

Fertilizer Requirement for Boro Rice Production in Bangladesh



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Executive Summary

Bangladesh is endowed with a climate favourable for the cultivation of a wide variety of both tropical and temperate crops. Rice is the staple food for above 150 million populations. Rice production system depends on a various management practices such as irrigation and fertilizer applications, crop management practices, use of new high yielding varieties and modern technologies. Boro rice is one of the major cereal food grains in Bangladesh which contributed more than 55% to the total rice production during 2008-09. Hybrid Boro rice yield depends on a considerable part on irrigation and fertilizer management practices.

Fertilizer is the most important nutrient elements in soils and plays the most vital role in crop production in Bangladesh. Fertilizer application mainly depends on the soil types, growing season, irrigation applications and the cultivars used and agro-climatic conditions of the locations. Every year huge amounts of chemical fertilizer are imported from foreign countries and the import rate is significantly higher for non urea fertilizer. Domestic production of urea fertilizer covered 50% to the total demand, where TSP (Triple super phosphate) was only 10%, Gypsum was 40% and MOP (Murate of potash) was fully imported in 2008-09.

Bangladesh government has set a target 19 million tons of Boro rice production under 4.8 million ha land in 2009-10. Therefore to achieve the targeted production of Boro rice in this year, the fertilizer supply would be one of the major concern things to the whole production system. The major fertilizer such as urea, TSP, MOP, gypsum and $ZnSO_4$ would be required 13.83, 5.65, 6.94, 0.41 and 3.06 lakh tons, respectively (applying fertilizer in recommendation dose). Applying on the basis of soil fertility, fertilizer requirement would be 13.2, 4.20, 4.64, 0.38 and 2.85 lakh tons, respectively and on the basis of farmer demand in field level, it would be 12.60, 5.23, 6.43, 0.39 and 2.51 lakh tons, respectively. The urea fertilizer stock will become 9.5 lakh tons after importing 3.5 lakh tons from Qatar. More than 3 lakh tons urea may be shortage in the total growing season which is above 24% compared to the total demand. From this study, it is clear that there is large gap between targeted production of Boro rice and fertilizer input. Therefore, timely supply and availability of fertilizer should receive top priority to sustain/increase Boro rice production when food availability is crucial factors for poverty stricken people, when the country being challenged with feeding increasing population.

Section 01

1.1 Introduction

Rice is the staple food for the people of Bangladesh and will continue to remain so in future. Rice production systems make a vital contribution to the reduction of hunger and poverty in Bangladesh. Besides, its economy is heavily dependent on this sector. The country needs substantial increase in rice production to provide her teeming millions with food and other basic needs of life. There are not many options but to raise level of rice production from the limited land resources and diverse climatic conditions for improving the living standard of her common people. Variations in management practices (irrigation and fertilizer application, crop management practices etc), use of new high yielding varieties (HYV) and modern technologies play a vital role to increase rice production of this country.

Boro rice is one of the major cereal food grains in Bangladesh, which is transplanted in winter season (December to February). Productivity of Boro rice depends on several of climatic parameters (temperature, rainfall, humidity, etc), hydrological properties of soil (pH, organic carbon, cation exchange capacity, etc), rice varieties, and major production inputs, such as irrigation and fertilizer management practices, above all government policies in this sector. A reasonable amount of Boro rice production is hampered in every year as a consequence of the above factors interactive over different scale in different locations.

Soils as suppliers of nutrients for rice plant growth are very important factors determining rice yield productivity. Nutrients in soil whether naturally endowed or artificially maintained, are the major determinant of the success or failure of a crop production system. As the pressure to grow more rice from the limited agricultural land, the soils come under the threat of nutrient depletion and thus, the sustainability of the cropping systems under the present soil and crop management practices face a great challenge. The

prevention of a reduction of Boro rice production through better nutrient management mainly fertilizer is therefore, an important issue for increasing Boro rice production and ensuring food sufficiency for the millions of Bangladesh.

