J. Agrofor. Environ. 2(2): 99-102, 2008 ISSN 1995-6983

Effects of weeding and fertilizer management on transplant *aman* rice *cv*. BRRI dhan 44

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Abstract: An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from August to December 2007 to find out the effect of frequency of weeding and fertilizer management on the yield of transplant aman rice cv. BRRI dhan44. The experiment consisted of four weeding treatments viz. no weeding (W_0), one weeding at 20days after transplanting (DAT) (W_1), two weeding at 20 and 35 DAT (W_2) and three weeding at 20, 35 and 50 DAT (W_3) ; and five fertilizer treatments viz. recommended chemical fertilizer (F_1), cow dung @10 t ha^{-1} (F_2), poultry manure @ 5 t ha^{-1} (F_3), 50% recommended chemical fertilizer + cow dung @ 5 t ha^{-1} (F_4) and 50% recommended chemical fertilizer + poultry manure @ 2.5 t ha^{-1} (F_5). The experiment was laid out in a randomized complete block design with three replications. Weeding and fertilizer had significant effect on plant height, number of effective tillers hill^{-1}, non-effective tillers hill^{-1}, grains panicle^{-1}, grain yield and straw yield. The highest grain yield (4.85 t ha^{-1}) was recorded in three weeding condition and the lowest was obtained from no weeding condition. Among the fertilizer treatments 50% recommended chemical fertilizer + poultry manure @ 2.5 t ha^{-1} produced the highest grain yield (5.01 t ha^{-1}).The combination of two weeding at 20 and 35 DAT with 50% recommended chemical fertilizer + poultry manure @ 2.5 t ha^{-1} produced the highest grain yield (5.8 ha^{-1}).
Key words: Weeding, Fertilizer management, Transplant *aman* rice, Grain yield.

Introduction

Weeds are the major biotic constraints to increased rice production worldwide. The prevailing climatic and edaphic factors are highly favourable for luxuriant growth of numerous species of weeds, which offer a keen competition with rice crop in Bangladesh. Many investigators have reported great losses in the yield of rice due to weed infestation in different parts of the world. Forty one percent yield reductions were observed due to weed infestation (Saha *et al.*, 2005). Weeding has a great influence on weed control and the performance of the associated crop. Thus the best weeding needs to be adopted by the farmers with a view to reducing weed infestation and maximizing rice yield. The highest grain yield was obtained under weed free condition (Mitra *et al*., 2005). Therefore, it is most important to find out the suitable time and the appropriate frequency of weeding. The soil fertility status of Bangladesh soils is gradually declining day by day. Most of the soils of Bangladesh have organic matter less than 1.5% and in many cases it is less than 1% (BARC, 1997). Improper soil management practices and the use of chemical fertilizers with no or very little use of manure, favourable climatic condition for microbial activities throughout the year may be responsible for this. It has already been indicated that the imbalanced use of fertilizer have thrusted tremendous pressure on the soil organic matter and nutrients resulting in the decrease of crop production. In present situation, commercially rice cultivation is not possible without applying fertilizer. In order to improve crop productivity more emphasis should be given on suitable fertilizer management. With these in view an experiment was undertaken to find out the effect of weeding and fertilizer management on the performance of *T. aman* rice cv. BRRI dhan44.

