

Application Gap of Fertilizers in Boro Rice Cultivation: A Field Level Study

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Abstract

The objectives of this study were to determine the application gap of fertilizers in boro rice cultivation and to explore the relationships between farmers' selected characteristics and their gap of fertilizer application. Besides, an attempt was made to identify the causes associated with application gap of different fertilizers and their probable remedies in boro rice cultivation. Data were collected from a sample of 100 farmers selected through simple random sampling procedure from Shankarpur Union of Jhikargachha Upazila under Jessore District during 5 August to 19 September, 2009. The findings revealed that 37% of the farmers had low application gap followed by 34% having high application gap of urea in cultivating boro rice. In case of TSP, more than one half (52%) of the respondents had low application gap and 30% had medium application gap but 44% of the respondents had medium application gap compare to 37% having low application gap in terms of MoP application. Among seven characteristics of farmers - age, education, farm size, annual income, credit received, extension contact and knowledge of using fertilizer, only two characteristics such as extension contact and knowledge of using fertilizer were found to have significant negative relationship with their application gap while the rest of the variables did not show any significant relationship. The causes of application gap of using fertilizers were high price of fertilizers, lack of credit facilities, and lack of adequate supply in time, poor fertilizer quality, and inadequate dealerships. Adequate credit facilities, timely supply of fertilizers and open market sale of fertilizers were the most important remedies opined by the farmers to minimize the gap.

Keywords: Application gap, fertilizer, boro rice, cultivation, farmers.

Introduction

Boro, an important rice season in Bangladesh, plays a significant role in increasing total rice production in one hand, and help decrease food insecurity, on the other hand. Boro rice reduces country's dependence on its 40% deeply flooded land, which yields no rice in years of disastrous floods. With the innovations of ground water tube wells for irrigation and modern high yielding and short duration boro rice varieties, farmers have been abandoning the risky low yielding rice in favor of boro rice. This rice made life better for many rural Bangladeshis (IFPRI, 1999). Fertilizers are

indispensable for the crop production systems of modern agriculture. Among the various inputs that affect crop production, fertilizer is the single most important one that plays a crucial role in yield increase. Inorganic fertilizers today hold the key to success of the crop production system of Bangladesh agriculture, being responsible for about 50% of the total production (BARC, 2004).

The Green Revolution of the 1970s resulted in remarkable increase in rice production. Dramatic change has been taken place in rice

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sector in many least developed countries including Bangladesh. In spite of doubling rice production, the country experiences a continued annual shortage of nearly 2.5 million tons of food grains (MoFDM, 2007). This shortage of food production will continue to increase even if the present level of population growth is maintained. Rice production has to be increased by at least 60% to maintain the present level of rice requirements by the year 2020 (Bhuiyan and Karim, 1999). These can be done by using improved agricultural technologies such as adopting modern varieties, improving irrigation facilities and using recommended doses of fertilizers.

Among various types of rice cultivated in our country, the boro rice gives higher per unit yield. But still the average per unit yield of boro rice is not up to the expectation. The yield of boro rice can be increased to a great extent by using different chemical fertilizers with their respective recommended doses (Karim, 1999). It is reported that higher contribution (53.8 percent) of fertilizer to yield in case of boro rice. But high yielding

crop varieties under intensive cropping will fail to express their full potential unless plant nutrients are supplied in adequate amounts and appropriate proportions. However, although there are number of proven rice technologies i.e. standard recommendations are available to the farmers and it has also been noticed that the farmers are deviating from the recommendations (Bhattacharya *et al.*, 1997). But there is no availability of adequate information about the level of using recommended dose of fertilizers by the farmers of our country concerning boro rice cultivation. In view of the foregoing discussion, the researchers undertook this study with the following objectives: i) to find out the application gap of using fertilizer in boro rice cultivation; ii) to describe some of the selected characteristics of the boro rice growers; iii) to explore the relationships between application gap of using fertilizer by the boro rice growers and their selected characteristics; and iv) to identify the associate causes of application gap of fertilizer and their possible solutions.

