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## RESPONSE OF TRANSPLANTED AMAN RICE VARIETIES TO SPLIT APPLICATION OF POTASSIUM

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### ABSTRACT

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The research was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, to investigate the effect of time of split application of potassium on the yield of three transplanted (T) aman rice varieties. Rice varieties were BRR1 dhan39, BRR1 dhan40 and BRR1 dhan41. Potassium was applied at the rate of 80 kg K ha<sup>-1</sup>. Experimental plot size was 5m<sup>2</sup> (2.5m x2.0 m). Four split application of potassium [K<sub>1</sub>= Control (No K application), K<sub>2</sub>= 40 g K plot<sup>-1</sup> at 15 DAT (days after transplanting), K<sub>3</sub>= 20 g K plot<sup>-1</sup> at 15 DAT+20 g K plot<sup>-1</sup> at 30DAT, K<sub>4</sub>= 10 g K plot<sup>-1</sup> at 15 DAT+ 10 g K plot<sup>-1</sup> at 25DAT+ 10 g K plot<sup>-1</sup> at 30 DAT+ 10 g K plot<sup>-1</sup> at 45 DAT] were considered as treatments. From the experiment it was found that split application of potassium had no significant effect on plant height, length of panicle, thousand grains weight. It was evident that two splits application of potassium i.e., 20 g K plot<sup>-1</sup> at 15 DAT+20 g K plot<sup>-1</sup> at 30 DAT with BRR1 dhan41 gave maximum no. of tiller hill<sup>-1</sup>, effective tiller hill<sup>-1</sup>, grains panicle<sup>-1</sup>, grain yield and straw yield, biological yield and harvest index. But varieties differed among themselves in terms of yield contributing characters and yield, and BRR1 dhan41 performed the best. Therefore, based on the findings of the present study, it may be concluded that for obtaining higher yield BRR1 dhan 41 can be grown following application of potassium at the rate of 80 kg ha<sup>-1</sup> in two equal split at 15 and 30 days after transplanting.

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## INTRODUCTION

Bangladesh is an important rice growing country of the world. The economy of Bangladesh is influenced markedly by rice. It covers 80 percent of the total cropped area (AIS, 2002). Rice is grown 9.94 million hectares of land with a total production of 2.35 ton ha<sup>-1</sup> in Bangladesh (BBS, 2006). Among the three rice crops aus (summer rice), transplant aman (grown in monsoon) and boro (grown in winter), transplant aman rice covers about 56% of the total rice area. It covers the largest area of 5.6 million hectares with a production of 9.3 million tons of rice (BBS, 2004). The average yield of aman rice is 1.64t ha<sup>-1</sup> and HYV transplant aman rice is 3.83 t ha<sup>-1</sup>. The benefits of health of rice include its ability to provide instant energy, regulate and improve bowel movements, stabilize blood sugar levels and slow down the aging process. It's also plays a role in providing Vitamin B1 to the human body. On the other hand, potassium is a major inorganic constituent of plants and its deficiency affects several metabolic processes. A number of physiological disorders are directly related to insufficient uptake of potassium. Potassium helps control or reduces the severity of plant diseases and increase the plant resistance to drought and other stress. It also helps overcome "bronzing disease" caused by iron toxicity and prevents root damages caused by hydrogen sulphide or by organic substances. It performs many functions in plants such as promoting growth and increasing yield, aiding in the translocation of carbohydrates to maintain cell permeability, increases the efficiency of the leaf in manufacturing sugars, strengthening plants tissues and preventing lodging, increasing resistance to pests, promoting root growth in conjunction with adequate supply of phosphates, acts an activator of a number of amino acid-activating enzymes. Singh et al. (2006) conducted an experiment in a silt loam soil to evaluate the effect of potassium and potassium levels on growth yields and seed quality of hybrid rice. They reported that 80 kg K ha<sup>-1</sup>. was found better to obtain higher production and good quality of hybrid rice.

