J. Environ. Sci. & Natural Resources, 6(2):101-108 , 2013 ISSN 1999-7361

Growth Parameters of Transplant *Aman* Rice (cv. BRRI dhan 52) as Influenced by Age of Tiller Seedlings, Number of Tiller Seedlings Hill^{-1} and Level of USG

K. S. Rahman, S. K. Paul, M. A. R. Sarkar and M. S. Islam

Department of Agronomy, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Abstract: The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, Bangladesh to investigate the effect of age of tiller seedlings, number of tiller seedlings hill^{-1} and application of urea super granules (USG) on the growth parameters of transplant *aman* rice cv. BRRI dhan52. The experiment comprised two ages of tiller seedlings viz. 25 and 35 days old, three levels of tiller seedling hill^{-1} viz.1, 3 and 5 seedlings hill^{-1} and three USG levels viz. 0, 1.8 and 2.7g USG. The experiment was laid out in a Randomized Complete Block Design with three replications. The highest and lowest plant height was found by transplanting 25-day and 35-day old tiller seedlings at all dates of observations. By transplanting 35-day old tiller seedlings total dry matter hill^{-1} was found highest at 15DAT and 45 DAT. Total dry matter hill^{-1} was the highest in 5 tiller seedlings hill^{-1} and it was in lowest in 1 tiller seedling hill^{-1}. Plant height was the highest in 5 tiller seedlings hill^{-1} which was as good as that of 3 tiller seedlings hill^{-1} and the lowest one was found in 1 tiller seedling hill^{-1} at 15 DAT. The tallest plant and highest total dry matter hill^{-1} were observed in 1.8g USG and the lowest one was observed in control treatment. Transplant *Aman* rice can be grown by transplanting 25-day old tiller seedling, 5 tiller seedlings hill^{-1} and by applying 1.8g USG for the highest plant height, more tiller and total dry matter production hill^{-1}.

Key words: Growth, Transplant *Aman* rice, Tiller seedling, USG

Introduction

Bangladesh is a flood prone country. Devastating flood very often washes away transplant *Aman* rice in Bangladesh. Farmers cannot re-transplant the affected land in the early and mid-September due to unavailability of seedlings. If available, seedlings are either too young or too old to produce a good crop. Thus limitation of seedlings is a great problem in this situation. Re-transplantation of separated tillers from an unaffected *Aman* crop may be used as seedlings to rehabilitate the damaged rice. Double transplanting practices has also been suggested for transplant *Aman* areas where transplanting is delayed due to flood water inundation (Alim *et al.* 1962). Rice has unique ability to tiller profusely as each leaf axils has the potential to produce a tiller. In rice, many of the late tillers do not produce due to higher population. This technique of transplanting of separated tillers may be a promising alternative for growing a post flood transplant *aman* crop (Sarkar *et al.,* 2011; Mridha *et al.,* 1991; Siddique *et al.,* 1991). Biswas and Salokhe (2001) suggested that in some flood-prone lowlands, where the transplanted crop is damaged by natural hazard, vegetative propagation using tiller separated (4 tillers hill^{-1}) from the previously established transplanted crop gave higher yield than nursery seedlings transplanted on the same date. Paul *et al.* (2002) reported that tillers can be separated at 25 or 35 days after transplanting (DAT) without hampering grain yield. In flood-prone areas, where seedlings become unavailable for transplanting due to early or late floods, transplanting 25-days old tiller seedlings with 2 tiller seedlings hill^{-1} improved yield of transplant *Aman* rice (Sarkar *et al.,* 2011). Removal of some tillers from the mother hill may help better development of the remaining tillers. Separated tillers can be used as tiller seedlings to replant especially in post flood situation.

