

## EFFECT OF POTASSIUM FERTILIZER ON THE GROWTH OF BORO RICE VARIETIES IN HAOR AREAS

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(Available online at: [www.jsau.com.bd](http://www.jsau.com.bd))

### Abstract

The experiment was conducted at the Tajpur village of the Lakshmansree Union, Sunamganj Sadar Upazila and Rahimapur village of the Beheli union, Jamalgonj Upazila, Sunamganj district during November 2016 to May 2017 to see the effect of variety and MoP fertilizer on the growth of boro rice varieties in *haor* areas. Two varieties (BRRI dhan29 and BRRI dhan58) and six MoP fertilizer rates including 147, 137, 127 [BARC Fertilizer Recommendation Guide], 117, 107 and 82 kg ha<sup>-1</sup> [Farmers' practice dose (FP)]. Urea-TSP-CaSO<sub>4</sub>-ZnSO<sub>4</sub> application followed as BARC Recommendation dose of 300-112-75-11 kg ha<sup>-1</sup> Farmers' practice (FP) where 165 and 82 kg ha<sup>-1</sup> Urea and TSP were used. The experiment was laid out in a randomized complete block design (RCBD) with three replications. Plant height of BRRI dhan58 (95.33 cm) was significantly higher than BRRI dhan29 (91.52 cm). Plant height also affected due to application of MoP fertilizer treatments at all stages of growth. Interaction effect of variety and MoP fertilizer showed significant variation at 45, 60 and 75 days after transplanting (DAT). At 75 days after transplanting (DAT), the higher number of tillers hill<sup>-1</sup> (21.83) was produced by BRRI dhan29. But it was higher in BRRI dhan58 (14.20) at harvest. Higher number of effective tillers hill<sup>-1</sup> (12.48) was produced by BRRI dhan58. The correlation values indicated that growth and yield parameters were positively significant except few non-yielding characters.

**Keywords:** Fertilizer, *haor*, varieties, boro season, growth parameter.

### Introduction

Potassium is very much important for rice growth and development. In leaves, marginal burning from tips, weakening of stem and prone to lodging occurs due to lack of proper dose of potassium and mode of its application at proper stage of crop growth. Use of potassium, especially at the later stage of crop growth is believed to reduce the MoP deficiency symptoms which favors the growth of this crop. Judicious application of fertilizers can increase the crop growth and yield per unit area and minimize the nutrient imbalance in soil. Large scale use of chemical fertilizers has created a potential health hazard, reduced microbial population and earthworm activities, affecting soil health and reduced utility of water bodies for men, animals and fishes (Abdel *et al.*, 2004). The recommended rates of N, P, K, S and Zn not only maintain soil health for sustainable agriculture but also save part of the cost of crop production. In addition, global environmental pollution can be reduced by application of reduced rates of fertilizers. MoP plays a major role in crop growth and development. It is necessary for basic physiological function such as formation of sugar and its subsequent movement among different parts, the synthesis of protein, normal cell division and growth (Samer *et al.*, 1990). Application of higher rates of MoP increases all the growth parameters (Thakur *et al.*, 1993). Among the nutrients, K is taken up by plants in large amounts. But this nutrient is lost in considerable amount through the percolation water. When K fertilization is done, its concentration drastically increases in soil solution. But within a period of 30 and 45 DAT, the concentration drastically reduced to a minimum level of 0.2 to 2.0 mg l<sup>-1</sup>. It has been reported by many workers that rice plant take more K than amount added as fertilizers (Sharif, 2009). Because of excess withdrawal though mining, the K fertility of soil is severely decreasing. Quantification of the amount of K taken up from soil solution and soil solid portion may help taking necessary measure to reduce the K mining from soil and loss by reproduction. This experiment was undertaken to observe the effect of different MoP fertilizer dose on the growth of boro rice varieties in *haor* areas.