## MATERIALS AND METHODS

The experiment was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh. The experimental site belongs to the agro-ecological zone 'Old Brahmaputra Floodplain', having Non-calcareous dark grey floodplain soil (UNDP and FAO, 1988). The land was medium high land with silt loam texture. The pH value of the soil was 6.5, low in organic matter content. Its general fertility level was also low ( total N is 0.08%, available P is 7.0 mg kg<sup>-1</sup>, exchangeable K is 0.07 me/100 gm soil, available S is 7.5 me kg<sup>-1</sup> ). Potassium was applied in the field at the rate of 80 kg K ha<sup>-1</sup>. Four levels of K [K<sub>1</sub>= Control (No K application), K<sub>2</sub>= 40 g K plot<sup>-1</sup> at 15 DAT (days after transplanting), K<sub>3</sub>= 20 g K plot<sup>-1</sup> at 15 DAT+20 g K plot<sup>-1</sup> at 30DAT, K<sub>4</sub>= 10 g K plot<sup>-1</sup> at 15 DAT+ 10 g K plot<sup>-1</sup> at 25DAT+ 10 g K plot<sup>-1</sup> at 30 DAT+ 10 g K plot<sup>-1</sup> at 45 DAT] were considered as treatments.

The experiment was laid out in a split plot design with 3 replications having unit plot size of 5m<sup>2</sup> (2.5m x2.0 m). Varieties were: BRRI dhan39, BRRI dhan40, BRRI dhan41 accommodated in the main plot and split application of potassium fertilizer (muriate of potash) was placed in the sub plot. Total number of plot was 36. The layout was done on 20 July having 1 m and 75 cm spacing between replications and the unit plots, respectively. Land preparation involved ploughing, harrowing and leveling in the field to make it suitable for crop establishment by a four wheel tractor. Soil was flooded and irrigated once with sufficient water to bring the top soil saturation and create an overlying water layer. The water depth was 5 cm but 10 cm was maintained for about one week after transplanting. From 30 days before head formation and flowering to the start of maturity, soil was frequently covered with water to a depth of 8 or 10 cm. A continual flow of water was maintained. The field was drained completely 30 to 45 days before harvest to ensure that the field would be dry enough for harvest. The source of K was commercially produced Muriate of Potash. Urea, Triple super phosphate, gypsum and zinc sulphate was applied at 120,100, 60 and 10 kg ha<sup>-1</sup> respectively during final land preparation. Thirty days old seedlings were transplanted from a nursery bed to the main field maintaining 3 seedlings hill<sup>-1</sup> with a spacing of 20 cmx15 cm. Necessary intercultural operations such as weeding, irrigation, pest management etc were performed accordingly and whenever

needed to ensure the growth of a successful crop. Ten hills plot<sup>-1</sup> were randomly uprooted before harvesting in order to collect the following data : Total number of tillers hill<sup>-1</sup>, number of effective tillers hill<sup>-1</sup>, panicle length, number of grain panicle<sup>-1</sup>, number of unfilled spikelets panicle<sup>-1</sup>, grain yield, straw yield, biological yield, harvest index ( HI). Data on grain and straw yield were recorded on a plot basis after drying in the sun maintaining 14% moisture, threshing, winnowing and finally converted to grain/straw weight per hectare.

All data were statistically analyzed with the help of MSTAT (Gomez and Gomez, 1984). Analysis of variance (ANOVA) was measured and significant differences between means were calculated by Duncan's multiple range test (DMRT).

## RESULT AND DISCUSSION

### Effect of variety

All yield contributing characters like plant height, total tillers hill<sup>-1</sup>, effective tillers hill<sup>-1</sup>, panicle length, grain panicle<sup>-1</sup>, grain yield, straw yield, biological yield significantly responded to different levels of applied K (Table 1). Among the varieties, BRR1 dhan41 showed superiority to BRR1 dhan39 and BRR1 dhan40 with respect to plant height, total tillers hill<sup>-1</sup>, effective tillers hill<sup>-1</sup>, panicle length, grain panicle<sup>-1</sup>, grain yield, straw yield, biological yield (Table 1). On the other hand, BRR1 dhan39 produced more no. of non- effective tillers hill<sup>-1</sup>, unfilled spikelets panicle<sup>-1</sup> and weight of 1000 grains than BRR1 dhan41. Production of taller plant, higher number of tillers hill<sup>-1</sup> favoured BRR1 dhan41 to produce significantly higher straw yield, biological yield than BRR1 dhan39. Though weight of 1000 grains is higher in BRR1 dhan39 than BRR1 dhan 41 but grain panicle<sup>-1</sup> is more in BRR1 dhan41 than BRR1 dhan 39 which favoured to produce significantly higher grain yield. BRR1 dhan40 gives moderate production in plant height, total tillers hill<sup>-1</sup>, effective tillers hill<sup>-1</sup>, panicle length, grain panicle<sup>-1</sup>, unfilled spikelets panicle<sup>-1</sup>, grain yield, straw yield, biological yield.