Methodology

Study Area, Population and Sampling

The study was conducted in five villages of Shankarpur Union under Jhikargachha Upazila of Jessore district. All the farm family heads of Shankarpur union constituted the population of the study. This union has fourteen villages and out of which five villages were selected following a random sampling technique. An up-to-date list of all boro rice farmers (the head of farm households) of the selected five villages was prepared with the help of respective Sub-

Assistant Agriculture Officer (SAAO). The list so prepared comprised about five hundred boro rice farmers. Approximately twenty percent (20%) of the boro rice farmers were selected randomly from each village. Thus, 100 boro farmers constituted the sample for this study.

Measurement of Application Gap

Application gap of fertilizer of a farmer was measured as the difference between recommended dose and actual applied dose of fertilizer for the total potential area under

boro rice cultivation. Application gap of a farmer was measured by using the following formula:

Application gap of using fertilizer = (R-A)

Where,

R= Recommended dose or required amount of fertilizer for the area (in proper unit)

A= Actual amount of fertilizer used in a unit area

Application Gap of Urea/TSP/MoP

Application gap of Urea/TSP/MoP fertilizers of a farmer was measured as the difference between recommended dose and actual applied dose of fertilizers for the total potential area under boro rice cultivation.

Application gap of Urea/TSP/MoP fertilizer = (R-A)

Where,

R= Recommended dose of Urea/TSP/MoP fertilizers for the area (in proper unit)

A= Actual amount of Urea/TSP/MoP fertilizers used in a unit area under boro rice cultivation

Overall Application Gap of Fertilizer

Overall application gap of fertilizer of a farmer was measured as the sum of difference between recommended dose and actual applied dose of fertilizer for the total potential area under boro rice cultivation.

Overall application gap of fertilizer =

$$\sum_{i=1}^3 (R - A) \quad (i = 1, 2, 3)$$

Where,

R= Recommended dose or required amount of fertilizer for the area (in proper unit)

A= Actual amount of fertilizers used in a unit area under boro rice cultivation

Data Collection and Analysis

Data were collected through interviewing the sampled farmers. The principal researcher himself collected data for this study. Pearson's Product Moment Correlation Coefficient (r) was computed to explore the relationships between farmers' selected characteristics and their application gap of fertilizers in boro rice cultivation.

Findings and Discussion

Some Basic Features of the Farmers

Data contained in Table 1 indicated that the largest proportion (51%) of the farmers were middle aged, while most of them had an education to an extent of primary to

secondary level. More than one half of the respondents belong to small sized farms, while an overwhelming majority of them (84%) had low annual income.

Table 1. Salient features of the selected characteristics of farmers (n= 100)

Characteristics	Measuring units	Categories	Farmers (%)	Mean	SD
Age	Years	Young (upto 35)	33	40.3	8.16
		Middle (36-50)	5		
		Old (above 50)	16		
Education	Years of schooling	No education (0)	12	4.19	3.36
		Sign only (0.5)	16		
		Primary (1-5)	40		
		Secondary (6-10)	27		
		Above secondary (> 10)	5		
Farm size	Hectare	Marginal (0.08-0.20)	43	0.372	0.388
		Small (0.21-1.00)	52		
		Medium (1.01-2.00)	4		
		Large (>2.00)	1		
Annual income	-000' taka	Low (15-70)	84	47.14	31.27
		Medium (71-120)	12		
		High (> 120)	4		
Credit received	-000' taka	No (0)	57	1.95	2.84
		Low (1-5)	32		
		Medium (5.001-10)	10		
		High (>10)	1		
Extension . contact	Scores	Low (11-15)	36	16.46	2.4-1
		Medium (16-20)	60		
		High (>20)	4		
Knowledge of using fertilizer	Scores	Low (9-11)	34	11.55	1.54
		Medium (12-14)	42		
		High (>14)	4		

Finding concerning credit received by the farmers shows that majority (57%) did not receive any credit, three-fifth (60%) of the respondents were found to have medium extension contact while a majority (54%) of them had low knowledge about using fertilizers followed by medium (42%).