1.2 Objectives of the Study

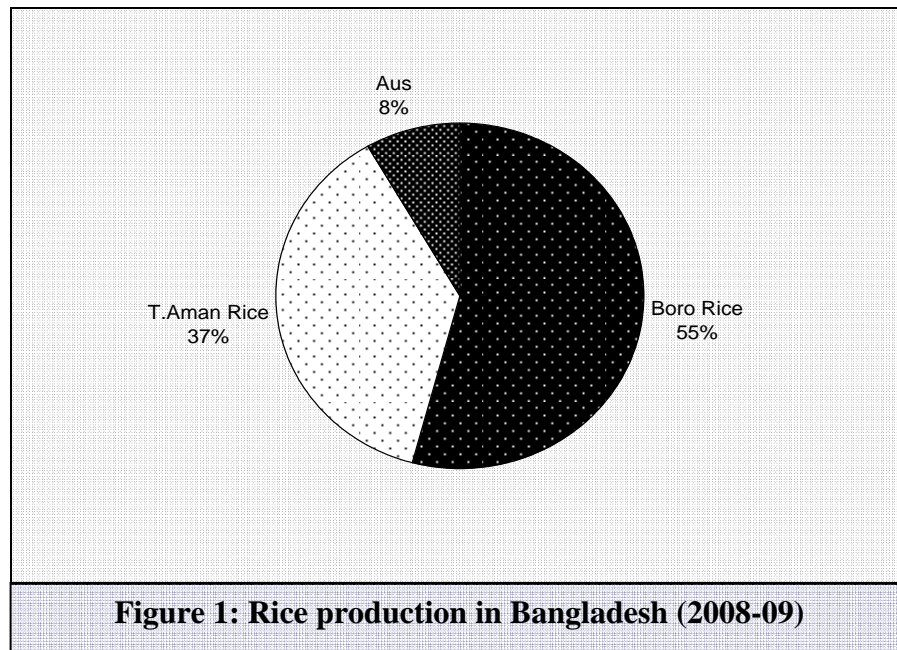
- To estimate the fertilizer doses considering ‘Recommendation dose of nutrient’, ‘Soil fertility’ and ‘Farmer demand in field level’ for Boro rice production
- Assessment of the possible fertilizer requirement for Boro rice production in Bangladesh in the year of 2009-10
- To identify the gap between fertilizer demand and supply for Boro rice production of the targeted year

Section 02

2.1 Rice Production in Bangladesh

Rice production systems make a vital contribution to the reduction of hunger and poverty in Bangladesh. Total rice production in Bangladesh was 10.32 million tons in the year 1975-76 when the country's population was only 79.90 millions and cultivated rice area was 10.32 million ha (BBS and DAE, 2007). However, the country is producing 34.28 million tons rice in the year of 2008-09, where Boro rice contributed more than 55% (18.5 million tons). From the analysis of the last few years data we found that its contribution in total rice production follows a increasing trend. Recently, the rate is increasing rapidly due to adoption of high yielding rice varieties, including modern rice cultivation technologies, improvement irrigation facilities and applications of fertilizer and pesticides. But for continuing this production rate there should be proper management practices. HYV Boro rice production depends on a considerable part on its

proper management practices, mainly fertilizer and irrigation application in different growing stages. Therefore, ensuring irrigation and fertilizer in farmer level on scheduled times (application time) are of major concern.



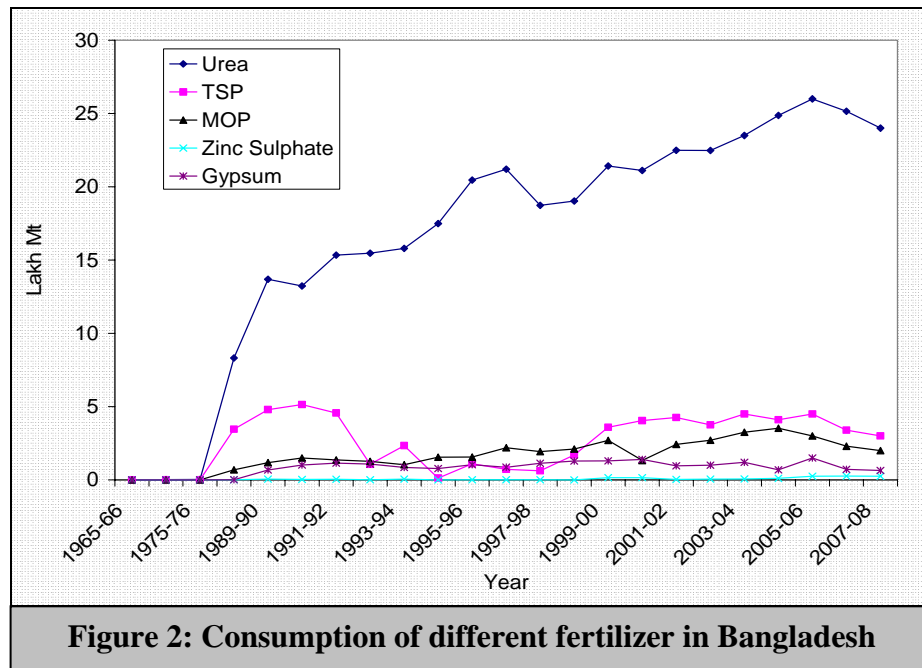
Bangladesh government has set a target 19 million tons for Boro rice production in the year of 2009-10. To achieve the target, all agricultural inputs which are involved directly or indirectly in Boro rice production must be adequate and accessible to farmer-field during the production period (December to May). Targeted Boro rice cultivation area is 4.8 million ha in 2009-10 which is more than one-fourth million ha from the previous year 2008-09.

