delay. As a consequence, the paddy price substantially increased. Again in the year 2020, the delay in rice import helped market price to rise.

#### **iv. Stockpiling tendency in 2020**

- According to the perceptions of the participants of FGD, the higher tendency of stockpiling of paddy and rice at farmers, traders and consumers level was noticed in the country during the panic of global pandemic COVID-19 (possibility of the famine in the world predicted by the national and international development agencies and think tanks). Due to the panic, the stock demand for Boro rice pushed up the market price. In addition, large farmers-cum-traders kept a substantial portion of their Boro paddy in the stock for obtaining a higher market price in future.

#### **v. Increase in cost of paddy cultivation and rice processing**

- According to farmers, labour shortage is getting severe day by day during transplanting and harvesting. Evidences show that higher labour (45%) and irrigation (15%) cost shared about 60% to total cost of production (AED, 2019). For this reason, paddy prices increase due to increasing cost of paddy cultivation.
- Rice mill owners opined that they have increased the price of rice to offset the additional cost since the cost of rice processing has gone up due to increase in cost of transportation, higher price of spare parts, labour wages and electricity cost. That is why, they earnestly sought various supports from the government.

#### vi. Seasonal traders increased

According to mill owners, seasonal paddy traders increased in recent days than the previous period. They maintained a stock for generating high profit. Thus, supply flow of paddy in the value chain was squeezed.

#### vii. Production loss from the disaster

It appears from Table 11, Aus and Boro production has increased in 2020 by 9.63 and 3.17 percent respectively compared to that in 2019 whereas Aman production has decreased by 10.06 percent. All together the national production was decreased by 1.71 percent. Loss of paddy production from amphan, prolonged flood and excessive rainfall affected the normal supply in the domestic market.

**Table 11: Production scenario in 2020 compared to 2019.**

Rice season	2019	2020	Rate of change (%)
<i>Aus</i>	3.01	3.30	9.63
<i>Aman</i>	15.50	13.94	-10.06
<i>Boro</i>	19.56	20.18	3.17
Total rice	38.07	37.42	-1.71

Source: DAE, 2020 and BRRI, 2020

#### viii. Grouping and political influence of the millers

It is observed that there are many groups or associations of the millers and traders, and has political affiliation among them which affect the paddy and rice market.

#### ix. Free and open market economy

Thinking "Leave the market alone" (Laissez-faire economics as Adam Smith mentioned) to better off the business, government should stay away from the market intervention. By taking advantage of this concept, the big traders and millers are creating business margin violently. This situation was repeatedly observed in the stressed years.

### 4. Conclusion and Recommendations

Bangladesh achieved self-sufficiency in rice production after 2008, but the market structure is still unorganized. National policy was production oriented and the market did not organize perfectly to accommodate the higher production. The value chain actors regulate the market in their own way and sometime earned super normal profit by creating artificial crises. Over the years, the cost of production has been increasing; farmers are not getting price incentives for their produce. Even though the nominal price of paddy and rice has been increasing, but the real price has sharply declined by about 2 percent over the time period. In recent days (after 2010), the increase in market price and import decisions does not seem to have a relation with the increase in marketed surplus as well as total rice production in Bangladesh. Government could not achieve the procurement targets from the beginning of the Boro production season. The main reasons for paddy and rice price hikes in 2020 are the panic of food shortage due to COVID-2019 pandemic, stockpiling affinity of the profit seekers, national data error and market manipulation by the big traders and millers. To overcome the price hike, the following are recommended:

#### i. Millers and traders should be service oriented and business professionals

- Concern ministry and department should have a policy to communicate with the rice millers and traders on regular basis so that a fair business environment prevails in this market.

#### ii. Achieving trust on data

- Database of rice farmers, millers and traders should be properly developed and regularly updated.
- Data error in rice production, population and food requirement should be properly acknowledged and minimized as early as possible.

- Trust at all level should be achieved through timely and effective harmonization of all dataset by using digital tools.

### **iii. Import decision**

- Government should assess the market carefully well ahead before announcing any import related decision.
- Import decision for rice should be made within one month before and two months after harvest.
- In this case market calendar can be developed and followed based on seasonal rice production.

### **iv. Up-gradation of procurement system**

- Farmers and millers friendly procurement systems should be developed.
- Introducing online trading system in the paddy-rice market is time demanding.
- BRRRI developed triangle procurement system can be implemented to ensure equal opportunity in the market.
- Government should declare separate minimum support prices (MSPs) for fine and coarse grain of paddy and rice.
- Government should procure at least 25 lac tons of rice so that market actors can realize that the government is an important actor for intervening market anytime.
- Government should retain at least 12 lac 50 thousand tons of rice every month as buffer stock. Procurement price should be determined considering 20% profit over the production cost.
- Procurement price should be declared before the transplanting of a season.

### **v. Cost minimization strategy**

- Labour wage rate should be fixed at a certain level where the minimum and maximum limits will be mentioned.
- Irrigation subsidy should be extended generally.
- Mechanization should be speeded up.
- Subsidy should be spread out so that all famers get benefit from it.
- Cash incentive and/or loan should be provided to the farmers for the development of mini-silo.

### **vi. Intensive market monitoring**

- Production and marketing system should be modernized through state of art technologies.
- An agricultural price commission can be formed and declaration of a price policy for agricultural commodities should be the main function of this commission.
- Hidden cost (illegal payment in transportation and market) at all levels should be stopped anyway.