Materials and Methods

The experiment was conducted at the Agronomy field laboratory, Bangladesh Agricultural University, Mymensingh, during the period from July to December 2012 to study the influence of age of tiller seedlings, number of tiller seedlings hill^{-1} and urea super granules (USG) on growth of transplant *aman* rice. The experimental sites belongs to the Sonatola Soil Series of Old Brahmaputra Floodplain (AEZ 9) having non calcareous dark grey floodplain soil. The land was medium high with sandy loam texture having pH 5.9. BRRI dhan52, a high yielding modern rice variety of transplant *Aman* rice, developed by the Bangladesh Rice Research Institute, has been used as the test crop. The experiment comprised two ages of tiller seedlings viz. 25 and 35 days old, three levels of tiller seedling hill^{-1} viz.1, 3 and 5 seedlings hill^{-1} and three USG levels viz. 0, 1.8 and 2.7g USG. The experiment was laid out in a Randomized Complete Block Design with three replications. Each block was divided into 18 unit plots where 18 treatment combinations were allocated at random. The distance between the unit plots and block were 0.5m and 1m respectively. There were 54 unit plots in the experiment. The size of unit plot was 4m × 2.5m. The experimental plots were fertilized with triple super phosphate (TSP), muriate of potash (MoP), gypsum and zinc sulphate @ 100, 70, 60, 10 kg ha^{-1}. The entire amounts of triple super phosphate (TSP), muriate of potash (MoP), and gypsum and zinc sulphate were applied at final land preparation. Nitrogen was applied according to experimental specification in the form of urea super granules (USG) at 10 days after transplanting 4 hill^{-1} in every alternate row. Four hills were randomly selected and marked with the bamboo sticks in each unit plot excluding border rows to record the data on plant height and tiller number. Plant height, tiller number, total dry matter were recorded four times at 15, 30, 45, 55 and 75 days after transplanting (DAT). For total dry matter determination, four hills were randomly selected in each plot excluding border rows. The plant samples were packed in labeled brown paper bags and dried in the oven at 80±5°C for 72 hours until constant weight was reached. Recorded data were analyzed statistically using "Analysis of Variance Technique and the differences among treatment means were adjudged by Duncan's Multiple Range Test (DMRT).

Results and Discussion

Plant height

Plant height was significantly affected by age of tiller seedlings during at 15, 30, 45, 60 and 75 days after transplanting (DAT). The highest plant height was obtained at all sampling dates when 25-day old tiller seedling was transplanted compared to transplanting older seedling (35-days old). Similar results were obtained by Hossain *et al.* (2011). This reduction in plant height was mainly due to the availability of short vegetative growth period for 35-day old tiller seedlings in comparison with 25-day old tiller seedling. Separation of tiller at 35 DAT resulted in reduced plant height where tiller separation at 25 DAT produced taller plants. Molla *et al.* (1992) reported that late tiller separation reduced plant height significantly to early tiller separation (Figure 1). Plant height was significantly affected by number of tiller seedlings hill^{-1} within the period of 15, 45 and 60 DAT. The highest plant height was obtained at 60 DAT when 1 tiller seedling were transplanted hill^{-1} and the lowest plant height was found during at 45 DAT when 5 tiller seedlings were transplanted hill^{-1}(Table 1). Plant height was significantly affected by USG application at 15, 30, 45 and 75 DAT. At all sampling dates the highest plant height was found when 1.8 g USG was applied and the lowest plant height was found when USG was not applied (Table 1).

Plant height was significantly influenced by the interaction between the age of tiller seedlings and number of tiller seedlings hill$^{-1,}$ age of tiller seedlings and USG application number of tiller seedlings hill^{-1} and USG application, age of tiller seedlings, number of tiller seedlings hill^{-1} and USG application at various dates of sampling. At 15 DAT the highest plant height was found in 35-day old tiller seedlings by transplanting 3 tiller seedlings hill^{-1} and the lowest plant height was found in 25-day old tiller seedlings by transplanting 1 tiller seedling hill^{-1}. At 45 DAT the highest plant height was found in 35-day old tiller seedlings by transplanting 5 tiller seedlings hill^{-1} and the lowest plant height was found in 25-day old tiller seedlings by transplanting 1 tiller seedlings hill^{-1}. At 60 DAT the highest Plant height was found in 35-day old tiller seedlings by transplanting 3 tiller seedlings hill^{-1} and the lowest plant height was found in 25-day old tiller seedlings by transplanting 3 tiller seedlings hill^{-1} (Table 2). The highest plant height was found in 25-day old tiller seedlings when 1.8 g USG was applied and the lowest plant height was found in 25-day old tiller seedlings when USG was not applied (Table 3). At 45 DAT significantly influenced on plant height. The highest plant height was found by transplanting 5 tiller seedlings hill^{-1} when 1.8 g USG was applied and the lowest plant height was found by transplanting 1 tiller seedling hill^{-1} when USG was not applied. At 60 DAT the highest plant height was found by transplanting 1 tiller seedling hill^{-1} when 1.8 g USG was applied and the lowest plant height was found by transplanting 3 tiller seedlings hill^{-1} when 2.7 g USG was applied. At 75 DAT the highest plant height was found by transplanting 3 tiller seedlings hill^{-1} when 1.8 g USG was applied and the lowest plant height was found by transplanting 1 tiller seedling hill^{-1} when USG was not applied (Table 4). At 15 DAT the highest plant height was found in 35-day old tiller seedling by transplanting 5 tiller seedlings hill^{-1} with the application of 1.8 g USG and the lowest plant height was found in 25-day old tiller seedlings by transplanting 3 tiller seedlings hill^{-1} without application of USG. At 45 DAT the highest plant height was found in 35-day old tiller seedling by transplanting 5 tiller seedlings hill^{-1} with the application of 1.8 g USG and the lowest plant height was found in 25-day old tiller seedlings by transplanting 1 tiller seedling hill^{-1} without application of USG (Table 5).