2.2 Fertilizer Demand in Bangladesh

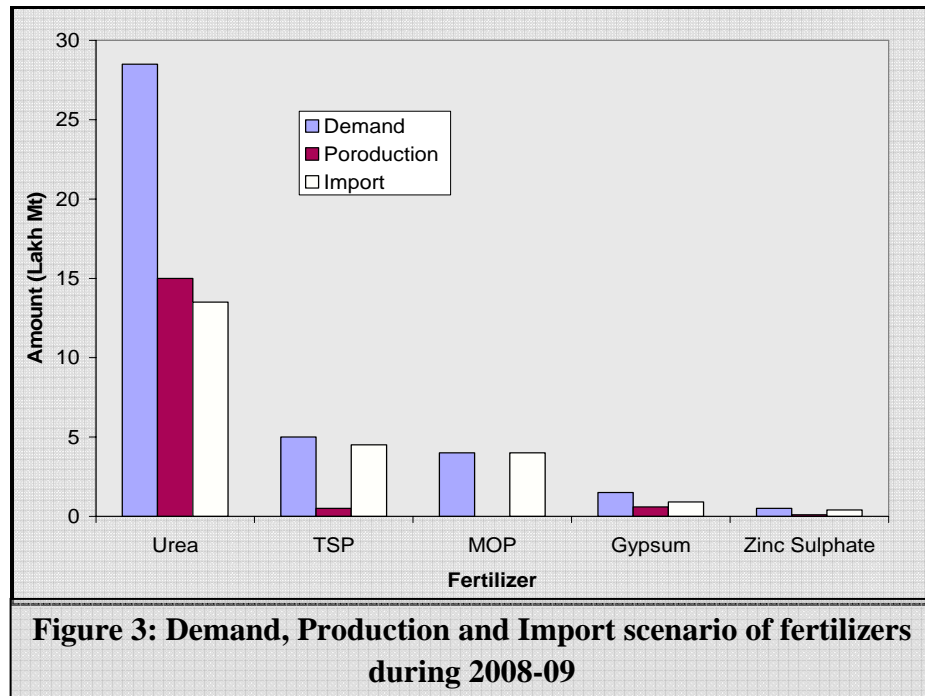
Fertilizer is the most important nutrient element in soils and plays the most vital role in crop production in Bangladesh. Fertilizer application mainly depends on the soil types, growing season, irrigation applications and the cultivars used. The demand for fertilizer is

also affected by agroclimatic conditions. High yielding varieties of Boro rice are highly responsive and need adequate supply of fertilizer to achieve targeted production. Urea (Nitrogen), Triple super phosphate (TSP), Murate of potash (MOP), Gypsum and Dasta (ZnSO₄) are the major fertilizers which are applied in agricultural land in various proportions for Boro rice production in Bangladesh. Urea is applied in three steps after Boro rice transplanting and the other types of fertilizers are applied during the field preparation.

The use of chemical fertilizers in Bangladesh agriculture was started sharply after the year of 1975. Urea application is significantly higher comparing to the other fertilizers application for crop production. Fertilizer application sharply increased with the introduction of high yielding varieties. Significant amount of fertilizer consumption was noted during 1975-76. Since then increasing trend of fertilizer was being observed which reached peak value of 40.05 lakh tons during 2005-06 (Fig. 2). Along with urea, TSP and MOP the use of gypsum, zinc sulphate and other micronutrients were also increased after the year of 1975-76.



All fertilizer requirements of the country such as urea, TSP, MOP, gypsum, zinc sulphate etc are met through import by the private companies. The total urea fertilizer production in 2008-09 was 15 lakh tons in six urea factories and total demand was 28.50 lakh tons. Domestic production covered more than 50% to the total demand of urea. Similarly, TSP domestic production was 0.50 lakh tons, which covered 10%, Gypsum was 0.60 lakh tons which was 40% to the total demand. Moreover, MOP demand was 4 lakh tons which was completely imported from foreign countries (Kafiluddin et al., 2008). It is quite evident that fertilizer demands are heavily dependent on imported fertilizer. Therefore, any disruption in the supply chain, it is quite possible to affect the total production system.