Materials and methods

The research work was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from July to December 2007 with a view to evaluating the effect of weeding and fertilizer management on the yield of transplant *aman* rice. The experiment included four weeding treatments, namely no weeding (W_0) , one weeding at 20 DAT (W_1), two weeding at 20 and 35 DAT(W_2) and three weeding at 20, 35 and 50 DAT (W_3); and five fertilizer treatments, namely recommended chemical fertilizer (217-50-60-33-5 kgha^{-1} of Urea-TSP-MOP-Gypsum-$ZnSO_4$, respectively) (F_1), cow dung @10 t ha^{-1} (F_2), poultry manure @ 5 t ha^{-1} (F_3), 50% recommended chemical fertilizer + cow dung @5 t ha^{-1} (F_4), 50% recommended chemical fertilizer + poultry manure @ 5 t ha^{-1} (F_5).The experimental field was a medium high land belonging to non-calcarious dark grey floodplain soil. The experiment was laid out in randomized complete block design with three replications. The size of unit plot was 4.0 m × 2.5m. The land was well prepared and fertilizers were applied according to the treatments. Except urea all other fertilizers were applied at the time of final land preparation. Urea was top dressed in three equal splits at 15, 35 and 55 days after transplanting (DAT).. Thirty five days old seedlings were transplanted on 7 August 2007. Three seedlings hill^{-1} were transplanted with a spacing of 25cm x 15cm. Five hills (excluding border hills) were randomly selected and tagged and uprooted from each plot prior to harvest for collecting data on different crop characters viz. plant height, number of total tillers hill^{-1}, number of effective tillers hill^{-1}, number of non-effective tillers hill^{-1}, number of sterile spikelets panicle^{-1}, number of grains panicle^{-1}. After sampling the whole plot was harvested on 9 December 2007. Grains were threshed, cleaned, sun dried and the grain yield plot^{-1} was recorded at 14% moisture content. Straw was sun dried to record the straw yield plot^{-1}. Data were analyzed statistically and the mean differences were adjudged by Duncun's Multiple Range Test (DMRT).

Results and Discussion

Effect of weeding

Various characters of transplant *aman* rice were significantly influenced by weeding except 1000-grain yield (Table 1). Results of the experiment showed that

the highest grain yield (4.85 t ha^{-1}) was observed in three weeding at 20, 35 and 50 DAT (W_3). The second highest yield (4.66tha^{-1}) was noted under the treatment of two weeding at 20 and 35 DAT (W_2). The highest number of effective tillers $hill^{-1}$ (8.91) and number of grains $panicle^{-1}$ (136.31) were observed under weeding at 20, 35and 50 DAT (W_3) which resulted in the highest grain yield. Hossain (2000) also reported that in case of three weeding condition crop-weed competition became less which resulted in increased grain yield. The lowest grain yield (3.57 t ha^{-1}) was recorded in no weeding (W_0) treatment, which might be due to lowest number of effective tillers $hill^{-1}$ (3.57), lowest number of grains $panicle^{-1}$ (101.39), more number of non-effective tillers $hill^{-1}$ (4.0), sterile spikelets $panicle^{-1}$ (44.47). The highest straw yield (6.0 t ha^{-1}) was also observed weeding at 20, 35 and 50 DAT (W_3) treatment, which may be due to highest plant height (111.29 cm) and number of total tillers $hill^{-1}$ (11.83). The lowest straw yield (3.57 t ha^{-1}) was also observed in no weeding (W_0) treatment because of shortest plant (102.88 cm) and lower number of total tillers $hill^{-1}$ (7.58). This result agrees with Mitra *et al*. (2005) who observed the lowest straw yield in weedy control condition. Incase of no weeding condition, crop-weed competition might be high for their growth resources and for the antagonistic effect of weed on crop yield was reduced.

Effect of Fertilizer

Fertilizer management practice exerted significant influence on all the crop characters of rice (except 1000-grain weight) including grain yield (Table 2).The experimental data indicate that the significantly highest grain yield (5.01 tha^{-1}) was produced when the crop received 50% recommended chemical fertilizer + poultry manure @ 2.5 tha^{-1} (F_5). Crop receiving 50% recommended chemical fertilizer + poultry manure @ 2.5 tha^{-1} (F_5) produced highest number of effective tillers $hill^{-1}$ (8.3) and number of grains $panicle^{-1}$ (148.58). Straw yield was also highest (5.98 tha^{-1}) when the crop was fertilized with 50% recommended chemical fertilizer + poultry manure @ 2.5 tha^{-1} (F_5) which may be due to longest plant (110.98 cm) and highest number of total tillers $hill^{-1}$ (11.57). Hassan *et al.* (2004), Singha *et al*. (2004), Haq *et al*. (2005) and Sharma *et al.* (2006) also opined that organic nutrient management involving cowdung or FYM or poultry manure and NPKS fertilizer is a must for sustainable rice yield. Yield retarding characters like non effective tillers $hill^{-1}$ (3.27) was highest in 50% recommended chemical fertilizer + poultry manure @ 2.5 tha^{-1} (F_5) treatment which was statistically identical with recommended chemical fertilizer (F_1), poultry manure @ 5 t ha^{-1} (F_3), 50% recommended chemical fertilizer + cow dung @5 t ha^{-1} (F_4). Number of sterile spikelets $panicle^{-1}$ was highest (47.63) in cow dung @10 t ha^{-1} (F_2) treatment for which the grain yield was lowest (3.59 tha^{-1}). Straw yield was lowest in cow dung @10 t ha^{-1} (F_2) treatment due to the shorter plant (105.06 cm) and lowest number of tillers $hill^{-1}$ (8.52). Cowdung contains less amount of nutrient composition i.e. without applying of chemical fertilizer it might not supply sufficient amount of nutrients to the plant which resulted in the lowest yield. Results showed that 50% recommended chemical fertilizer + poultry manure @ 2.5 tha^{-1} (F_5) may be used to obtain the highest yield of transplant *aman* rice cv. BRRI dhan 44