J. Environ. Sci. & Natural Resources, 6(2): 101-108, 2013 ISSN 1999-7361

Table 1. Effect of age of tiller seedlings, number of tiller seedlings hill^{-1} and USG application on plant height, number of tiller hill^{-1} and total dry matter hill^{-1}

	Plant height (cm)					Number of tiller hill^{-1}					Total dry matter hill^{-1} (g)				
	Days after transplanting					Days after transplanting					Days after transplanting				
	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75
Age of tiller seedling															
A_1	54.64a	67.95a	78.27a	79.06a	107.31a	4.84	6.70	8.43	10.65	12.97	0.91b	2.29	3.24b	6.62	10.26a
A_2	50.42b	65.90b	74.81b	77.78b	106.09b	4.65	6.51	8.22	10.47	12.79	1.09a	2.34	3.34a	6.49	9.70b
No. of tiller seedlings hill^{-1}															
T_1	50.10b	66.73	74.91b	80.14a	106.39	4.61	6.40	8.71	10.46	12.91	0.92	2.06c	3.03c	6.36c	9.35c
T_2	53.23a	65.86	78.96a	76.71c	106.62	4.55	6.35	8.66	10.41	12.86	0.96	2.35b	3.33b	6.40b	9.75b
T_3	54.26a	68.19	75.77b	78.41b	107.10	4.66	6.46	8.77	10.52	12.97	1.13	2.54a	3.52a	6.90a	10.85a
USG application															
N_0	51.86b	65.54b	73.32c	77.96	104.69c	4.50	6.45	8.73	10.42	12.87	1.07	2.40	3.37	6.23c	9.02c
N_1	54.58a	68.87a	79.67a	79.19	108.29a	4.66	6.40	8.68	10.37	12.82	1.04	2.33	3.31	6.88a	10.75a
N_2	51.15b	66.37b	76.65b	78.10	107.13b	4.66	6.51	8.79	10.48	12.93	0.89	2.23	3.19	6.55b	10.18b

Figures in column under each factor of treatment having the same letter or without letter do not differ significantly whereas figures with dissimilar letter(s) differ significantly as per DMRT, A_1= 25-day old tiller seedlings, A_2= 35-day old tiller seedlings, T_1= 1 tiller seedlings hill^{-1}, T_2= 3 tiller seedlings hill^{-1}, T_3= 5 tiller seedlings hill^{-1}, N_0= control, N_1= 1.8g USG, N_2= 2.7g USG.

Table 2. Interaction effect of age of tiller seedlings and number of tiller seedlings hill^{-1} on plant height, number of tiller hill^{-1} and total dry matter hill^{-1}

Age of tiller seedlings (days)	No. of tiller seed lings hill^{-1}	Plant height (cm)					Number of tillers					Total dry matter hill^{-1} (g)				
		Days after transplanting					Days after transplanting					Days after transplanting				
		15	**30**	**45**	**60**	**75**	**15**	**30**	**45**	**60**	**75**	**15**	**30**	**45**	**60**	**75**
A_1	T_1	50.20b	65.72	73.31c	76.36b	105.36	4.78ab	6.78ab	8.67ab	10.44ab	12.67	0.85b	2.15	3.03	6.51	9.83
	T_2	50.79b	65.57	75.17bc	77.06b	106.30	4.00b	6.00b	7.44d	9.33c	11.89	0.89b	2.15	3.12	6.46	10.19
	T_3	50.25b	66.40	75.96b	78.67b	106.61	4.44ab	6.44ab	8.11bcd	9.89abc	12.89	0.99b	2.58	3.58	6.89	10.78
A_2	T_1	50.00b	67.73	76.50b	78.13b	107.41	4.00b	6.00b	7.78cd	9.78bc	12.78	0.85b	1.98	3.02	6.20	8.88
	T_2	55.67a	66.14	76.37b	82.15a	106.94	5.00a	7.00a	9.00a	10.67a	13.00	1.03b	2.55	3.55	6.35	9.32
	T_3	58.27a	69.98	81.96a	78.14b	107.59	4.56ab	6.56ab	8.56abc	10.33ab	13.11	1.40a	2.50	3.46	6.92	10.92
CV (%)		5.44	5.72	3.12	3.63	3.62	12.19	12.56	9.66	7.98	6.46	9.69	16.96	11.72	9.7	8.12
Level of significance		**	NS	*	*	NS	**	**	**	**	NS	**	NS	NS	NS	NS

Figures in column under each factor of treatment having the same letter or without letter do not differ significantly whereas figures with dissimilar letter(s) differ significantly as per DMRT, ** = Significant at 1% level of probability, * = Significant at 5% level of probability, NS = Not significant, A_1= 25-day old tiller seedlings, A_2= 35-day old tiller seedlings, T_1= 1 tiller seedlings hill^{-1}, T_2= 3 tiller seedlings hill^{-1}, T_3= 5 tiller seedlings hill^{-1}.