### Effect of split application of K

Effect of split application of K on effective tillers hill<sup>-1</sup>, non- effective tillers hill<sup>-1</sup>, panicle length, grain panicle<sup>-1</sup>, unfilled spikelets panicle<sup>-1</sup>, 1000 grains weight of grain yield, straw yield, biological yield is shown in Table 2. Potassium has a pronounced effect on three T.aman rice varieties i.e., BRR1 dhan39, BRR1 dhan40, BRR1 dhan41 in producing maximum number of tillers hill<sup>-1</sup>, grain panicle<sup>-1</sup>, grain yield, straw yield, biological yield. Two split of potassium gives maximum number of tillers hill<sup>-1</sup>, effective tillers hill<sup>-1</sup>, grain panicle<sup>-1</sup>, grain yield, straw yield, biological yield and minimum of number of non- effective tillers hill<sup>-1</sup>, unfilled spikelets panicle<sup>-1</sup>. On the other hand, at the basal dose, maximum number of unfilled spikelets panicle<sup>-1</sup> was found. Four splits application of potassium i.e., 10 g K plot<sup>-1</sup> at 15 DAT+ 10 g K plot<sup>-1</sup> at 25DAT+ 10 g K plot<sup>-1</sup> at 30 DAT+ 10 g K plot<sup>-1</sup> at 45 DAT showed better performance than basal dose in case of total tillers hill<sup>-1</sup>, effective tillers hill<sup>-1</sup>, grain panicle<sup>-1</sup>, grain yield, straw yield and biological yield. More non- effective tillers hill<sup>-1</sup> was found in four split application of potassium than basal. Maximum number of non- effective tillers hill<sup>-1</sup> was found in one split application of potassium i.e. when 40 gm K was applied in the experimental plot. Fallah (1997) in his experiment with rice crop applied 250 kg K ha<sup>-1</sup> at 5 different dates. He reported that grain yield was increased by K application and was highest when K applied in two equal splits (50% as basal application + 50% forty-five days after transplanting). Meena et al. (2003) conducted a field experiment at the Indian Agricultural Research Institute, Delhi to study the productivity and economics of *Oryza sativa* L. as influenced by K application. The experiment was laid out in split plot design with two levels of potassium, viz. 62.5 and 125 Kg K ha<sup>-1</sup>. Significantly higher number of tiller, dry matter accumulation, grain and straw yields were recorded with the application of 62.5 Kg K ha<sup>-1</sup> applied in two equal splits (half at transplanting and half at maximum tillering).

**Table1.** Effect of variety on yield and yield contributing characters of *T. aman* rice

Variety	Plant height (cm)	Total tiller hill <sup>-1</sup>	Effective tillers hill <sup>-1</sup> (No.)	Non-effective tillers hill <sup>-1</sup> (No.)	Length of panicle (cm)	Grains panicle <sup>-1</sup> (No.)	Unfilled spikelets panicle <sup>-1</sup> (No.)	1000-grain wt(g)	Grain yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )	Biological yield (t ha <sup>-1</sup> )	Harvest index (%)
BRRi dhan 39 (V1)	83.93c	11.60c	7.81c	3.79a	23.87b	107.56c	25.79a	24.88	2.75c	3.84c	6.59c	41.60b
BRRi dhan 40 (V2)	106.85b	12.39b	8.48b	3.91a	23.79b	144.57b	16.44b	24.93	4.23b	5.38b	9.61b	43.96a
BRRi dhan 41 (V3)	126.87a	13.19a	11.12a	2.07b	25.41a	165.77a	14.93c	24.71	4.56a	5.90a	10.46a	43.35a
$\bar{S}\bar{X}$	4.90	0.12	0.12	0.11	0.17	0.84	0.40	0.21	0.03	0.05	0.06	0.35
Level of significance	0.01	0.01	0.01	0.01	0.05	0.01	0.01	NS	0.01	0.01	0.01	0.05

NS: Not significant; In a column, figures with same letter(s) or without letters do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.