2.3 Fertilizer Dose for Boro rice production in Bangladesh

Information on nutrient balance for a particular crop production system is very useful in developing nutrient management strategies for sustainable production. The continuous and unbalanced use of the chemical fertilizers under intensive cropping systems has been

considered to be the main cause for declining crop yield and environmental degradation. All essential elements must be present in optimum amounts and in forms usable by rice plants. Nitrogen, phosphorus, zinc, potassium and sulfur are nutrients elements most commonly applied by rice farmers. The amount of nutrients for Boro rice production in Bangladesh is given Table 1. Nitrogen is a major component of proteins, hormones, chlorophyll, vitamins and enzymes, essential for rice. Rice plants require a large amount of nitrogen at the early and mid-tillering stage to maximize the number of panicles (Datta, 1981). The recommended doses of other nutrients are also necessary for potential rice yield. Eliminate any one of these elements, and plants will display abnormalities of growth, deficiency symptoms, or may not reproduce normally.

Table 1: Recommendation dose of nutrients for Boro rice production			
Type of fertilizer	Amount of nutrient (Kg/ha)	Average value of nutrient (Kg/ha)	Average dose of fertilizer (Kg/ha)
Urea (N)	110-130	120	267
TSP (P)	50-55	52.5	109
MOP (K)	79-82	80.5	134
Zinc Sulphate (Zn)	2	2	8
Gypsum (S)	10	10	59

(Source: BRRI, 2010 and author's own calculation)

Soil fertility is the inherent capacity of soil to supply nutrients to plants in adequate amounts and in suitable proportions. Soil fertility plays a vital role for applying fertilizer in agriculture field. High and medium fertile soils require less amount of fertilizer because of the existence of huge amount of organic matter. On the other hand, low fertile soils require high fertilizer dose. Table 2 shows that low fertile soil require two to three times more fertilizer than the medium and high fertile soil. In this study we considered average value of fertilizer dose to find out the total demand of fertilizer in the year 2009-10. In farmer level fertilizer application dose is almost similar comparing to other two doses (Table 3). Farmers of Bangladesh use a less amount of urea fertilizer compared to the nutrient requirement and soil fertility doses. But the TSP and MOP dose are almost

similar to the nutrient requirement dose. In this study, it is clear that there is a small gap among all types of fertilizers in all three types of fertilizer doses.

Table 2: Recommendation dose of fertilizer for Boro rice production in Bangladesh considering soil fertility			
Type of fertilizer	Type of soil	Dose (Kg/ha)	Average dose (Kg/ha)
Urea	Medium fertile soil	197.60	254.40
	Low fertile soil	311.22	
TSP	Medium fertile soil	61.75	81.51
	Low fertile soil	101.27	
MOP	Medium fertile soil	59.28	89.54
	Low fertile soil	119.80	
Zinc Sulphate	Medium fertile soil	4.94	7.41
	Low fertile soil	9.88	
Gypsum	Medium fertile soil	28.40	54.96
	Low fertile soil	81.51	

(Source: BRRI, 2010 and author's own calculation)

Table 3: Fertilizer application in Farmer-level in Bangladesh		
Type of fertilizer	Dose (Kg/ha)	Average dose (Kg/ha)
Urea	224.5-262.0	243
TSP	89.9-112.0	101
MOP	112.3-134.7	124
Zinc Sulphate	7.5	7.5
Gypsum	37-60	48.5

(Source: BRRI, 2010 and author's own calculation)

2.4 Fertilizer requirement for Boro rice production in 2009-10

Bangladesh government has set a target 19 million tons of Boro rice production under 4.8 million ha land in 2009-10. Therefore to achieve the targeted production of Boro rice in this year, the fertilizer supply would be one of the major concern things to the whole production system. The major fertilizer such as urea, TSP, MOP, gypsum and ZnSO₄ would be required 13.83, 5.65, 6.94, 0.41 and 3.06 lakh tons, respectively considering

nutrient requirement dose. When we considered fertilizer application on basis of soil fertility then fertilizers requirement would be 13.2, 4.20, 4.64, 0.38 and 2.85 lakh tons, respectively. But when the farmer demand was considered in field level, then fertilizers requirement would be 12.60, 5.23, 6.43, 0.39 and 2.51 lakh tons, respectively. From the analysis it is clear that if we fulfill the requirement of fertilizer on the basis of nutrient then it is slightly higher than the other two processes. But the requirements are more or less similar for the Boro rice in the targeted year.