### Materials and Methods

The experiment was conducted at *Dekar haor* and *Halir haor* in Sunamganj district during November 2016 to May 2017. The experimental sites were situated at the Tajpur village of the Lakshmansree Union, Sunamganj Sadar Upazila and Rahimapur village of the Beheli union, Jamalgonj Upazila, Sunamganj. The site falls in the Sylhet Basin Agro-ecological zone (AEZ-21). The experiment included two factors, two varieties (BRRI dhan29 and BRRI dhan58) and

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six MoP fertilizer practices including  $F_1 = \text{MoP } 147 \text{ kg ha}^{-1}$ ,  $F_2 = \text{MoP } 137 \text{ kg ha}^{-1}$ ,  $F_3 = \text{MoP } 127 \text{ kg ha}^{-1}$  [BARC Fertilizer Recommendation dose],  $F_4 = \text{MoP } 117 \text{ kg ha}^{-1}$ ,  $F_5 = \text{MoP } 107 \text{ kg ha}^{-1}$ ,  $F_6 = \text{MoP } 82 \text{ kg ha}^{-1}$  [Farmer's practice dose (FP)]. In case of  $F_1$ - $F_5$  Urea-TSP-CaSO<sub>4</sub>-ZnSO<sub>4</sub> followed BARC Recommendation dose of 300-112-75-11 kg ha<sup>-1</sup> through Urea-TSP-CaSO<sub>4</sub>-ZnSO<sub>4</sub>,  $F_6$  followed Farmers' practice (FP) as 165 and 82 kg ha<sup>-1</sup> Urea and TSP were also used for this experiment. The experiment was laid out in a randomized complete block design (RCBD) with three farmers replications. The initial soil nutrients status were pH 4.8, organic matter status 2.8%, total N 0.15%, available P 4.10 ppm, exchangeable K 0.18 meq 100 g<sup>-1</sup> and available S 26 ppm. The size of plot was 4 m × 5 m. Thirty five days old seedlings were transplanted maintain spacing 20 cm × 15 cm. The experimental field was ploughed and prepared on 1-5 January 2017 with the help of a power tiller. Immediately after final land preparation, the experimental layout was made on 5-6 January 2017 according to experimental treatments. The total amount of triple superphosphate, muriate of potash, gypsum and zinc sulphate was applied during final land preparation except urea. MoP was applied as per treatments. Urea (N) was applied in equal 3 splits i.e., one-third at 15 days after transplanting, again one-third at active tillering stage (30 DAT) and rest of one-third before panicle initiation stage (45 DAT). Rice was transplanted on 5-6 January 2017. Standing water was maintained 4-5 cm in the field throughout the growing period. BRRRI dhan58 was harvested on 29 April 2017 and BRRRI dhan29 was harvested on 8 May 2017. Data were collected on growth characters. The initial and post-harvest soil sample was collected from 0-15 cm soil depth and analyzed. The recorded data were compiled and tabulated for statistical analysis. Analysis of variance and LSD were done with the help of computer package, MSTAT-C.

## Results and Discussion

The effect of variety on plant height was significant at all growth stages except 75 DAT (Table 1). BRRRI dhan58 produced longer plant (95.33 cm) than BRRRI dhan29 (91.52 cm). Al-amin (2016) reported that the tallest plant (92.17 cm) produced in BRRRI dhan58, which was significantly higher than BRRRI dhan29 (89.6 cm). Kamuruzzaman (2016) and Khisha (2002) showed the similar results in their experiment.

**Table 1. Effect of variety on plant height of boro rice in the haor areas**

Variety	Plant height (cm)					
	Days after transplanting (DAT)					
	15	30	45	60	75	At harvest
BRRRI dhan29	26.67	35.66	49.38	65.84	85.23	91.52
BRRRI dhan58	28.53	43.03	55.84	71.01	85.44	95.33
LS	**	**	**	**	NS	**
LSD	0.18	0.72	0.03	0.31	-	0.25

LS = Level of significance; NS= Non-significance; \*\* = Significant at 1 % level of probability; LSD= Least Significant Difference

The effect of MoP fertilizer on plant height was significant at all growth stages due to application of different doses of MoP fertilizer (Table 2). Application of BARC Fertilizer Recommendation Guide based fertilizer (127 kg MoP ha<sup>-1</sup>) was produced the longest plant (94.67 cm) whereas the shortest plant (92.33 cm) was recorded due to fertilizers applied as amount of farmers' practice (82 kg MoP ha<sup>-1</sup>). Kamuruzzaman (2016) reported the tallest plant (89.46 cm) in BRRRI dhan58 with proper agronomic management and fertilizer. Banu *et al.* (2009), Das *et al.* (2004), Khisha (2002), Chowdhury *et al.* (1992) and Channadasappa *et al.* (1998) showed the similar results in their study.