Application Gap of Urea, TSP and MoP fertilizers

The recommended dose of Urea was 270 kg per hectare (BARC, 2004). Application gap of urea ranged from 1 to 45 kg. The mean and standard deviation were 26.14 and 17.11 respectively. The farmers were classified into three categories based on their application

gap of Urea fertilizer has shown in Table 2. The majority (37 percent) of the farmers had low application gap of using urea. However, 29 percent of the respondents had medium and 34 percent having high application gap of using urea fertilizer. The recommended dose of TSP was 140 kg per hectare (BARC, 2004). Application gap of TSP ranged from 20 to 65 kg. The mean and standard deviation were 38.16 and 16.38 respectively. The farmers were classified into three categories based on their application gap of TSP is shown in Table 2. The majority (52 percent) of the farmers had low application gap of using TSP compared to 30 percent of the respondents had medium application gap and

18 percent of the respondents had high application gap of using TSP fertilizer. The recommended dose of MoP was 140 kg per hectare (BARC, 2004). Application gap of MoP ranged from 20 to 65 kg. The mean and standard deviation were 40.30 and 15.37 respectively. The farmers were classified into three categories based on their application gap of MoP is shown in Table 4.2. The

majority (44 percent) of the farmers had medium application gap of using MoP compared to 37 percent of the respondents having low application gap and 19 percent of the respondents had high application gap of using MoP fertilizer. Islam and Haq (1998) also found more or less similar findings in their study.

Table 2. Distribution of farmers according to their application gap in using fertilizer

Name of the fertilizers	Categories	Farmers (%)	Mean	SD
Urea	Low (1-15)	37	26.14	17.11
	Medium (16-30)	29		
	High (30-45)	34		
TSP	Low (20-35)	52	38.36	16.38
	Medium (36-51)	30		
	High (51-65)	18		
MoP	Low (20-35)	37	40.30	15.37
	Medium (36-51)	44		
	High (51-65)	19		
Overall gap	Low (48-85)	34	104.78	33.51
	Medium (86-123)	40		
	High (123-160)	26		

Overall Application Gap of Fertilizer

Overall application gap of fertilizer ranged from 48.51 to 160.78 kg. The mean and standard deviation were 104.78 and 33.51 respectively. The farmers were classified into three categories based on their application gap of fertilizer has presented in Table 3. The majority (40 percent) of the farmers had medium application gap of using fertilizer compared to 34 percent of the respondents having low application gap and 26 percent of the respondents had high application gap of using fertilizer. The annual report of BRRI (2001) also reported similarly. Imbalanced fertilizer use is both costly in terms of nutrient loss from soil mining, decline in food supply and loss of soil fertility and land productivity and the consequent decline in

food production. Bangladesh should a strategy for balanced fertilization to promote soil building to support sustainable land use system and ensure stable supply of food grains from existing agricultural lands.

Comparison between Application Gap of Fertilizers

An attempt was made to compare between application gap of fertilizers such as Urea, TSP and MoP in boro rice cultivation. The data in Table 3 indicates that farmers on an average used 9.68 percent reduced rate of urea, 27.40 percent TSP and MoP by 28.79 percent considering the recommended and actual doses of fertilizers. DAE (2005) also reported similarly that application gap regarding nitrogen containing fertilizer (Urea and DAP) for crop production is

comparatively lower than that of phosphate and potash containing fertilizers such as TSP and MoP respectively, in Bangladesh.

Table 3. Application gap of fertilizers (%)

Application gap	Required dose (kg)	Mean gap	Percent gap
Urea	270	26.14	9.68
TSP	140	38.36	27.40
Mop	140	40.30	28.79
Overall		35.25	21.96

This means all the respondents of the study area used varying extent of lower doses of

chemical fertilizers. This may be due to lack of awareness of farmers concerning function of different fertilizers, high price and improper distribution system of fertilizer.

Causes for Application Gap of Fertilizers and Farmers' Opinion upon Possible Remedies

Findings in Table 4 indicate that 'scarcity of fertilizers', 'farmers unable to use balanced fertilizers' and 'lack of adequate supply of fertilizers in time' were the most important causes that compel farmers to use fertilizers inappropriately.