**Table 2.** Effect of time of split application of K on yield and yield contributing characters of *T. aman* rice

Time of split application of K	Plant height (cm)	Total tiller hill <sup>-1</sup>	Effective tillers hill <sup>-1</sup> (No.)	Non-effective tillers hill <sup>-1</sup> (No.)	Length of panicle (cm)	Grains panicle <sup>-1</sup> (No.)	Unfilled spikelets panicle <sup>-1</sup> (No.)	1000-grain wt(g)	Grain yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )	Biological yield (t ha <sup>-1</sup> )	Harvest index (%)
Control (K1)	109.51	9.26c	6.42d	2.84c	24.42	121.78d	21.78a	24.62	2.98d	4.31d	7.29d	40.84d
40 g K plot <sup>-1</sup> at 15 DAT (K2)	108.58	13.04b	8.98c	4.06a	24.54	143.53b	19.08b	24.62	3.79c	5.08c	8.86c	42.44c
20 g K plot <sup>-1</sup> at 15 DAT+20 g K plot <sup>-1</sup> at 30 DAT (K3)	109.03	13.87a	11.18a	2.69c	24.33	152.64a	15.50c	24.96	4.49a	5.48a	9.96a	44.98a
10 g K plot <sup>-1</sup> at 15 DAT+ 10 g K plot <sup>-1</sup> at 25DAT+ 10 g K plot <sup>-1</sup> at 30 DAT+ 10 g K plot <sup>-1</sup> at 45 DAT (K4)	96.42	13.39b	9.95b	3.43b	24.16	139.24c	19.86b	25.15	4.14b	5.29b	9.44b	43.63b
S $\bar{X}$	5.65	0.13	0.14	0.13	0.19	0.97	0.46	0.24	0.04	0.06	0.07	0.40
Level of significance	NS	0.01	0.01	0.01	NS	0.01	0.01	NS	0.01	0.01	0.01	0.01

NS: Not significant; In a column, figures with same letter(s) or without letters do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.

**Table 3.** Effect of interaction of variety and time of split application of K on yield and yield contributing characters of *T. aman* rice

Interaction V × K	Plant height (cm)	Total tiller hill <sup>-1</sup>	Effective tillers hill <sup>-1</sup> (No.)	Non-effective tillers hill <sup>-1</sup> (No.)	Length of panicle (cm)	Grains/ panicle <sup>-1</sup> (No.)	Unfilled spikelets panicle <sup>-1</sup> (No.)	1000- grain wt(g)	Grain yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )	Biological yield (t ha <sup>-1</sup> )	Harvest index (%)
V1K1	83.98	8.30f	5.66g	2.64cde	24.44	80.84k	29.16a	24.82	2.11h	3.19g	5.30h	39.84
V1K2	84.23	12.27d	7.52e	4.75a	24.24	116.19i	27.35ab	24.63	2.61g	3.81f	6.42g	40.62
V1K3	84.97	13.81c	10.79b	3.02bcd	23.60	122.28h	20.89c	25.31	3.27e		7.33f	
V1K4	82.55	12.00d	7.25e	4.75a	23.20	110.93j	25.77b	24.76	3.02f	4.29de	7.31f	41.29
V2K1	115.80	10.73e	7.10ef	3.63b	23.08	123.14h	18.50cd	24.50	3.42e	4.49d	7.91e	43.28
V2K2	116.52	13.58c	8.40d	5.18a	23.86	145.92g	15.05e	24.80	4.12d	5.46c	9.58c	43.04
V2K3	116.51	13.12c	9.54c	3.59b	24.03	157.30d	13.13e	24.87	5.02a	6.09ab	11.11a	45.18
V2K4	78.59	12.12d	8.89cd	3.23bc	24.20	151.93f	19.10cd	25.54	4.37c	5.48c	9.85c	44.35
V3K1	128.75	8.75f	6.52f	2.23e	25.73	161.35c	17.67d	24.55	3.41e	5.24c	8.65d	39.41
V3K2	125.00	13.26c	11.03b	2.23e	25.51	168.50b	14.85e	24.42	4.62b	5.97b	10.59b	43.66
V3K3	125.61	14.68b	13.21a	1.47f	25.36	178.36a	12.48e	24.69	5.16a	6.29a	11.45a	45.10
V3K4	128.12	16.05a	13.72a	2.33de	25.07	154.87e	14.72e	25.16	5.05a	6.11ab	11.15a	45.26
<b>S<math>\bar{X}</math></b>	9.79	0.23	0.24	0.23	0.33	1.68	0.79	0.42	0.07	0.10	0.11	0.70
<b>CV (%)</b>	4.41	6.14	5.14	22.84	4.14	5.65	3.57	10.01	5.77	7.47	5.67	4.53
Significance	NS	0.05	0.01	0.01	NS	0.05	0.01	NS	0.01	0.01	0.05	0.01

NS: Not Significant; In a column figures with same letter(s) or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.