Interaction effect

The interaction of weeding and fertilizer management significantly influenced various characters of transplant *aman* rice except 1000-grain weight (Table 3). The highest plant height (114.1 cm), number of effective tillers $hill^{-1}$ (10.73), number of total spikelets $panicle^{-1}$ (181.37), grain yield (5.9 t ha^{-1}) and straw yield (6.5 t ha^{-1}) were found in the interaction of three weeding at 20, 35 and 50 DAT × 50% recommended chemical fertilizer with poultry manure @ 2.5 t ha^{-1} which were statistically identical with the interaction of two weeding at 20 and 35 DAT × 50% recommended chemical fertilizer and poultry manure @ 2.5 t ha^{-1} . On the other hand, yield reducing characters like non effective tillers $hill^{-1}$ (4.2), number of sterile spikelets $panicle^{-1}$ (56.5) were highest and yield contributing characters like number of effective tillers $hill^{-1}$ (2.8), number of grains $panicle^{-1}$ (70.00) were lowest in the interaction of no weeding × cowdung @ 10 t ha^{-1} which contributed to the lowest grain yield (3.0 t ha^{-1}). The straw yield was lowest (4.91 t ha^{-1}) in the interaction of no weeding × poultry manure @ 5 t ha^{-1}. The study showed grain yield of transplant aman rice cv. BRRI dhan44 was identical under the interaction of two weeding and three weeding with poultry manure @ 2.5 tha^{-1}. Therefore, it is wise to adopt two weeding at 20 and 35 DATs along with 50% of recommended chemical fertilizer + poultry manure @2.5 tha^{-1} for the better performance of transplant aman rice *cv*. BRRI dhan 44.

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Table 1 Effect of weeding on the yield attributes and yield of transplant *aman* rice cv. BRRI dhan44

Weeding	Plant height at maturity (cm)	Total tillers hill^{-1}	Effective tillers hill^{-1}	Non-effective tillers hill^{-1}	Grains panicle^{-1}	Sterile spikelets panicle^{-1}	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
W_0	102.88 b	7.58 d	3.57d	4.0 a	101.39 d	44.47a	3.57d	5.11d
W_1	105.92 b	9.59 c	6.53c	3.06 b	120.91c	40.00b	4.00c	5.40c
W_2	109.49 a	10.25 b	7.8 b	2.43 c	134.56b	37.20c	4.66b	5.63b
W_3	111.29 a	11.83 a	8.91a	2.92 b	136.31a	29.2d	4.85a	6.0a
Level of significance	**	**	**	**	**	**	**	**
S $\overline{X}$	1.156	0.121	0.140	0.0653	0.527	0.213	0.0535	0.068

Table 2 Effect of fertilizer management on the yield attributes and yield of transplant *aman* rice cv. BRRI dhan44