Table 3. Interaction effect of age of tiller seedlings and USG application on plant height, number of tiller hill^{-1} and total dry matter hill^{-1}

No. of tiller seedlings hill^{-1}	USG application	Plant height (cm)					Number of tillers					Total dry matter hill^{-1} (g)				
		Days after transplanting					Days after transplanting					Days after transplanting				
		15	**30**	**45**	**60**	**75**	**15**	**30**	**45**	**60**	**75**	**15**	**30**	**45**	**60**	**75**
A_1	N_0	49.55	63.07c	69.79d	78.14	103.81c	3.44d	5.44d	6.56d	7.89d	9.67d	1.05	2.37	3.33	6.13b	9.09b
	N_1	53.08	69.89a	80.29a	80.13	108.96a	5.44a	7.44a	9.33a	11.67a	14.67a	0.95	2.38	3.36	6.70ab	10.48a
	N_2	48.62	64.73bc	74.37c	78.90	105.50b	4.33bc	6.33bc	8.33bc	10.11b	13.11b	0.74	2.13	3.04	7.03a	11.28a
A_2	N_0	54.18	68.00ab	76.84b	77.79	105.58b	4.56bc	6.56bc	7.78c	9.22c	11.67c	1.10	2.42	3.42	6.32b	9.02b
	N_1	56.08	67.86ab	79.04ab	78.24	107.61a	4.00cd	6.00cd	8.78ab	10.78b	13.78b	1.13	2.28	3.26	7.07a	11.01a
	N_2	53.67	68.00ab	78.93ab	77.30	108.76a	5.00ab	7.00ab	8.78ab	10.78b	13.44b	1.05	2.33	3.35	6.08b	9.03b
CV (%)		5.44	5.72	3.12	3.63	3.62	12.19	12.56	9.66	7.98	6.46	9.69	16.96	11.72	9.7	8.12
Level of significance		NS	**	**	NS	**	**	**	**	**	**	NS	NS	NS	**	**

Figures in column under each factor of treatment having the same letter or without letter do not differ significantly whereas figures with dissimilar letter(s) differ significantly as per DMRT, * = Significant at 5% level of probability, NS = Not significant, A_1= 25-day old tiller seedlings, A_2= 35-day old tiller seedlings, N_0= control, N_1= 1.8g USG, N_2= 2.7g USG

Table 4. Interaction effect of age of tiller seedlings and number of tiller seedlings hill^{-1} on plant height, number of tiller hill^{-1}and total dry matter hill^{-1}

Number of tiller seedlings hill^{-1}	USG application	Plant height (cm)					Number of tillers					Total dry matter hill^{-1} (g)				
		Days after transplanting					Days after transplanting					Days after transplanting				
		15	**30**	**45**	**60**	**75**	**15**	**30**	**45**	**60**	**75**	**15**	**30**	**45**	**60**	**75**
T_1	N_0	50.46	65.58	71.06d	76.91bc	102.20c	3.67	5.67c	6.83d	8.50	10.33	1.11	2.13	3.07	5.35d	6.95f
	N_1	50.02	68.07	76.55c	81.90a	107.60a	4.83	6.83ab	9.17ab	11.17	14.17	0.87	1.97	2.97	6.62bc	10.52bc
	N_2	49.82	66.53	77.12bc	81.62a	108.20a	4.67	6.67abc	8.67ab	10.67	13.67	0.78	2.09	3.04	6.00cd	9.28de
T_2	N_0	50.97	63.76	71.41d	78.33abc	103.72bc	4.50	6.50abc	7.33cd	8.50	10.33	1.15	2.57	3.59	6.12cd	8.61e
	N_1	57.24	69.28	79.62b	76.35bc	108.76a	4.17	6.17abc	8.50ab	11.00	14.00	0.92	2.41	3.38	7.72a	11.83a
	N_2	51.48	64.53	76.28c	75.43c	108.55a	4.83	6.83ab	8.83ab	10.50	13.00	0.82	2.07	3.03	6.47bc	10.12cd
T_3	N_0	54.17	67.27	77.48bc	78.65abc	108.17a	3.83	5.83bc	7.33cd	8.67	11.33	0.96	2.49	3.46	7.22ab	11.50ab
	N_1	56.48	69.27	82.83a	79.32ab	108.50a	5.17	7.17a	9.50a	11.50	14.50	1.33	2.60	3.58	6.31c	9.88cd
		52.13	68.03	76.55c	77.25bc	104.63b	4.50	6.50abc	8.17bc	10.17	13.17	1.08	2.52	3.52	7.19ab	11.16ab
CV (%)		5.44	5.72	3.12	3.63	3.62	12.19	12.56	9.66	7.98	6.46	9.69	16.96	11.72	9.7	8.12
Level of significance		NS	NS	**	**	**	NS	*	**	NS	NS	NS	NS	NS	**	**