### **vii. Regulation for rice processing industry**

- Announcement of auto, major and husking mills of rice as agroindustry is a need.
- More practical policy and regulations for the said agroindustry should be developed.
- Milling outrun (ratio of paddy and rice) should practically be re-determined.
- Incentive in pricing for electricity (Tk 3 per kwh), bank interest (4%) and taxation can be declared for auto rice millers.
- Simplification of Bank loan for agroindustry should be ensured.
- Equity and entrepreneurship fund (EEF) should be available for all the paddy-rice traders and millers.

### **viii. Government intervention**

As and when necessary, government should intervene in the market. Especially during the stressed year, the government should intervene in the market effectively to some extent overlooking the concept of open market economy.

### **Further research scope**

This study was accomplished by conducting a very quick survey in the field and using time series data from secondary sources. Many important insights could not be touched within that short period of time. Therefore, a comprehensive study should be undertaken in order to dig out the root causes of price hike and functions of the value chain actors in the market. The demand and supply analysis in details is necessary for national policy formulation.

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Table 1: Area, production and yield of cleaned rice in Bangladesh over the years 1972-2020

Year	Area (000'ha)				Production (000'ton)				Yield (ton/ha)		
	Aus	Aman	Boro	Total	Aus	Aman	Boro	Total	Aus	Aman	Boro
1972-73	2930	5713.8	1002.6	9646.4	2243	5587	2071	9901	0.77	0.98	2.07
1973-74	3107.9	5718.7	1222.7	10049.3	2801	6699	2220	11720	0.9	1.17	1.82
1974-75	3179.1	5449.9	1161.2	9790.2	2859	6000	2250	11109	0.9	1.1	1.94
1975-76	3419.9	5759.9	1147.9	10327.7	3229	7045	2286	12560	0.94	1.22	1.99
1976-77	3217.1	5806.4	854.2	9877.7	3014	6905	1650	11569	0.94	1.19	1.93
1977-78	3161.7	5771.2	1093.7	10026.6	3103	7422	2239	12764	0.98	1.29	2.05
1978-79	3234.6	5805.1	1071.8	10111.5	3287	7429	1929	12645	1.02	1.28	1.8
1979-80	3036.3	5972.7	1148.4	10157.4	2809	7303	2427	12539	0.93	1.22	2.11
1980-81	3111.2	6035.8	1160	10307	3289	7964	2630	13883	1.06	1.32	2.27
1981-82	3145.6	6010.3	1301.7	10457.6	3270	7209	3152	13631	1.04	1.2	2.42
1982-83	3158.1	5993	1432.8	10583.9	3065	7516	3548	14129	0.97	1.25	2.48
1983-84	3138.7	6006.7	1401.2	10546.6	3222	7843	3350	14415	1.03	1.31	2.39
1984-85	2937.6	5710.2	1574.4	10222.2	2783	7930	3909	14622	0.95	1.39	2.48
1985-86	2844.9	6018.9	1533.2	10397	2828	8542	3671	15041	0.99	1.42	2.39
1986-87	2903.6	6052.4	1651.7	10607.7	3130	8267	4010	15407	1.08	1.37	2.43
1987-88	2788.3	5590.4	1942.6	10321.3	2993	7690	4731	15414	1.07	1.38	2.44
1988-89	2683.46	5100.8	2438.3	10222.56	2856	6857	5831	15544	1.06	1.34	2.39
1989-90	2255	5702.5	2453.6	10411.1	2475	9202	6033	17710	1.1	1.61	2.46
1990-91	2107.3	5775.3	2547.9	10430.5	2261	9167	6357	17785	1.07	1.59	2.49
1991-92	1915.9	5692.3	2634.9	10243.1	2179	9269	6807	18255	1.14	1.63	2.58
1992-93	1735.1	5843.7	2598.9	10177.7	2075	9680	6586	18341	1.2	1.66	2.53
1993-94	1649.4	5843.3	2580.8	10073.5	1850.2	9419.2	6772.2	18041.6	1.12	1.61	2.62
1994-95	1663.75	5594.17	2663.54	9921.46	1790.7	8504	6538.7	16833.4	1.08	1.52	2.45
1995-96	1541.85	5646.4	2753.57	9941.82	1676	8790	7220.6	17686.6	1.09	1.56	2.62
1996-97	1592.29	5802.49	2782.59	10177.37	1870	9551	7460	18881	1.17	1.65	2.68
1997-98	1565.88	5808.45	2888.56	10262.89	1874.6	8849.8	8137.3	18861.7	1.2	1.52	2.82
1998-99	1424.26	5165.5	3526.67	10116.43	1616.9	7735.8	10551.9	19904.6	1.14	1.5	2.99
1999-00	1351.32	5704.87	3651.89	10708.08	1734	10306	11027	23067	1.28	1.81	3.02
2000-01	1325.23	5709.96	3761.84	10797.03	1916	11249	11920.5	25085.5	1.45	1.97	3.17
2001-02	1242.18	5647.22	3771.34	10660.74	1808	10726	11766	24300	1.46	1.9	3.12
2002-03	1243.72	5682.11	3844.84	10770.67	1850.7	11118.4	12222.2	25191.3	1.49	1.96	3.18
2003-04	1202.58	5677.61	3943.5	10823.69	1831.8	11520.5	12837.1	26189.4	1.52	2.03	3.26
2004-05	1024.68	5279.92	4063.79	10368.39	1500	9819	13837.1	25156.1	1.46	1.86	3.4
2005-06	1034.27	5429.01	4065.81	10529.09	1745	10810	13975.3	26530.3	1.69	1.99	3.44
2006-07	905.71	5415.62	4250.1	10571.43	1512	10841	14965	27318	1.67	2	3.52
2007-08	918.66	5048.16	4607.85	10574.67	1507	9662	17762	28931	1.64	1.91	3.85
2008-09	1065.56	5497.77	4716.31	11279.64	1895	11613	17809	31317	1.78	2.11	3.78
2009-10	984.22	5662.89	4706.6	11353.71	1709	12207	18059	31975	1.74	2.16	3.84
2010-11	1112.87	5645.64	4770	11528.51	2132.82	12791	18616	33539.82	1.92	2.27	3.9
2011-12	1138	5580	4810	11528	2333	12798	18783	33914	2.5	2.29	3.9
2012-13	1053	5610	4760	11423	2158	12897	18778	33833	2.05	2.3	3.95
2013-14	1051	5530.2	4790	11371.2	2326	13023.3	19007	34356.3	2.21	2.36	3.97
2014-15	1045	5530	4846	11421	2328	13190.2	19343	34861.2	2.23	2.38	3.99
2015-16	1025	5590.4	4685.1	11300.5	2468	13591.4	19001.1	35060.5	2.44	2.43	4.06
2016-17	941.7	5583.3	4547.3	11072.3	2133.6	13656	18411.8	34201.4	2.27	2.44	4.05
2017-18	1075.1	5679.5	4859.4	11614	2709.7	13993.8	19575.8	36279.3	2.52	2.46	4.03
2018-19	1145.13	5621.9	4909.85	11676.88	2920.2	14054.9	20388.5	37363.6	2.55	2.5	4.15
2019-20	1152.55	5876.44	4863.92	11892.91	2930	15357	20437	38724	2.544	2.495	4.2