The interaction effect of variety and fertilizer on plant height was significant at 45, 60 and 75 DAT (Table 3). BRRRI dhan58 produced longer plant (97.07 cm) than BRRRI dhan29 (92.27 cm) under BARC Fertilizer recommendation guide based fertilizer (127 kg MoP ha<sup>-1</sup>). Singh and Singh (2000) conducted a field experiment to evaluate effect of levels and phases of potassium application on rice and found K application significantly enhanced the growth and yield of rice. Natarajan *et al.* (2005) support this result. Potassium fertilizer involves in activation of enzyme related to starch synthesis.

**Table 2. Effect of MoP fertilizer on plant height of boro rice in the haor areas**

MoP (kg ha <sup>-1</sup> )	Plant height (cm)					
	Days after transplanting (DAT)					
	15	30	45	60	75	At harvest
147	27.65	39.90	52.50	68.37	85.85	93.92
137	27.40	40.03	53.08	68.85	85.33	93.82
127	28.82	39.75	54.12	70.15	86.83	94.67
117	27.98	39.88	53.33	68.53	84.80	92.99
107	27.95	39.35	52.05	68.83	86.05	92.88
82	25.80	37.14	50.58	65.80	83.13	92.33
LS	**	**	**	**	**	**
LSD	0.32	1.24	0.31	0.53	0.34	0.43
CV (%)	1.9	5.48	1.02	1.35	0.69	0.80

LS = Level of significance; \*\* = Significant at 1% level of probability; CV=Co-efficient of variation; LSD= Least Significant Difference

**Table 3. Interaction effect of variety and MoP fertilizers on different plant height of boro rice in the haor areas**

Interaction [Variety × MoP (kg ha <sup>-1</sup> )]	Plant height (cm)						
	Days after transplanting (DAT)						
	15	30	45	60	75	At harvest	
BRR1 dhan29	147	26.03	36.40	48.83	66.10	86.43	92.00
	137	25.90	36.33	50.37	66.97	85.27	91.87
	127	28.20	34.87	51.27	67.90	87.40	92.27
	117	27.77	36.23	50.83	66.30	85.83	91.07
	107	27.40	35.87	48.83	66.27	86.67	91.47
	82	24.73	34.23	46.17	61.50	81.03	90.43
BRR1 dhan58	147	29.27	43.40	56.17	70.63	85.27	95.83
	137	28.90	43.73	55.80	70.73	85.40	95.77
	127	29.43	44.63	56.97	72.40	86.27	97.07
	117	28.20	43.53	55.83	70.77	83.77	94.77
	107	28.50	42.83	55.27	71.40	85.43	94.30
	82	26.87	40.04	55.00	70.01	85.23	94.23
LS	NS	NS	**	**	**	NS	
LSD	-	-	0.44	0.75	0.48	-	
CV%	9.45	9.81	5.54	5.55	3.85	4.18	

LS = Level of significance; NS= Non-significance; \*\* = Significant at 1% level of provability; CV=Co-efficient of variation; LSD= Least Significant Difference

The effect of variety on number of total tillers hill<sup>-1</sup> was significant at 60, 75 and at harvest (Table 4). BRR1 dhan58 produced higher number of tillers hill<sup>-1</sup> (14.20) than BRR1 dhan29 (12.12). Thakur *et al.* (1993) found the effect of application of potash on wetland rice with an increase in the potassium level up to 66 kg K ha<sup>-1</sup> with an increase in number of total tillers hill<sup>-1</sup>.

**Table 4. Effect of variety on number of total tillers hill<sup>-1</sup> of boro rice in the haor areas**

Variety	Number of total tillers hill <sup>-1</sup>					
	Days after transplanting (DAT)					
	15	30	45	60	75	At harvest
BRR1 dhan29	3.02	6.99	14.64	19.13	21.83	12.12
BRR1 dhan58	2.98	6.88	14.20	18.28	21.16	14.20
LS	NS	NS	NS	*	*	**
LSD	-	-	-	0.35	0.28	0.18

LS = Level of significance; NS= Non-significance; \*\* = Significant at 1% level of probability; \* = Significant at 5% level of provability; LSD= Least Significant Difference