Figures in column under each factor of treatment having the same letter or without letter do not differ significantly whereas figures with dissimilar letter(s) differ significantly as per DMRT, ** = Significant at 1% level of probability, * = Significant at 5% level of probability, NS = Not significant, T_1= 1 tiller seedlings hill^{-1}, T_2= 3 tiller seedlings hill^{-1}, T_3= 5 tiller seedlings hill^{-1}, N_0= control, N_1= 1.8g USG, N_2= 2.7g USG.

Table 5. Interaction effect of age of tiller seedlings, number of tiller seedlings hill^{-1} and USG application on plant height, number of tiller hill^{-1} and total dry matter hill^{-1}

Age of tiller seedlings (days)	Number of tiller seedlings hill^{-1}	USG application	Plant height (cm)					Number of tillers					Total dry matter hill^{-1} (g)				
			Days after transplanting					Days after transplanting					Days after transplanting				
			15	**30**	**45**	**60**	**75**	**15**	**30**	**45**	**60**	**75**	**15**	**30**	**45**	**60**	**75**
A_1	T_1	N_0	49.01fg	61.42	67.11f	77.02	100.66	3.33ef	5.33ef	6.33f	7.67g	8.33f	1.40	2.24	3.11cd	4.79f	6.36g
		N_1	50.89efg	69.47	75.60de	85.13	108.75	6.00a	8.00a	10.67a	12.67a	15.67a	0.85	1.97	2.86d	5.84def	10.71ab
		N_2	50.71fg	66.27	77.23cde	84.31	106.67	5.00a-d	7.00a-d	9.00bc	11.00bc	14.00bc	0.71	2.23	3.13cd	6.87a-d	11.13ab
	T_2	N_0	45.71g	62.52	67.32f	77.40	103.17	3.00f	5.00f	6.33f	7.67g	9.33f	0.84	2.22	3.24a-d	6.09cde	8.94cde
		N_1	57.01a-d	69.33	80.93abc	76.00	109.37	4.67a-e	6.67a-e	7.67c-f	10.67bcd	13.67bcd	1.07	2.30	3.28a-d	6.86a-d	10.33bc
		N_2	49.66fg	64.87	77.27cde	75.67	106.37	4.33b-f	6.33b-f	8.33b-e	9.67c-f	12.67cde	0.77	1.94	2.83d	6.91a-d	11.29ab
	T_3	N_0	53.92b-f	65.27	74.93e	80.00	107.60	4.00c-f	6.00c-f	7.00ef	8.33fg	11.33e	0.90	2.67	3.64abc	7.52ab	11.77ab
		N_1	51.34ef	70.87	84.33ab	79.27	108.77	5.67ab	7.67ab	9.67ab	11.67ab	14.67ab	0.93	2.86	3.94a	6.37bcd	9.13cd
A_2		N_2	45.49g	63.07	68.60f	76.73	103.47	3.67def	5.67def	7.67c-f	9.67c-f	12.67cde	0.73	2.21	3.16bcd	7.32abc	11.43ab
	T_1	N_0	51.91def	69.73	75.00e	76.80	103.73	4.00c-f	6.00c-f	7.33def	9.33def	12.33de	0.82	2.03	3.03cd	5.90def	7.53efg
		N_1	49.15fg	66.67	77.50cde	78.67	108.77	3.67def	5.67def	7.67c-f	9.67c-f	12.67cde	0.89	1.98	3.08cd	7.57ab	11.68ab
		N_2	48.93fg	66.80	77.00cde	78.93	109.73	4.33b-f	6.33b-f	8.33b-e	10.33b-e	13.33bcd	0.85	1.94	2.94cd	5.13ef	7.43fg
	T_2	N_0	56.22b-e	65.00	75.50de	79.27	104.27	3.67def	5.67def	8.33b-e	9.33def	11.33e	1.45	2.92	3.48a-d	6.15cde	8.29def
		N_1	57.48abc	69.23	78.30cde	76.70	105.83	6.00a	8.00a	9.33ab	11.33ab	14.33ab	0.77	2.53	3.94a	7.87a	11.99a
		N_2	53.31c-f	64.20	75.30e	75.20	110.73	5.33abc	7.33abc	9.33ab	11.33ab	13.33bcd	0.87	2.20	3.22a-d	6.04de	8.95cde
	T_3	N_0	54.41b-f	69.27	80.03bcd	77.30	108.73	3.67def	5.67def	7.67c-f	9.00efg	11.33e	1.02	2.32	3.27a-d	6.92a-d	11.24ab
		N_1	61.62a	67.67	84.50a	79.37	108.23	4.67a-e	6.67a-e	9.33ab	11.33ab	14.33ab	1.73	2.33	3.22a-d	6.77a-d	10.63ab
		N_2	58.77ab	73.00	81.33abc	77.77	105.80	5.33abc	7.33abc	8.67bcd	10.67bcd	13.67bcd	1.43	2.84	3.88ab	7.06a-d	10.88ab
CV (%)			5.44	5.72	3.12	3.63	3.62	12.19	12.56	9.66	7.98	6.46	9.69	16.96	11.72	9.7	8.12
Level of significa nce			**	NS	**	NS	NS	*	*	*	*	**	NS	NS	*	*	*