Source: Different issue of BBS and DAE.



**Table 2: Demand and supply situation**

Year	Domestic production (MT)	Import (MT)	Export (MT)	Total availability (MT)	Mid-year Population (M)	Per capita availability (gm/day)	Per capita requirement (gm/day)	Deficit/surplus (gm/day)
1991	17.8	0.010	0	17.8	108.0	451.5	541.3	-89.8
1992	18.3	0.039	0	18.3	110.4	454.2	542.1	-87.9
1993	18.3	0.019	0	18.4	112.7	446.2	545.1	-99.0
1994	18.0	0.074	0	18.1	115.2	430.9	550.3	-119.4
1995	16.8	0.814	0	17.6	117.7	411.0	538.7	-127.8
1996	17.7	1.141	0	18.8	120.2	429.3	541.1	-111.8
1997	18.9	0.034	0	18.9	122.7	422.4	543.4	-121.0
1998	18.9	1.103	0	20.0	125.2	436.9	532.3	-95.4
1999	19.9	3.067	0	23.0	127.7	493.0	538.9	-45.9
2000	23.1	0.433	0	23.5	129.0	499.1	549.0	-49.9
2001	25.1	0.561	0	25.6	131.0	536.4	550.4	-14.1
2002	24.3	0.126	0	24.4	133.0	503.2	553.9	-50.7
2003	25.2	1.556	0	26.7	135.0	542.8	565.3	-22.5
2004	26.2	0.801	0	27.0	137.5	537.6	564.2	-26.5
2005	25.2	1.295	0	26.5	139.8	518.4	560.4	-41.9
2006	26.5	0.532	0	27.1	141.8	522.9	562.6	-39.7
2007	27.3	0.720	0	28.0	142.6	538.7	567.7	-29.0
2008	28.9	2.045	0	31.0	144.6	586.9	562.3	24.6
2009	31.3	0.603	0	31.9	146.5	596.9	564.8	32.1
2010	32.0	0.088	0	32.1	148.4	591.9	567.4	24.6
2011	33.5	1.561	0	35.1	150.4	639.4	570.2	69.2
2012	33.9	0.528	0	34.4	152.3	619.6	569.7	49.9
2013	33.8	0.028	0	33.9	154.1	602.0	571.4	30.6
2014	34.4	0.375	0.025	34.7	156.0	609.5	565.7	43.9
2015	34.9	1.490	0.004	36.3	158.0	630.3	570.1	60.2
2016	35.1	0.257	0.004	35.3	160.0	604.7	562.9	41.8
2017	34.2	0.133	0.004	34.3	162.7	578.1	554.2	23.9
2018	36.3	3.893	0.004	40.2	164.7	668.2	541.9	126.3
2019	37.4	0.206	0.004	37.6	165.6	621.5	552.5	69.0
2020	38.7	0.004	0.004	38.7	167.6	632.5	541.3	91.3

Source: FPMU.

**Table 3: Unit cost and return of T. Aman and Boro season**

Year	T. Aman		Boro	
	Cost of production (Tk/kg)	Return (Tk/kg)	Cost of production (Tk/kg)	Return (Tk/kg)
2009	13.41	15.92	14.04	15.84
2010	16.14	19.52	18.15	18.54
2011	20.10	18.77	21.20	14.89
2012	16.71	17.62	18.15	18.01
2013	17.54	20.81	19.03	19.10
2014	18.00	17.60	18.59	17.26
2015	17.84	19.31	20.09	16.87
2016	19.61	22.22	21.37	24.03
2017	20.06	23.17	21.51	20.48
2018	19.75	20.45	21.55	18.80
2019	21.33	20.68	19.71	21.84
2020	23.96	26.25	17.08	23.75

Source: Different issues of the Agricultural Economics Division, BRRI.

