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EFFECT OF MINERAL NITROGEN ON THE WEED INFESTATION IN HYV TRANSPLANT *AMAN* RICE

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ABSTRACT

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh from July to December 2014 to observe the effect of mineral nitrogen on the weed infestation and yield of transplant *Aman* rice. The experiment comprised three varieties *viz.* BRRI dhan49, BRRI dhan51 and BRRI dhan52 and five levels of nitrogen *viz.* 0, 40, 60, 80, and 100 kg ha^{-1}. The experiment was laid out in a randomized complete block design (RCBD) with three replications. Variety, level of nitrogen and their interaction significantly influenced on weed infestation and yield of transplant *Aman* rice. The lowest weed infestation was found in BRRI dhan52 which was statistically identical with BRRI dhan49. In case of interaction, BRRI dhan52 fertilized with 60 kg N ha^{-1} showed the best performance (3.54 t ha^{-1}) which was as good as BRRI dhan51 (3.50 t ha$^{-1)}$ fertilized with 100 kg N ha^{-1} and BRRI dhan52 (3.49 t ha^{-1}) fertilized with 80 kg N ha^{-1} with respect to grain yield. Therefore, it can be concluded that BRRI dhan52 might be grown with 60 kg N ha^{-1} for higher grain yield.

Key words: Nitrogen, weed infestation, Transplant *aman* rice.

Introduction

Nitrogen (N) is the most essential element in determining the yield potential of rice and nitrogenous fertilizer is one of the major inputs to rice production. Application of nitrogen at booting stage increases yield (Chopra and Chopra, 2004). It is also the constituent of key cell molecules such as amino acids, nuclec acid, chlorophyll, ATP and several plant hormones, but also the pivotal regulator involved in many biological processes including carbon metabolism, amino acid metabolism, amino acid metabolism and protein synthesis (Cai *et al*., 2012). Nitrogen fertilization is the major agronomic practice that effect the yield and quality rice crop, which requires as much as possible at early and mid tillering stages to maximize panicle number and during reproductive stage to produce optimum spikelets panicle^{-1} (Sathiya and Ramesh, 2009). Nitrogen is an essential nutrient of rice production, but excessive N application would lead to increased production cost and negative effects of blocking agricultural sustainable development such as environmental pollution and rice quality decline (Yoseftabar, 2013). Rice being the major feeder of N, requires adequate supply from planting to flowering for better establishment growth and higher yield level (Pushpanathan *et al.,* 2005). Grain and straw yields and yield attributes were effectively increased with N application (Vennila *et al.,* 2007). Considering the above facts, the present research study was therefore undertaken to find out the suitable variety and optimum level of N for better crop growth and higher yield.

Weed is a vital constraint in case of rice cultivation. The density, total dry weight and infestation percentage of weed vary due to the rice variety, growing season and fertilizer management. The infestation of weed is relatively high in transplant *Aman* rice (Bari *et al*., 1995). Nitrogen fertilizer has influence on weed density, total dry weight and infestation percentage (Rekha *et al.,* 2002).

In view of the above this piece of work was carried out with the following objectives: i) to find out the suitable variety and optimum level of nitrogen for higher grain yield of transplant *Aman* rice, ii) to find the percent of weed infestation in transplant *Aman* rice and to find out the interaction, if any, between variety and level of nitrogen fertilizer application on the yield of transplant *Aman* rice.

Materials and Methods

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh from July to December 2014 to find out the effect of mineral nitrogen on the weed infestation and yield of transplant *Aman* rice. The experiment was conducted with three cultivars viz. BRRI dhan49, BRRI dhan51 and BRRI dhan52 and five nitrogen levels viz. 0, 40, 60, 80, and 100 kg N ha^{-1}. The experiment was laid out in a randomized complete block design (RCBD) with three replications. The size of unit plot was 4.0 × 2.5 m. The land was opened with a power tiller and subsequently ploughed four times with country plough followed by laddering on 5 August 2014. The land was fertilized with TSP, MoP, gypsum and $ZnSO_4$ as per recommendation of BRRI for BRRI dhan49, BRRI dhan51 and BRRI dhan52. Varieties BRRI dhan49, BRRI dhan51 and BRRI dhan52 were fertilized with 83-100-100-10 kg ha^{-1}, 50-80-60-10 kg ha^{-1} and 50-80-60-10 kg ha^{-1} TSP, MoP, gypsum and $ZnSO_4$ respectively. The entire amounts of TSP, MoP, gypsum and $ZnSO_4$ were applied at the time of final land preparation. Urea was applied as the experimental treatments. Urea was applied in two installments at 7 DAT and Panicle Initiation stage. Thirty two days old seedling of transplant *Aman* rice BRRI dhan49, BRRI dhan51 and BRRI dhan52 were transplanted on 6 August 2014; at the rate of three seedlings $hill^{-1}$ maintaining row and hill spacing of 25 cm ×15 cm, respectively. Other cultural operations were done properly depending upon the requirements. Three hand weeding was done in the experimental plot. The data on weed population was collected. Yield of transplant aman rice viz. grain yield, straw yield biological yield and harvest index (%) were recorded at harvesting. The data were statistically analyzed using STAR statistical package to find out the variation resulting from the experimental treatments. The significance of difference between the pair of means compared by LSD test at 5% level of probability (Gomez and Gomez, 1984).