Table 4. Associated causes with application gap of different fertilizers and probable remedies opined by the farmers

Sl. No.	Causes	Probable remedies	Farmers (%)
1	Scarcity of fertilizers	Increase availability of fertilizers	97
2	Farmers unable to use balanced fertilizers due to high price	Supply of fertilizers at a lower price by giving more subsidies. Price monitoring commission should be formed by the Govt.	95
3	Lack of adequate supply of fertilizers in time	Supply of desired types of fertilizers before the onset of season	85
4	Lack of adequate credit facilities	Govt. should provide adequate amount credit. Credit distribution procedure should be made easier and credit should be given to real farmers	85
5	Govt. appointed dealers claim higher price of fertilizers than actual price	Govt. should check high price claiming by dealers. Appointment of dealership should be done without political bias	70
6	Farmers' lack of knowledge about balanced doses of different fertilizers and their uses	Farmers should be given necessary information about recommended doses of fertilizers by extension workers. Demonstration should be organized showing proper doses of fertilizers	67
7	Lack of training about fertilizer application	Proper training should be organized about application of different fertilizers	63
8	Inadequate extension contact	Extension contact should be increased	61
9	Farmers have to pay bribe for collecting credit from bank	Steps should be taken for checking the bribing	50
10	Low price of farm products	Reasonable price of farm products should be ensured by the Govt.	47
11	Lack of printed materials such as booklets, leaflet etc. about use of balance dose of fertilizers	Printed materials about fertilizers application along with balance doses should be available to all categories of farmers	42
12	Fertilizer doses become imbalance due to adulterated fertilizer application	Measures should be taken to stop marketing of adulterated fertilizers	34

On the contrary, 'low price of farm products', 'lack of printed materials such as booklets, leaflet etc. about use of balance dose of fertilizers' and 'fertilizer doses become imbalance due to adulterated fertilizer application' were noticed as the least important causes concerning with fertilizer application gap made by the farmers. Increasing availability of fertilizers, supply of fertilizers at a lower price by giving more subsidies and price monitoring commission should be formed by the Govt. and supply of desired types of fertilizers before the onset of season were the important opinions opined by the farmers to minimize the application gap of different fertilizers.

Relationships between Application Gap of Using Fertilizer and Selected Characteristics of the Farmers

Correlation result shows that among seven selected characteristics of farmers only two characteristics such as extension contact and knowledge of using fertilizers had significant negative relationship with their application gap of using fertilizers for boro rice cultivation. Islam *et al.* (2008) also reported similarly. Regular contact with different extension media such as development officials, various kinds of printed materials, television, radio, etc. makes an individual informative about many aspects.

Table 5. Co-efficient of correlations showing relationship between the selected characteristics of the farmers and their application gap of using fertilizer

Dependent variable	Independent variables (farmers' selected characteristics)	Computed Value of 'r'
Application gap of using fertilizers	Age	0.051
	Education	0.026
	Farm size	-0.109
	Annual income	0.004
	Credit received	-0.068
	Extension contact	-0.306 **
	Knowledge of using fertilizer	-0.413**

* Significant at 0.05 level of probability (table value = 0.195 with 98 d.f.)

** Significant at 0.01 level of probability (table value = 0.254 with 98 d.f.)

All these sources of contact might be influencing for minimizing the gap concerning fertilizer application. On the other hand, better knowledge of farmers about a cultivation technique also helps him to perform his task efficiently. Duwayari, *et al.* (1998) concluded in such a way that if

farmers have better knowledge for operating a business, it will bring a good outcome with minimum difficulties/obstacles. However, the remaining five characteristics of farmers did not have significant relation with their fertilizer application gap.

Conclusion

Chemical fertilizers are a vital part of modern agriculture. The new high-yielding crop varieties which supply so much of the

region's food only perform well when they are provided with an adequate and timely supply of plant nutrients in the form of

different chemical fertilizers. The findings of the study revealed that majority of the boro rice growers used recommended dose of urea while TSP and MoP by minimum number of farmers. This means the farmers are more concern about use of Urea than TSP and MoP. This is why the application gap of Urea is lower than those of TSP and MoP fertilizers. Applying inappropriate fertilizer means an imbalance use of different plant nutrients. Nitrogen applications tend to be much too high in relation to the amount of potassium and phosphate used. This is partly the result of price differentials, and partly the

lack of knowledge among farmers about the need for balanced fertilizer applications. Hence, inappropriate application of fertilizers not only reduces the yield of boro rice but also pollutes the environment and damage the agro-ecosystem to a great extent. However, the extension service providers should strengthen motivational campaign so that the farmers become aware about the use of recommended dose of all the inorganic fertilizers in boro rice cultivation. In addition, Government should take initiative regarding easy access of fertilizers to farmers through proper distribution system.

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