**Table 4: Market price of input and output in Aman season over the years of 2009-2020**

Unit price	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Output (Tk/kg)</b>												
- Paddy (producer price)	17.98	25.61	25.91	22.04	25.19	28	24.15	24.17	34.66	29.12	25.11	26.17
- Straw	1	1	1	1.5	2	2	2	2.3	2.3	2.3	2	2
Bran/husk	2	5	5	6	6	6	6	6.5	6.8	8	8	
<b>Inputs</b>												
<b>Seed/Seedling (Tk/kg)</b>	35	22	15	35	31	31	31	32	33	40	50	50
<b>Fertilizer (Tk/kg)</b>												
- Urea	12	12	12	20	20	20	16	16	16	16	16	16
- TSP	70	43	22	22	22	22	22	22	22	22	22	22
- MOP	60	35	25	15	15	15	15	15	15	15	15	15
- Gypsum	6	8	10	8	8	8	8	8	8	10	10	10
- Zinc	100	120	120	120	150	150	160	150	150	150	180	180
- Manure	1.2	1.2		2.5	2.5	3	3	3	3	5	5	5
<b>Labour (Tk/mandays)</b>												
Family	140	160	180	240	250	260	280	300	320	360	400	440
Hired	140	160	180	240	250	260	280	300	320	360	400	440

Source: FPMU, Ministry of Food.

**Table 5: Cost structure in Aman season over the years of 2009-2020**

Costs	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Seed/Seedling</b>	525	330	390	525	465	465	465	480	528	800	1000	1000
<b>Fertilizer</b>												
- Urea	636	636	636	1060	1060	1060	848	848	848	992	992	992
- TSP	1400	860	440	440	440	440	440	440	440	550	550	550
- MOP	1440	840	600	360	360	360	360	360	360	525	450	450
- Gypsum	84	112	140	112	112	112	112	112	112	200	200	200
- Zinc	200	240	240	240	300	300	320	300	300	450	360	360
- Manure	1200	1200	1500	1500	1500	1500	1650	1650	1650	3000	3250	3250
<b>Pesticides</b>	700	700	750	750	750	750		800	800	1100	1250	1300
<b>Irrigation</b>	900	1000	1200	1200	1000	1000	1100	1100	1100	1100	1644	1700
<b>Land Preparation</b>	2200	2000	2200	2400	2400	2400	2700	2700	2700	3200	3300	3300

Costs	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Labour (mandays)</b>												
- Family	3500	4000	4500	6000	6250	6500	7000	7500	8000	10800	11200	11000
- Hired (mandays)	4900	5600	6300	8400	8750	9100	9800	10500	11200	14400	14000	15400
<b>Interest on Capital*</b>	709	540	690	410	428	437	463	481	501	657	674	711.41
<b>Land Rental</b>	4500	4500	6000	6000	6000	6000	6000	6000	6000	6000	7000	7000
<b>Total cost (Tk/acre)</b>	22894	22558	25586	29397	29815	30424	32008	33271	34539	43774	45870	47213

\* (Interest on working capital \* interest rate \* considerable crop period)/2. Working capital = Total cost - (Land rent + Cost of family labour). Source: FPMU, Ministry of Food.

**Table 6: Profitability of Aman paddy and market prices of clean rice**

Items	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Production of Paddy (Kg/acre)	1600	1580	1600	1600	1600	1600	1600	1600	1600	1625	1680	1700
Gross return from paddy (Tk/acre)	28768	40464	41456	35264	40304	44800	38640	38672	55456	47320	42185	44489
Cleaned rice (kg/acre)	1096	1082	1096	1056	1056	1056	1056	1066	1087	1073	1680	1122
Cost of paddy (Tk/acre)	22894	22558	25586	29397	29815	30424	31258	33271	34539	43774	45870	47213
Net cost of paddy (Tk/acre) (deduct value of straw)	21294	20958	23986	26997	26615	27224	28058	29591	30859	40036	42510	43853
Milling/Transport (Tk/acre)	1200	1580	2400	2400	2800	2882	4000	4320	4400	4063	3914	4250
Net cost of rice (Tk/acre) (deduct value of straw)	22494	22538	26386	29397	29415	30106	32058	33911	35259	44099	46424	48103
Unit cost of paddy (Tk/kg)	13.3	13.3	15.0	16.9	16.6	17.0	17.5	18.5	19.3	24.6	25.3	25.8
Unit cost of rice (Tk/kg)	20.1	19.7	20.3	24.75	24.8	25.4	28.0	28.5	29.0	37.0	37.9	38.8
Producer price of paddy (Tk/kg)	17.98	25.61	25.91	22.04	25.19	28	24.15	24.17	34.66	29.12	25.11	26.17
Retail price of rice (Tk/kg)	22.21	28.75	31.73	26.23	30.05	32.92	28.78	29.37	38.95	37.19	29.98	43.97
Net profit of paddy (Tk/kg)	3.77	12.33	10.92	5.17	8.56	10.99	6.15	5.68	15.37	4.48	-0.19	0.37

Source: FPMU, Ministry of Food.