Fertilizer management	Plant height at maturity (cm)	Total illers hill^{-1}	Effective tillers hill^{-1}	Non-effective tillers hill^{-1}	Grains panicle^{-1}	Sterile spikelets panicle^{-1}	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
F_1	108.24ab	10.18b	7.25b	2.93b	125.13b	33.06 d	4.43b	5.66b
F_2	105.06b	8.52e	5.43e	3.09ab	101.45e	47.63a	3.59d	5.29c
F_3	106.57b	9.67c	6.56c	3.11ab	122.75c	36.38c	4.24c	5.36c
F_4	106.14b	9.13d	6.0d	3.13ab	118.56d	32.63b	4.08c	5.39c
F_5	110.98a	11.57a	8.3a	3.27a	148.58a	31.90e	5.01a	5.98a
Level of significance	*	**	**	*	**	**	**	**
S $\overline{X}$	1.293	0.135	0.157	0.073	0.5893	0.238	0.171	0.76

Table 3 Interaction effect of weeding and fertilizer management on yield attributes and yield of transplant *aman* rice cv. BRRI dhan44

Weeding × Fertilizer	Plant height at maturity (cm)	Total tillers hill^{-1}	Effective tillers hill^{-1}	Non-effective tillers hill^{-1}	Grains panicle^{-1}	Sterile spikelets panicle^{-1}	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
$W_0 \times F_1$	103.25b-f	7.90jk	4.00i	3.90a	99.00n	38.25j	3.75hi	5.83b
$W_0 \times F_2$	99.50f	7.00l	2.80j	4.20a	70.00p	56.50a	3.00j	4.92c
$W_0 \times F_3$	102.25c-f	7.50kl	3.73i-j	3.77a	96.83no	44.50c	3.75hi	4.91e
$W_0 \times F_4$	100.97ef	7.00 l	3.00j	4.00a	95.25o	46.50d	3.50i	4.92e
$W_0 \times F_5$	108.43a-e	8.50h-j	4.33i	4.17a	145.88c	36.61g	3.83g-i	5.00e
$W_1 \times F_1$	107.20a-f	10.00 d-f	7.00d-f	3.00bc	119.50ij	37.00fg	4.17e-g	4.92e
$W_1 \times F_2$	101.25d-f	875 g-i	5.50h	3.25b	110.00l	48.00c	3.14j	5.33c-e
$W_1 \times F_3$	106.20a-f	9.50 e-f	6.50fg	3.00bc	116.jk	38.00fg	4.10g0h	5.33de
$W_1 \times F_4$	105.60a-f	9.20 f-h	6.00jh	3.20bc	114.0k	44.00e	4.10g-h	5.50 b-d
$W_1 \times F_5$	109.37a-e	10.50 d	7.67c-e	2.83b-d	144.69cd	33.00i	4.50c-e	5.92b
$W_2 \times F_1$	110.00a-d	10.30 de	8.50c	1.80d	142.00de	32.00i	4.80be	6.00b
$W_2 \times F_2$	110.00a-c	8.33 ji	5.60hg	2.73c-e	105.81m	51.00b	4.00g-h	5.08de
$W_2 \times F_3$	110.47a-c	10.00 d-f	7.50c-e	2.50d-e	140.00ef	35.00h	4.50c-e	5.25de
$W_2 \times F_4$	107.00a-f	9.80 d-f	7.00ef	2.80b-d	135.00g	38.00fg	4.20 e-g	5.83c-e
$W_2 \times F_5$	108.00a-f	12.80 b	10.47a	2.33ef	150.00b	30.00j	5.80a	6.50a
$W_3 \times F_1$	112.00ab	12.50 b	9.50b	3.00bc	140.00ef	25.00l	5.00b	5.90b
$W_3 \times F_2$	112.50a-b	10.00 d-f	7.80c-e	2.20fg	120.00i	35.00h	4.25d-g	5.86b
$W_3 \times F_3$	110.83a-c	11.67c	8.50c	3.17bc	137.80fg	28.00k	4.60cd	5.95b
$W_3 \times F_4$	110.00a-d	10.50d	8.00cd	2.50d-f	130.00h	30.00j	4.50c-e	5.80bc
$W_3 \times F_5$	114.10a	14.47a	10.73a	3.74a	153.73a	28.00k	5.90a	6.50a
Level of significance	*	**	**	**	**	**	**	**
S $\overline{X}$	2.586	0.270	0.314	0.146	1.179	0.447	0.119	0.153

In a column, figures having similar letter do not differ significantly whereas figures with dissimilar letter differ significantly as per DMRT. ** Significant at 1% level of probability, NS: Not significant

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