Figures in column under each factor of treatment having the same letter or without letter do not differ significantly whereas figures with dissimilar letter(s) differ significantly as per DMRT, ** = Significant at 1% level of probability, * = Significant at 5% level of probability, NS = Not significant, A_1= 25-day old tiller seedlings, A_2= 35-day old tiller seedlings, T_1= 1 tiller seedlings hill^{-1}, T_2= 3 tiller seedlings hill^{-1}, T_3= 5 tiller seedlings hill^{-1}, N_0= control, N_1= 1.8g USG, N_2= 2.7g USG.

Number of tiller hill^{-1}

Number of tiller hill^{-1} was not significantly affected by age of tiller seedlings hill^{-1}, number of tiller seedlings hill^{-1} and USG application at all date of observations (Table 1). Hasanuzzaman *et al.* (2009) reported that application of granular urea produced remarkable number of tillers due to its higher application rate compared to USG but in this case 3 splits produced significantly more tillers than 2 splits. Rana *et al.* (1989) observed similar results. Hasan (2007) conducted an experiment during the *aman* season of 2006 and recorded the increased number of tillers hill^{-1} with increased nitrogen levels USG. Rama *et al.* (1989) mentioned that the number of panicles m^{-2} increased significantly when nitrogen level increased from 40 to 120 kg N ha^{-1} as USG. Alam (2002) observed that total tillers hill^{-1} and effective tillers hill^{-1} increased significant with the increase of level of USG, when USG was applied as one, two, three and four granules per 4 hills during the *boro* season. Singh and Mahapatra (1989) also observed that number of panicles m^{-2} were significantly higher when USG was applied at 90 kg ha^{-1} as deep placement than split application of urea. Singh and Singh (1986) worked with different levels of nitrogen as USG @ 27.54 and 87 kg ha^{-1}. They reported that number of tillers m^{-2} increased with increasing nitrogen fertilizer. Hasanuzzaman *et al.* (2009) reported that deep placement of USG showed highest number of tillers might be due to little loss of N from soil and slowly releasing process.

Number of tiller hill^{-1} was significantly influenced by the interaction between the age of tiller seedlings and number of tillers seedlings hill^{-1} at 15, 30, 45 and 60 DAT. At 15, 30, 45 and 60 DAT the highest number of tillers hill^{-1} was found in 35-day old tiller seedlings by transplanting 3 tiller seedlings hill^{-1} and the lowest number of tillers hill^{-1} was found in 25-day old tiller seedlings by transplanting 3 tiller seedlings hill^{-1} (Table 2). Number of tillers hill^{-1} was significantly influenced by the interaction between the age of tiller seedlings and USG application within all the dates of observations. At 15, 30, 45, 60, 75 DAT the highest number of tillers hill^{-1} was found in 25-day old tiller seedlings when 1.8 g USG was applied and the lowest number of tillers hill^{-1} was found in 25-day old tiller seedlings when USG was not applied at (Table 3). Number of tillers hill^{-1} was significantly influenced by the interaction between number of tiller seedlings hill^{-1} and application of USG at 30 and 45 DAT. At 30 and 45 DAT the highest number of total tiller hill^{-1} was found by transplanting 5 tiller seedlings hill^{-1} when 1.8 g USG was applied and the lowest number of tiller hill^{-1} was found by transplanting 1 tiller seedlings hill^{-1} when USG was not applied (Table 4). Number of tillers hill^{-1} was significantly influenced by the interaction between age of tiller seedlings, number of tiller seedlings hill^{-1} and USG application at all the dates of observations. At 15 and 30 DAT the highest number of total tiller hill^{-1} was found in 35-day old tiller seedling by transplanting 3 tiller seedlings hill^{-1} with the application of 1.8 g USG and the lowest number of total tiller hill^{-1} was found in 25-day old tiller seedlings by transplanting 3 tiller seedlings hill^{-1} without application of USG. At 45, 60 and 75 the highest number of total tiller hill^{-1} was found in 25-day old tiller seedling by transplanting 1 tiller seedling hill^{-1} with the application of 1.8 g USG and the lowest number of total tiller hill^{-1} was found in 25-day old tiller seedlings by transplanting 1 tiller seedling hill^{-1} without application of USG (Table 5).