**Table 7: Input-output structure of Boro paddy cultivation over the years of 2009-2020**

Input-output	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Paddy (kg/acre)	2250	2250	2250	2350	2350	2360	2380	2380	2380	2448	2400	2400
Straw (Kg/acre)	2250	2250	2250	2350	2350	2360	2380	2380	2380	2448	2400	2400
<b>Inputs</b>												
<b>Seed/Seedling</b>	20	20	30	20	20	20	20	20	20	20	20	20
<b>Fertilizer</b>												
- Urea	90	90	90	85	85	90	90	90	90	90	90	90
- TSP	35	40	40	40	40	40	40	40	40	40	40	45
- MOP	30	35	35	35	35	35	35	35	35	35	35	40
- Gypsum	20	20	20	20	20	20	20	20	23	23	23	25
- Zinc	3	3	3	3	3	3	3	3	3	3	3	3
- Manure	500	500	600	500	500	800	800	800	500	800	800	800
<b>Labour</b>												
- Family (mandays)	30	30	30	30	30	25	25	25	25	25	25	20
- Hired (mandays)	50	50	50	50	50	55	55	55	55	55	55	50

Source: FPMU, Ministry of Food.

**Table 8: Market prices of input and output in Boro season over the years of 2009-2020**

Unit price	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
- Paddy (Tk/kg)												
- Straw(Tk/kg)	0.5	0.75		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
<b>Seed/Seedling (Tk/kg)</b>	35	35	35	36	34	34	36	36	36	50	50	50
<b>Fertilizer (Tk/kg)</b>												
- Urea	12	12	12	20	20	16	16	16	16	16	16	16
- TSP	40	22	22	22	22	22	22	22	22	22	22	22
- MOP	35	25	15	15	15	15	15	15	15	15	15	15
- Gypsum	7	7	8	8	8	8	8	8	10	10	10	10
- Zinc	100	100	110	120	120	15	-	-	-	150	150	160
- Manure	1.5	1.5	2	3	3	3	4.5	4.5	5	5	5	5
<b>Labour (Tk/mandays)</b>												
- Family	140	160	200	240	250	260	-	-	-	400	-	450
- Hired	140	160	200	240	250	260	-	-	-	400	-	450

Source: FPMU, Ministry of Food.

**Table 9: Cost structure in Boro season over the years of 2009-2020**

Cost	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Seed/Seedling</b>	700	700	700	720	680	680	720	720	720	1000	1000	1000
<b>Fertilizer</b>												
- Urea	1080	1080	1080	1700	1700	1440	1440	1440	1440	1440	1440	1440
- TSP	1400	880	880	880	880	880	880	880	880	880	880	990
- MOP	1050	875	525	525	525	525	525	525	525	525	525	600
- Gypsum	140	140	160	160	160	160	160	160	230	230	230	250
- Zinc	300	300	330	360	360	450	450	450	450	450	450	480
- Manure	750	750	1200	1500	1500	2400	3600	3600	4000	4000	4000	4000
<b>Pesticides</b>	700	800	900	750	750	750	800	800	900	1100	1100	1800
<b>Irrigation</b>	5000	5000	5000	5500	6500	6000	6700	6700	7000	7500	7700	8000
<b>Land Preparation</b>	2500	2500	2500	2600	3600	4000	4500	4500	5000	5000	5500	6000
<b>Labour</b>												
- Family (mandays)	4200	4800	6000	7200	7500	6500	7500	8000	8500	10000	10000	9000
- Hired (mandays)	7000	8000	10000	12000	12500	14300	16500	17600	18700	22000	22000	22500
<b>Interest on Capital</b>	1031	850	436	666	728	788	905	933	995	1351	1368	1302
<b>Land Rental</b>	5000	5000	5500	6000	6000	6000	6500	6500	6500	7000	7000	8000
<b>Total cost (Tk/acre)</b>	30851	31675	35211	40561	43383	44873	51180	52808	55840	62476	63193	65362

Source: FPMU, Ministry of Food.

**Table 10: Profitability of Boro paddy and market prices of clean rice**

Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Straw	1125	1688	2250	3525	3525	3540	3540	3570	3570	3672	3600	3600
Total Cost/Acre (paddy)	30851	31675	35211	40561	43383	44873	51180	52808	55840	62476	63193	65362
Milling/Transportation	2250	3375	4700	4700	4700	4720	3540	3570	3570	4896	4800	4900
Total Cost/Acre (rice)	33101	35050	39911	45261	48083	49593	54720	56378	59410	67372	67993	70262
Net Cost of paddy (deduct value of straw)	29726	29988	32961	37036	39858	41333	47610	49237	52270	58804	59593	61762
Net Cost of rice (deduct value of straw)	31976	33362	37661	41736	44558	46053	51180	52808	55840	63700	64393	66662
Paddy (kg/acre)	2250	2250	2250	2350	2350	2360	2380	2380	2380	2448	2400	2400
Rice (kg/acre)	1486	1508	1508	1575	1551	1558	1558	1580	1571	1631	1584	1584
Net cost of paddy (Tk/kg)	13.21	13.33	14.65	15.76	16.96	17.51	20.00	20.69	21.96	24.02	24.83	25.73
Net cost of rice (Tk/kg)	21.52	22.12	24.97	26.50	28.73	29.57	32.85	33.42	35.54	39.06	40.65	42.08
Net profit of paddy (Tk/kg)	4.36	12.33	10.86	5.33	8.29	11.38	4.76	3.84	13.21	6.72	0.18	1.00
Producer price of paddy (Tk/kg)	17.57	25.66	25.51	21.09	25.25	28.89	24.76	24.53	35.17	30.74	25.01	26.73
Retail price of rice (Tk/kg)	21.33	29.14	31.42	25.92	30.06	32.97	28.67	29.14	39.51	37.11	29.92	44.22

Source: FPMU, Ministry of Food.