In spite of some uncertainty in fertilizer stock, Government of Bangladesh announced that fertilizer stock is sufficient for whole Boro season and there are no possibilities of price increase and shortage of fertilizer (Prothom –alo, 2nd January 2010¹). It was added that 6.5 lakh tons urea already stocked and 3 lakh tons urea will soon add to the total stock, importing from Qatar. Therefore urea fertilizer would be 9.5 lakh tons (including imported from Qatar). As a result, 4.33 lakh tons urea fertilizer might be shortage in the total growing season which is more than 30% compared to the total demand (considering nutrient recommendation doses). If we consider urea fertilizer requirement on the basis of soil fertility, then the shortage would be 3.7 lakh tons which is 28% and if it is considered on the basis of farmer demand in field level, then it would be 3.1 lakh tons which is more than 24% of the total demand. It should be also noted that other crops like wheat, potato, banana etc are also grown in winter season which are not considered on the fertilizer requirement analysis. A considerable amount of urea is applied for wheat, banana, potato and other vegetables in Bangladesh. Added the requirement of urea for other crops in winter season then the percentages of shortage will be higher.

¹ Parliamentary meeting in December 31, 2009, Minister of Industries Mr. Dilip Barua stated that fertilizer stock is sufficient for whole Boro season and there are no possibilities to increase price and shortage of fertilizer. He added that 6.5 lakh tons urea already stocked and 3 lakh tons urea will soon add to the total stock, importing from Qatar

From our analysis, it is clear that we will face a large gap between targeted production and fertilizer input. The other fertilizers supply depends on the import policies of Government. Moreover, time and cost are also related with the whole process of import, production, market and above all Government distribution and monitoring policies, which are sometimes complex and time consuming.

Targeted Boro rice production (millions tons)	Targeted Boro paddy production (millions tons)	Type of fertilizer	Total amount (lakh tons)		
			Base on Nutrient	Base on Soil fertility	Base on Farmer demand
19	28.5	Urea	13.83	13.20	12.60
		TSP	5.65	4.20	5.23
		MOP	6.94	4.64	6.43
		ZnSO ₄	0.41	0.38	0.39
		Gypsum	3.06	2.85	2.51

Section 03

3.1 Conclusion

The sustainable increase of rice production for food sufficiency requires efforts to enhance the capacity of rice production system. All agricultural inputs which are involved directly or indirectly in rice production must be adequate and accessible at farmers' field during the total growing season. This study shows that urea, TSP, MOP, gypsum and ZnSO₄ would be required 13.83, 5.65, 6.94, 0.41 and 3.06 lakh tons, respectively on the basis of nutrient recommendation dose and 13.2, 4.20, 4.64, 0.38 and 2.85 lakh tons, respectively on the basis of soil fertility and 12.60, 5.23, 6.43, 0.39 and 2.51 lakh tons, respectively on the basis of farmer demand in field level, to achieve 19 million tons Boro rice production under 4.8 million ha land. But fertilizer stock, mainly urea is not sufficient for the total growing season. More than 3 lakh tons urea may be shortage and this effect may have a significant role in total rice production system.

Timely supply and availability of fertilizers at reasonable prices at the doorsteps of the hard working farmers in the country is very much necessary for optimum supply of nutrients to the depleted soils for successful achieving the targeted Boro rice production. Therefore, timely supply and availability of fertilizer should receive top priority to sustain/increase Boro rice production when food availability is crucial factors for poverty stricken people, when the country being challenged with feeding increasing population.

References

- BBS (Bangladesh Bureau of Statistics), 2007. Statistical Year Book of Bangladesh. Planning Division, Ministry of Planning Government of the People's Republic of Bangladesh, Dhaka.
- Biswas, J.K. 2010. Personal communication with Dr. Jiban Krishna Biswas, Chief Scientific Officer, BRRI, Gazipur, Bangladesh.
- DAE (Directorate of Agricultural Extension), 2007. Government of the People's Republic of Bangladesh. Ministry of Agricultural, Dhaka.
- De Datta, S.K., 1981. Principles and practices of rice production. International Rice Research Institute. Los Banos, Philippines. 349 pp.
- Kafiluddin, A., and M. S. Islam. 2008. Fertilizer distribution, subsidy, marketing, promotion and agronomic use efficiency scenario in Bangladesh. International Fertilizer Industry Association (IFA), Melbourne, Australia.
- Rashid, M.A. 2010. Personal communication with Dr. Abdur Rashid, Principle Scientific Officer, BRRI, Gazipur, Bangladesh.