Total dry matter production

There was significant effect of age of tiller seedlings on total dry matter production hill^{-1} at 15, 45 and 75 days after transplanting (Table 1). The highest total dry matter production was found when 25-day old tiller seedlings were transplanted while dry matter production was reduced when 35-day old tillers were transplanted (Figure 2). Total dry matter production hill^{-1} was significantly affected by number of tiller seedlings hill^{-1} at 30, 45, 60 and 75 DAT. The highest total dry matter production hill^{-1} was found at all dates when 5 tiller seedlings were transplanted hill^{-1}. The lowest one was found at all dates of observations when 1 tiller seedling was transplanted hill^{-1}. The intermediate total dry matter yield was recorded while 3 tiller seedlings were transplanted. Total dry matter production hill^{-1} was found to increase with increasing the number of tiller seedlings hill^{-1}. This finding was supported by Hossain *et al.* (2011). They obtained the highest total dry matter when 6 tiller seedlings were transplanted hill^{-1} which was as good as 6 tiller seedlings transplanted hill^{-1} and the lower one also recorded with 2 tiller seedlings were transplanted hill^{-1}. Sarkar *et al.* (2002) reported that maximum total dry matter was obtained in intact hill compared to separated hill (Table 1). Total dry matter production hill^{-1} was significantly affected at 60 and 75 DAT due to the effect of USG application. The highest total dry matter production hill^{-1} was found at all dates when 1.8 g USG was applied and the lowest was found at all date of observations when USG was not applied (Table 1). Roy *et al.* (1990) and Mamin *et al.* (1999) reported that straw yield always significantly higher in intact mother hills than splitted treatments which might be due to higher plant height, more tillers unit^{-1} area and undisturbed vegetative growth. Total dry matter production hill^{-1} was significantly influenced by the interaction between the age of tiller seedlings and number of tiller seedlings hill^{-1} at 15 DAT. The highest total dry matter production hill^{-1} was found in 35-day old tiller seedlings by transplanting 5 tiller seedlings hill^{-1} and the lowest total dry matter production hill^{-1} was found in 35-day old tiller seedlings by transplanting 5 tiller seedlings hill^{-1} followed by 35-day old tiller seedling by transplanting 3 seedlings hill^{-1} and 25-day old tiller seedlings by transplanting 1 tiller seedling hill^{-1} (Table 2). Total dry matter production hill^{-1} was significantly influenced by the interaction between the age of tiller seedlings and USG application at 45, 60 and 75 DAT. At 60 and 75 DAT the highest total dry matter production hill^{-1} was found in 35-day old tiller seedlings when 1.8 g USG was applied and the lowest total dry matter production hill^{-1} was found in 35-day old tiller seedlings when 2.7 g USG was applied (Table 3). Total dry matter production hill^{-1} was significantly influenced by the interaction between number of tiller seedlings hill^{-1} and USG application at 60 and 75 DAT. At 60 and 75 DAT the highest total dry matter production hill^{-1} was found by transplanting 3 tiller seedlings hill^{-1} when 1.8 g USG was applied and the lowest total dry matter production hill^{-1} was found by transplanting 1 tiller seedlings hill^{-1} when USG was not applied (Table 4). Total dry matter production hill^{-1} was significantly influenced by the interaction between age of tiller seedlings, number of tiller seedlings hill^{-1} and USG application at 45, 60 and 75. At 45 DAT the highest total dry matter production hill^{-1} was found in 25-day old tiller seedling by transplanting 5 tiller seedlings hill^{-1} with the application of 1.8g USG which is as like as when transplanting 35-day old tiller seedling by transplanting 3 tiller seedlings hill^{-1} with the application of 1.8g USG and the lowest total dry matter production hill^{-1} was found in 25-day old tiller seedlings by transplanting 1 tiller seedling hill^{-1} with the application of 1.8 g USG. At 60 and 75 DAT the highest total dry matter production hill^{-1} was found in 35-day old tiller seedling by transplanting 3 tiller seedlings hill^{-1} with the application of 1.8g USG and the lowest total dry matter production hill^{-1} was found in 25-day old tiller seedlings by transplanting 1 tiller seedling hill^{-1} without application of USG (Table 5).

Conclusion

From the findings of the experiment it can be concluded that tallest plant and total dry matter production hill^{-1} could be obtained in transplant *Aman* rice planted by transplanting 25-day old tiller seedlings with 5 tiller seedlings hill^{-1}. Application of 1.8g urea super granules appeared as the promising practice in respect of tallest plant and total dry matter production hill^{-1}.