The effect of fertilizer on number of total tillers hill<sup>-1</sup> was significant at 15, 30, 75 DAT and harvest (Table 5). Application of BARC Fertilizer Recommendation Guide based fertilizer (127 kg MoP ha<sup>-1</sup>) was produced the highest number of tillers hill<sup>-1</sup> (14.85) whereas the lowest number of tillers hill<sup>-1</sup> (11.02) was recorded due to fertilizers applied as farmers' practice (82 kg MoP ha<sup>-1</sup>). At harvest total tillers hill<sup>-1</sup> were recorded 13.45, 13.42, 14.85, 13.63 and 12.58 cm for 147, 137, 127, 117 and 107 kg ha<sup>-1</sup>, respectively. Meena et al. (2003) reported the increased number of tillers hill<sup>-1</sup> for K application. Results also supported by De Datta and Mikkelsen (1985).

**Table 5. Effect of MoP fertilizer on number of total tillers hill<sup>-1</sup> of boro rice in the haor areas**

MoP (kg ha <sup>-1</sup> )	Number of total tillers hill <sup>-1</sup>					
	Days after transplanting (DAT)					
	15	30	45	60	75	At harvest
147	3.17	7.23	14.67	19.35	21.90	13.45
137	3.20	7.13	14.27	18.23	20.97	13.42
127	3.77	7.83	14.97	19.20	22.77	14.85
117	2.90	6.70	14.87	18.63	21.17	13.63
107	2.67	6.70	14.13	18.37	21.50	12.58
82	2.30	6.00	13.63	18.47	20.67	11.02
LSD	0.16	0.39	-	-	0.48	0.32
LS	**	**	NS	NS	**	**

LS = Level of significance; NS = Non-significance; \*\* = Significant at 1 % level of probability; LSD= Least Significant Difference

The interaction effect of variety and fertilizer on number of total tillers hill<sup>-1</sup> was significant at harvest (Table 6). BRRI dhan58 produced the highest number of tillers hill<sup>-1</sup> (15.47) with BARC Fertilizer recommendation Guide based fertilizer (127 kg MoP ha<sup>-1</sup>). The number of total tillers hill<sup>-1</sup> recorded were 12.17, 12.03, 14.23, 12.20, 11.63 and 10.43 for 147, 137, 127, 117, 107 and 82 kg ha<sup>-1</sup> MoP fertilizer which produced by BRRI dhan29 and 14.73, 14.80, 15.47, 15.07, 13.53 and 11.60 for 147, 137, 127, 117, 107 and 82 kg ha<sup>-1</sup> MoP fertilizer which produced by BRRI dhan58. Sabir et al. (2003) support these results.

#### Correlation coefficient (r) analysis:

The positive significant correlation was found between grain yield vs plant height (0.90\*\*), total tillers hill<sup>-1</sup> (0.81\*\*), effective tillers hill<sup>-1</sup> (0.79\*), panicle length (0.62\*\*), grains panicle<sup>-1</sup> (0.34\*), 1000-grain weight (0.59\*\*) and straw yield (0.90\*\*). Again the negative significant correlation was found between grain yield vs sterile spikelets panicle<sup>-1</sup> (-0.48) (Table 7).

The positive significant correlation was found between plant height vs effective tillers hill<sup>-1</sup> (0.76\*\*), panicle length (0.58\*\*), grains panicle<sup>-1</sup> (0.36\*), 1000-grain weight (0.62\*\*), grain yield (0.90\*\*) and straw yield (0.84\*\*). Further the negative significant correlation was found between plant height vs sterile spikelets panicle<sup>-1</sup> (-0.51) (Table 7).

The positive significant correlation was found between total tillers hill<sup>-1</sup> vs effective tillers hill<sup>-1</sup> (0.96\*\*), panicle length (0.60\*\*), total spikelets panicle<sup>-1</sup> (0.38\*), grains panicle<sup>-1</sup> (0.46\*\*), 1000-grain weight (0.57\*\*), grain yield (0.81\*\*) and straw yield (0.79\*\*). Moreover the negative significant correlation was found between total tillers hill<sup>-1</sup> vs sterile spikelets panicle<sup>-1</sup> (-0.35) (Table 7).