**Table 11: Cost of production of Boro season, 2020**

Serial no.	Particulars	Cost and price determination			
		Unit	Unit price	Quantity per acre	Per acre price
1	Seed	Kg	50	20	1000
2	Fertilizer cost	Tk.			7760
3	Pesticides				1800
4	Labour:	Man-days			
4.1	Family	Man-days	450	20	9000
4.2	Hired	Man-days	450	50	22500
5	Ploughing (animal/power tiller)		2000	3	6000
6	Irrigation				8000
7	Threshing				5000
	Working capital				52060
8	Interest on working capital				1301.5
9	Land rent				8000
10	Per total cost of cultivation				65362
11	Production:				0
	Paddy	Kg	20	2400	48000
	Straw	Kg	1.5	2400	3600
12	Per acre net cost of production				61762
13	Per kilogram (Kg) net cost of paddy production				<b>25.734</b>
14	Per kg production cost in 2019				24.83
15	Compared to 2019, change in production cost				3.64
	Rice processing				
16	Rice obtained from paddy (66%)	Kg			1584
17	Per acre rice and husk (30%)	Kg	8	800	6400
18	Milling of rice (boiled and carrying)		2	2400	4800
19	Per acre total cost (12+18)				66561.5
20	Per acre net cost (19-17)				60161.5
21	Per Kg net cost (20/16)				<b>37.98</b>

Source: Ministry of Agriculture.

**Table 12: Monthly price of paddy and rice at farm, wholesale and retail level during T. Aman and Boro 2016-2020**

Months	<i>T. Aman</i> paddy		<i>T. Aman</i> rice			<i>Boro</i> paddy		<i>Boro</i> rice		
	Farmers' price	Wholesale price	Farmers' price	Wholesale price	Retail price	Farmers' price	Wholesale price	Farmers' price	Wholesale price	retail price
January 2016	1391	1411	2459	2460	2674	1543	1505	2527	2502	2737
February 2016	1383	1414	2511	2453	2677	1485	1494	2474	2497	2743
March 2016	1339	1382	2436	2372	2600	1438	1457	2479	2401	2654
April 2016	1298	1350	2389	2301	2527	1359	1358	2460	2276	2524
May 2016	1370	1326	2450	2286	2511	1257	1248	2296	2220	2471
June 2016	1450	1382	n/a	2414	2642	1402	1409	2419	2281	2528
July 2016	1537	1397	n/a	2540	2776	1473	1509	2456	2415	2647
August 2016	1548	1583	n/a	2711	2947	1648	1662	2635	2709	2942
September 2016	n/a	1767	n/a	2976	3192	1870	1831	2956	3017	3243
October 2016	n/a	1840	n/a	3233	3455	1912	1955	3178	3266	3480
November 2016	1886	1826	3191	3222	3445	1915	1958	3498	3299	3510
December 2016	1818	1832	3112	3165	3389	1914	2005	3154	3275	3492

Months	<i>T. Aman</i> paddy		<i>T. Aman</i> rice			<i>Boro</i> paddy		<i>Boro</i> rice		
	Farmers' price	Wholesale price	Farmers' price	Wholesale price	Retail price	Farmers' price	Wholesale price	Farmers' price	Wholesale price	retail price
January 2017	1967	1941	3184	3214	3426	2010	2044	3276	3309	3530
February 2017	2025	2067	3260	3301	3501	2191	2204	3388	3376	3585
March 2017	2170	2151	3293	3388	3589	2199	2246	3432	3397	3620
April 2017	2222	2173	3464	3423	3625	2160	2239	3486	3442	3662
May 2017	2442	2266	3713	3835	4058	2089	2071	3713	3868	4096
June 2017	n/a	2006	n/a	3989	4220	2194	2214	3864	3967	4196
July 2017	2275	2003	n/a	3843	4062	2190	2220	3738	3842	4085
August 2017	n/a	n/a	n/a	3816	4032	2249	2278	3731	3824	4062
September 2017	n/a	2000	n/a	3947	4174	2407	2475	3948	4113	4352
October 2017	2275	2120	n/a	3931	4168	2396	2466	3870	3970	4220
November 2017	2203	2127	3505	3690	3925	2280	2370	3654	3740	3991
December 2017	2278	2303	3609	3744	3966	2251	2369	3780	3764	4013
January 2018	2299	2296	3634	3767	4000	2350	2431	3904	3816	4077
February 2018	2305	2352	3651	3780	4018	2425	2401	3880	3795	4057
March 2018	2289	2300	3573	3752	3983	2087	2426	3808	3812	4067
April 2018	2094	2156	3489	3593	3832	1934	1924	3602	3614	3864
May 2018	2538	2077	3500	3522	3750	1750	1755	3331	3478	3711
June 2018	n/a	2098	n/a	3492	3718	1767	1807	3351	3445	3668
July 2018	n/a	2172	3400	3536	3770	1802	1842	3363	3477	3708
August 2018	n/a	2184	n/a	3522	3760	1785	1826	3334	3419	3649
September 2018	n/a	1773	3050	3488	3720	1771	1810	3330	3376	3632
October 2018	n/a	1644	n/a	3346	3582	1696	1739	3209	3247	3483
November 2018	1619	1593	3008	3098	3332	1679	1713	3123	3125	3361
December 2018	1561	1589	2894	2936	3169	1592	1643	3197	3025	3257
January 2019	1758	1693	2939	3032	3278	1715	1742	3108	3080	3302
February 2019	1626	1650	2842	2906	3158	1737	1741	3122	2995	3238
March 2019	1594	1595	2772	2817	3065	1845	1746	2975	2869	3129
April 2019	1553	1569	2715	2752	2999	1526	1563	2890	2813	3069
May 2019	2261	1522	2584	2738	2975	1407	1356	2629	2740	2974
June 2019	1291	1495	n/a	2739	2974	1413	1424	2604	2660	2907
July 2019	n/a	1582	n/a	2706	2935	1420	1427	2603	2656	2902
August 2019	1450	1580	n/a	2702	2945	1480	1421	2624	2651	2899
September 2019	1450	1493	n/a	2691	2926	1391	1394	2572	2641	2891
October 2019	1456	1334	2492	2640	2875	1353	1376	2539	2575	2824
November 2019	1427	1509	2317	2694	2919	1435	1429	2573	2602	2859
December 2019	1524	1515	2562	2681	2931	1609	1510	2633	2658	2908
January 2020	1596	1588	2550	2697	2950	1745	1648	2935	2663	2920
February 2020	1725	1719	2639	2813	3056	1821	1675	2806	2776	3046
March 2020	1863	1863	2885	3024	3255	2035	1846	2924	1988	3223
April 2020	2027	1935	3094	3270	3511	2554	1905	3577	3149	3412
May 2020	1525	1909	n/a	3350	3581	1819	1869	3479	3316	3553