References

Akhter, S. 1999. Effect of row-spacing and urea super granule on the yield and yield contributing characters of T. *aman* rice. MS (Ag) Thesis in Agronomy, BAU. Mymensingh. 33p.

Alam, B.M.R. 2002. Effect of urea super granule on the growth and yield of three varieties of *boro* rice. MS (Ag.) Thesis, Dept. Agron., Bangladesh Agril. Univ., Mymensigh.119 p.

Alim, A.; Sen, J. L.; Ullah, M. T. and Chowdhury, M. A. 1962. Review of half a century of rice research in east Pakistan. Govt. of East Pakistan, EPG press Dhaka, pp: 119.

Biswas, P. K. and Salokhe, V. M. 2001. Effects of planting date, intensity of tiller separation and plant density on the yield of transplanted rice. *The journal of Agricultural science*, 137: 279-287.

Hasan, S. M. 2007. Effect of level of urea super granules on the performance of T. *aman* rice. M. Sc. Ag. Thesis in Agronomy, BAU, Mymensingh.

Hasanuzzaman, M.; Nahar,K.; Alam, M. M.; Hossain, M. Z. and Islam, M. R. 2009. Response of transplant *aman* rice to different application methods of urea fertilizer. *International Journal of Agriculture*, 1 (**1**): 01-05

Hossain, M. A.; Sarkar, M. A. R. and Paul, S. K. 2011. Growth analysis of late transplant *aman* rice (cv. BR 23) raised from tiller seedlings. Libyan Aric. *Res. Cen. J. Intl.*, 2 (**6**): 265-273.

Hossain, M. M. and Haque, M. Z. 1990. Seedlings age and density effect on basal tiller survival and yield of transplant deep water rice.[*Cited from Rice Abst.* 13 (**5**): 250.

Mamin, M. S. I.; Alam, M. Z.; Ahmed, A. U.; Rashid, M. A.; and Jameel, F. 1999. Effect of splitting tillers on the yield and yield components of transplanted *Aman* rice. Ann. Bangla. Agric., 9: 1-9.

Mishra, B. K.; Mishra., Das, A. K. and Jena, D. 2000. Effect of time for urea super granule placement of low land rice. Ann. Res. 20:4, 443-447.

Mollah, M. I. U.; Hossain, S. M. A.; Islam, N. and Miah, M. N. I. 1992. Some aspects of tiller separation in transplant *Aman* rice. *Bangla. Agron. J.,* 4: 45-49.

Mridha, M. A.; Nasiruddin J. M. and Siddique, S. B. 1991. Tiller separation on yield and area covered in rice. Proc. of the 16th Ann. BAAS conf. held on 5-7 July 191, Dhaka pp: 67.

Rahman, M. A. 2003. Effect of levels of urea super granules and depth of placement on the growth and yield of transplant *aman*rice. MS (Ag.) Thesis, Dept. Agron., Bangladesh Agril, Univ., Mymensingh. 100 p.

Rana, S.; Reddy, G. and Reddy, K.1989. Effect of levels and sources of nitrogen on rice. Indian J. Agron., 34: 435-436.

Rama, S.; Reddy, G. and Reddy, K. 1989. Effect of levels and sources of nitrogen on rice. Indian J. Agron., 34: 435-436.

Roy, S. K.; Biswas P. K. and Quasem, A.1990. Effects of tiller removal and replanted tillers on the yield of the main and the subsequent rice crops. *Bangla. J. Agric.,* 15: 11-18.

Sarkar, M. A. R.; Paul, S. K. and Hossain, M. A. 2011. Effect of row arrangement, age of tiller seedlings and number of tiller seedlings $hill^{-1}$ on performance of transplant aman rice. *The Journal of Agricultural Science,* 6 (**2**): 59-68.

Sarkar, M. A. R.; Paul, S. K. and Ahmed. M. 2002. Effect of row arrangement and tiller separation on the growth of transplant *Aman* rice. *Pakistan Journal of Biological Sciences,* 5(**4**): 504-506.

Siddique, S. B.; Mazid, M. A.; Mamun, M. A.; Ahmed, K. U.; Jabbar, M. A.; Mridha, A. J.; Ali, M. G.; Chowdhury, A. A.; Roy, B. C.; Hafiz, M. A.; Biswas, J. C. and Islam, M. S. 1991. Cultural practices for modern rice cultivation under low land ecosystems. Proceedings of workshop on experiences with modern rice cultivation in Bangladesh held in 23-25 April, 1991 at BRRI, Gazipur.

Singh, S. P. and Singh, M. P. 1986. Response of dwarf rice cv. Jaya to different rates, methods and forms of urea materials. *Environ. And Ecol*., 15 (**3**): 612-613.

Singh, I. C. and Mahapatra, I. C. 1989. Economics of use. Pert. *Marketing Newsl.,* 5(**12**):1-17.