**Table 6. Interaction effect of variety and MoP fertilizers on different tillers hill<sup>-1</sup> of boro rice in the haor areas**

Interaction [Variety × MoP (kg ha <sup>-1</sup> )]	Number of total tillers hill <sup>-1</sup>						
	Days after transplanting (DAT)						
	15	30	45	60	75	At harvest	
BRRi dhan29	147	3.00	7.07	14.47	19.53	22.00	12.17
	137	3.20	7.27	14.40	18.07	21.87	12.03
	127	3.67	7.87	15.00	20.00	22.87	14.23
	117	3.07	6.87	15.93	19.13	21.47	12.20
	107	2.73	6.80	14.13	18.93	21.93	11.63
	82	2.47	6.07	13.93	19.13	20.87	10.43
BRRi dhan58	147	3.33	7.40	14.87	19.17	21.80	14.73
	137	3.20	7.00	14.13	18.40	20.07	14.80
	127	3.87	7.80	14.93	18.40	22.67	15.47
	117	2.73	6.53	13.80	18.13	20.87	15.07
	107	2.60	6.60	14.13	17.80	21.07	13.53
	82	2.13	5.93	13.33	17.80	20.47	11.60
LS	NS	NS	NS	NS	NS	NS	*
LSD	-	-	-	-	-	-	0.45

LS = Level of significance; NS= Non-significance; \* = Significant at 5 % level of probability;  
LSD= Least Significant Difference

**Table 7. Correlation (r) values between different growth and yield parameters**

Parameter studied	r value	Parameter studied	r value	Parameter studied	r value
Grain yield VS Plant height	0.90**	Plant height VS Effective tillers hill <sup>-1</sup>	0.76**	Total tillers hill <sup>-1</sup> VS Effective tillers hill <sup>-1</sup>	0.96**
Grain yield VS Total tiller hill <sup>-1</sup>	0.81**	Plant height VS Non effective tillers hill <sup>-1</sup>	-0.15 <sup>NS</sup>	Total tillers hill <sup>-1</sup> VS Non effective tillers hill <sup>-1</sup>	-0.03 <sup>NS</sup>
Grain yield VS Effective tillers hill <sup>-1</sup>	0.79**	Plant height VS Panicle length	0.58**	Total tillers hill <sup>-1</sup> VS Panicle length	0.60**
Grain yield VS Non effective tillers hill <sup>-1</sup>	-0.09 <sup>NS</sup>	Plant height VS Total spikelets panicle <sup>-1</sup>	0.15 <sup>NS</sup>	Total tillers hill <sup>-1</sup> VS Total spikelets panicle <sup>-1</sup>	0.38*
Grain yield VS Panicle length	0.62**	Plant height VS Grains panicle <sup>-1</sup>	0.36*	Total tillers hill <sup>-1</sup> VS Grains panicle <sup>-1</sup>	0.46**
Grain yield VS Total spikelets panicle <sup>-1</sup>	0.15 <sup>NS</sup>	Plant height VS Sterile spikelets panicle <sup>-1</sup>	-	Total tillers hill <sup>-1</sup> VS Sterile spikelets panicle <sup>-1</sup>	-0.35*
Grain yield VS Grains panicle <sup>-1</sup>	0.34*	Plant height VS 1000- grain weight	0.62**	Total tillers hill <sup>-1</sup> VS 1000- grain weight	0.57**
Grain yield VS Sterile spikelets panicle <sup>-1</sup>	-0.48**	Plant height VS Grain yield	0.90**	Total tillers hill <sup>-1</sup> VS Grain yield	0.81**
Grain yield VS 1000- grain weight	0.59**	Plant height VS Straw yield	0.84**	Total tillers hill <sup>-1</sup> VS Straw yield	0.79**
Grain yield VS Straw yield	0.90**				

NS= Non Significance; \*\* = Significant at 1 % level of provability; \* = Significant at 5 % level of probability

## Conclusion

The experiment showed that the variety BRRI dhan58 produced higher plant height and number of total tillers hill<sup>-1</sup> than BRRI dhan29 which reflected in the yield. BARC Fertilizer Recommendation Guide based fertilizers gave the best performance among other treatments. On the basis of results it may be concluded that BRRI dhan58 may be suggested with application of 127 kg ha<sup>-1</sup> MoP fertilizer with other fertilizers as per BARC recommendation of the *haor* areas.

## Acknowledgement

The authors express thankful acknowledgement for the financial support rendered by Bangladesh Agricultural Research Council (BARC) under the project of “Yield gap minimization of boro rice in the *haor* areas through agronomic management with special reference to fertilization”.

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