Months	<i>T. Aman</i> paddy		<i>T. Aman</i> rice			<i>Boro</i> paddy		<i>Boro</i> rice		
	Farmers' price	Wholesale price	Farmers' price	Wholesale price	Retail price	Farmers' price	Wholesale price	Farmers' price	Wholesale price	retail price
June 2020	1525	2130	3950	3748	3984	2122	2011	3544	3591	3869
July 2020	n/a	2193	n/a	3723	3982	n/a	2153	n/a	3701	3950
August 2020	n/a	2222	n/a	3819	4060	n/a	2279	n/a	3833	4057
September 2020	n/a	2421	n/a	4027	4261	n/a	2503	n/a	4044	4272
October 2020	n/a	2617	n/a	4153	4397	n/a	2673	n/a	4193	4422

Source: Department of agricultural marketing.

**Table 13: Procurement target and achievement of rice at government storage**

Year	Target ("000" ton)	Achievement ("000" ton)	Target achieved (%)	Closing stock*
1996	670	618	92.24	366
1997	555	245	44.14	538
1998	650	264	40.62	270
1999	850	839	98.71	287.6
2000	850	836	98.35	555.1
2001	850	599	70.47	715.7
2002	900	648	72.00	515.1
2003	1050	898	85.52	347
2004	1000	747	74.70	602
2005	1200	1094	91.17	79
2006	1400	1202	85.86	510
2007	1400	706	50.43	614
2008	1601	1331	83.14	479
2009	1500	1211	80.73	1076
2010	1147	563	49.08	998
2011	1170	968	82.74	574
2012	1300	1276	98.15	1170
2013	1400	1186	84.71	1080
2014	1420	1384	97.46	664
2015	1300	1270	97.69	1154
2016	500	444	88.80	1099
2017	2392	940	39.30	480
2018	2198	2195	99.86	509
2019	2210	466	21.09	1044
2020	2460	924	37.57	542**

Source: FPMU. \*Closing stock is considered on December. \*\*as of 27 December 2020.

**Table 14: Seasonal index of Aman season**

Month	Seasonal index	GSI	GSI+SE	GSI-SE
January	98.17	98.626	106.00	91.26
February	100.45	100.91	108.28	93.54
March	100.79	101.26	108.63	93.89
April	99.07	99.53	106.90	92.16
May	98.67	99.13	106.50	91.76
June	96.71	97.16	104.53	89.79
July	101.40	101.87	109.24	94.50
August	104.62	105.11	112.48	97.74
September	100.96	101.42	108.79	94.05
October	100.94	101.41	108.78	94.04
November	95.67	96.11	103.48	88.74
December	97.02	97.47	104.84	90.10

Note: GSI=Grand seasonal index, SE= Standard error.

**Table 15: Seasonal index (SI) of Boro season**

Month	SI	GSI	GSI+SE	GSI-SE
January	99.12	100.06	101.83	98.28
February	99.08	100.02	101.80	98.25
March	99.04	99.98	101.76	98.21
April	99.13	100.07	101.84	98.29
May	99.24	100.19	101.96	98.41
June	99.40	100.34	102.12	98.57
July	98.60	99.54	101.31	97.77
August	98.79	99.73	101.50	97.95
September	99.02	99.97	101.74	98.19
October	99.14	100.08	101.85	98.31
November	99.09	100.03	101.80	98.25
December	99.06	100.00	101.78	98.23

Note: GSI=Grand seasonal index, SE= Standard error.