V1K1=BRRRI dhan 39×no K application, V2K3=BRRRI dhan 40×two split application of K, V1K2=BRRRI dhan 39 × one split application of K, V2K4=BRRRI dhan 40×four split application of K, V1K3=BRRRI dhan 39×two split application of K, V3K1=BRRRI dhan 41×no K application, V1K4=BRRRI dhan 39×four split application of K, V3K2=BRRRI dhan 41×one split application of K, V2K1=BRRRI dhan 40×no K application, V3K3=BRRRI dhan 41×two split application of K, V2K2=BRRRI dhan 40 × one split application of K, V3K4=BRRRI dhan 41× four split application of K.

## Interaction Effect of Variety and K split application

### Total Tiller Hill<sup>-1</sup>

The variety BRR1 dhan41 with four splits application of K gives the highest number of total tillers hill<sup>-1</sup>. The lowest number tillers hill<sup>-1</sup> was found in variety BRR1 dhan41 with basal application of K which is statistically similar to variety BRR1 dhan39 with basal application of K.

### Number of Effective Tillers Hill<sup>-1</sup>

Table 3 shows that the highest number of effective tillers hill<sup>-1</sup> was counted in the combination of variety BRR1 dhan41 with two splits application of K which is statistically similar to the combination of variety BRR1 dhan41 with four splits application of K. Lowest number of tillers hill<sup>-1</sup> was found in BRR1 dhan39 with basal application of K.

### Number of non-effective tillers hill<sup>-1</sup>

The trend of interaction effect between variety and split application of potassium was found to have adverse effect in BRR1 dhan40 on the production of non-effective tillers hill<sup>-1</sup> with one split application which is statistically similar to BRR1 dhan39 with four split application of K. Less number non-effective tillers hill<sup>-1</sup> was found BRR1 dhan41 with two split application of K which might have caused greater production.

### Grain Panicle<sup>-1</sup>

The combination of variety BRR1 dhan41 with two splits application of K produced higher number of grains panicle<sup>-1</sup> and variety BRR1 dhan39 with basal application of K shows the lower number of grain panicle<sup>-1</sup>.

### Unfilled spikelets panicle<sup>-1</sup>

The maximum number of unfilled spikelets panicle<sup>-1</sup> was observed in BRR1 dhan39 with no K application which is statistically similar to BRR1 dhan39 with one split application. The lowest number of unfilled spikelets panicle<sup>-1</sup> was found in BRR1 dhan40 with one split application of K which is statistically similar to BRR1 dhan 40 with two split, BRR1 dhan 41 with one split, two split and four split application of K.

### Grain yield

The highest number of grain yield was found in the interaction between variety BRR1 dhan41 with two splits application of K which is statistically similar to the interaction between variety BRR1 dhan41 with four splits application of K and variety BRR1 dhan40 with two splits application of K. Lowest number of grain yield found in BRR1 dhan39 with basal dose.

### Straw yield

The highest number of straw yield was found in the interaction between variety BRR1 dhan41 with two splits application of K which is statistically similar to the interaction between variety BRR1 dhan41 with four splits application of K and variety BRR1 dhan40 with two splits application of K. In every variety, straw yield increased gradually in one split then two split application of potassium, In case of four split application of potassium, except BRR1 dhan39 other two varieties showed less number of straw yield.

### Biological yield

The maximum Biological yield was obtained from BRR1 dhan40 with two split application of potassium which is identical with BRR1 dhan41 with two split application of potassium and four split of Potassium. There is a great difference in biological yield of BRR1 dhan40 and BRR1 dhan41 in compared to BRR1 dhan39 in case of two split application of potassium.

## CONCLUSION

Based on the findings of the present study, it may be concluded that for obtaining higher yield BRR1 dhan 41 can be grown following application of potassium at the rate of 80 kg ha<sup>-1</sup> in two equal split at 15 and 30 days after transplanting.

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