**Table 16: Monthly domestic, FOB, and import parity prices of rice during 2016-2020**

Year	Month	Bangladesh wholesale price (BDT/quintal)		FOB price (BDT/quintal)				Import parity price (BDT/quintal)			
		Aman	Boro	Thailand 5% broken	Vietnam 5% broken	India 5% broken	Pakistan 5% broken	Thailand 5% broken	Vietnam 5% broken	India 5% broken	Pakistan 5% broken
2016	Jan	2460	2502	2795	2756	2615	2809	3215	3170	2877	3231
	Feb	2453	2497	2876	2697	2658	2825	3307	3102	2924	3249
	Mar	2372	2401	2848	2799	2684	2743	3276	3219	2952	3154
	Apr	2301	2276	2949	2855	2729	2786	3391	3283	3002	3204
	May	2286	2220	3306	2864	2882	2969	3802	3294	3171	3414
	Jun	2414	2281	3360	2805	3013	3119	3865	3226	3315	3587
	Jul	2540	2415	3528	2761	3029	3264	4057	3175	3332	3754
	Aug	2711	2709	3092	2692	2880	3139	3555	3095	3168	3610
	Sep	2976	3017	2875	2590	2801	2805	3306	2978	3082	3225
	Oct	3233	3266	2756	2615	2735	2894	3170	3007	3008	3328
	Nov	3222	3299	2674	2642	2680	2864	3075	3039	2948	3294
	Dec	3165	3275	2764	2617	2737	2949	3179	3010	3010	3391
2017	Jan	3214	3309	2811	2633	2903	3139	3233	3028	3194	3610
	Feb	3301	3376	2782	2713	2933	3204	3199	3120	3226	3684
	Mar	3388	3397	2773	2753	2927	3148	3189	3166	3220	3620
	Apr	3423	3442	2870	2686	2947	3247	3301	3088	3241	3734
	May	3835	3868	3170	2764	3078	3364	3646	3179	3386	3869
	Jun	3989	3967	3511	3180	3257	3435	4037	3657	3582	3951
	Jul	3843	3842	3092	3113	3168	3415	3555	3580	3485	3928
	Aug	3816	3824	3015	3051	3149	3349	3467	3508	3463	3851
	Sep	3947	4113	3140	2982	3274	3257	3611	3429	3601	3745
	Oct	3931	3970	3125	3062	3139	3280	3594	3522	3453	3772
	Nov	3690	3740	3109	3078	3092	3298	3576	3540	3401	3792
	Dec	3744	3764	3125	3029	3217	3264	3593	3483	3539	3754
2018	Jan	3767	3816	3311	3243	3335	3364	3808	3729	3668	3869
	Feb	3780	3795	3213	3290	3302	3276	3695	3783	3632	3768
	Mar	3752	3812	3136	3253	3274	3326	3606	3741	3601	3824
	Apr	3593	3614	3347	3382	3233	3529	3849	3889	3556	4059
	May	3522	3478	3308	3527	3131	3517	3804	4056	3444	4045
	Jun	3492	3445	3144	3497	3052	3437	3615	4021	3358	3953
	Jul	3536	3477	2909	3086	3013	3292	3346	3549	3315	3786
	Aug	3522	3419	2960	3045	2998	3275	3404	3501	3297	3767
	Sep	3488	3376	2996	3096	2907	3255	3445	3560	3198	3743
	Oct	3346	3247	3027	3172	2839	3141	3481	3648	3123	3612
	Nov	3098	3125	2949	3186	2899	2958	3391	3664	3189	3402
	Dec	2936	3025	2952	2990	2925	3062	3395	3438	3217	3522
2019	Jan	3032	3080	3054	2780	3021	3060	3513	3197	3323	3519
	Feb	2906	2995	3021	2639	2986	2998	3474	3034	3284	3447
	Mar	2817	2869	3002	2723	3037	3041	3453	3131	3340	3498
	Apr	2752	2813	3076	2782	2982	3129	3537	3199	3280	3598
	May	2738	2740	3010	2775	2900	3081	3462	3191	3190	3543
	Jun	2739	2660	3098	2611	2890	3027	3562	3003	3179	3481
	Jul	2706	2656	3052	2605	2986	3025	3510	2996	3284	3479
	Aug	2702	2651	3183	2637	2952	2958	3660	3032	3247	3402
	Sep	2691	2641	3125	2482	2909	3066	3594	2854	3200	3526
	Oct	2640	2575	3064	2648	2856	2972	3524	3046	3142	3418
	Nov	2694	2602	3038	2674	2845	2916	3494	3075	3130	3353
	Dec	2681	2658	3100	2695	2846	2913	3564	3100	3131	3350
2020	Jan	2697	2663	3297	2713	2899	3009	3792	3121	3189	3460
	Feb	2831	2776	3323	2841	2907	3109	3822	3267	3198	3576
	Mar	3024	1988	3757	3168	2852	3353	4320	3643	3138	3856
	Apr	3270	3149	4212	3506	2923	3545	4844	4031	3215	4077
	May	3350	3316	3851	3577	2939	3506	4429	4113	3233	4032
	Jun	3748	3591	3978	3419	2892	3535	4575	3932	3181	4065
	Jul	3723	3701	3621	3351	2943	3377	4164	3853	3237	3884
	Aug	3819	3833	3816	3733	3011	3339	4388	4293	3312	3840
	Sep	4027	4044	3804	3635	2986	3327	4374	4180	3284	3826
	Oct	4153	4139	3542	3674	2892	3233	4073	4225	3182	3718

 Source: [www.http://ricestat.irri.org:8080/wrs](http://ricestat.irri.org:8080/wrs)

## Focus Group Discussion (FGD) & Key Informant Interview (KII)