Results and Discussion

Nine weed species infested the experimental plots belonging to five families which were *Paspalum scrobiculatum*, *Echinochloa crusgalli*, *Digitaria sanguinalis*, *Oxalis europaea*, *Monochoria vaginalis*, *Nymphaea nouchali*, *Cyperus difformis, Scirpus juncoides* and *Fimbristylis miliacea*. Weed population and dry weight were significantly affected by variety. The highest weed population m^{-2} was found in dwarf variety BRRI dhan51 and the lowest in the tallest variety BRRI dhan52.

Table 1. Effect of variety and nitrogen on weed population and percent weed infestation in transplant *Aman* rice

Treatments	Weed population density (Number m^{-2}) at different days after transplanting (DAT)			Infestation (%)
	25	35	45	
Variety				
BRRI dhan49 (V_1)	4.28b	8.67b	14.17ab	52.71b
BRRI dhan51 (V_3)	5.33a	9.39a	14.44a	65.59a
BRRI dhan52 (V_3)	3.33c	4.44c	11.22b	49.79b
CV (%)	8.47	9.47	10.23	6.25
Level of significance	**	**	*	**
Nitrogen levels (kg ha^{-1})				
0 (N_0)	8.22	12.33a	18.11a	4.60a
40(N_1)	5.11	8.33b	17.78a	3.90b
60 (N_2)	3.22	6.53c	10.22c	3.60b
80 (N_3)	2.56	3.44d	8.22d	3.22c
100 (N_4)	2.00	3.22d	8.00d	3.12c
CV (%)	8.47	9.47	10.23	11.47
Level of significance	NS	**	**	**

In a column, values having similar letter or without letter do not differ significantly whereas values with dissimilar letter differ significantly as per DMRT. NS= Not significant; **= Significant at 1% level of probability; CV=Coefficient of variation

Table 2. Interaction effect of variety and N level on weed population and weed infestation in transplant *Aman* rice

Interaction effect of variety and N level	Weed population density (Number m^{-2}) at different days after transplanting (DAT)			Infestation (%)
	25	35	45	
$V_1 \times N_0$	8.33b	14.00a	23.00a	80.42b
$V_1 \times N_1$	3.33fg	7.33de	17.67bc	60.61def
$V_1 \times N_2$	3.33fg	7.67de	9.00hij	46.97f-i
$V_1 \times N_3$	3.33fg	3.67fg	8.52hij	40.91hij
$V_1 \times N_4$	2.00gh	4.33fg	6.67j	33.33ij
$V_2 \times N_0$	10.33a	13.33a	18.00bc	90.55a
$V_2 \times N_1$	7.67bc	12.00ab	20.00b	81.82b
$V_2 \times N_2$	5.00de	9.33cd	12.67d-g	65.15de
$V_2 \times N_3$	3.33fg	4.33fg	7.67ij	57.58d-g
$V_2 \times N_4$	3.33fg	4.33fg	10.00ghi	45.45ghi
$V_3 \times N_0$	6.00cd	9.67cd	13.33def	74.21cd
$V_3 \times N_1$	4.33def	5.67ef	15.67cd	60.21def
$V_3 \times N_2$	3.33fg	3.67fg	9.00hij	59.41def
$V_3 \times N_3$	3.00fg	2.33gh	8.67hij	33.15ij
$V_3 \times N_4$	0.67h	1.00h	7.33ij	30.30j
CV (%)	8.47	9.47	10.23	6.25
Level of significance	**	**	*	**

Table 3. Interaction effect of nitrogen levels and variety on yield of *Aman* rice

Interaction effect of variety and N level	Grain yield of rice (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
$V_1 \times N_0$	3.22bc	5.29b	8.49b	37.81d
$V_1 \times N_1$	3.16cd	5.06bc	8.22b	38.42cd
$V_1 \times N_2$	3.38ab	4.58de	7.97bc	42.48ab
$V_1 \times N_3$	3.41ab	4.87cd	8.28b	41.22abc
$V_1 \times N_4$	2.93ef	4.21f	7.14d	41.07abc
$V_2 \times N_0$	2.98def	3.80g	6.78d	43.99a
$V_2 \times N_1$	3.08cde	4.30ef	7.38cd	41.72ab
$V_2 \times N_2$	3.08cde	4.08fg	7.16d	43.00ab
$V_2 \times N_3$	2.82f	4.01fg	6.83d	41.25abc
$V_2 \times N_4$	3.50a	5.04bc	8.54b	41.01abc
$V_3 \times N_0$	2.95ef	4.31ef	7.26d	40.63bcd
$V_3 \times N_1$	2.99def	4.19f	7.18d	41.67ab
$V_3 \times N_2$	3.54a	5.63a	9.17a	38.59cd
$V_3 \times N_3$	3.49a	5.09bc	8.58ab	40.68bcd
$V_3 \times N_4$	3.40ab	4.76cd	8.16b	41.63ab
CV (%)	3.26	4.01	4.53	3.83
Level of significance	**	**	**	**

In a column, values having similar letter or without letter do not differ significantly whereas values with dissimilar letter differ significantly as per DMRT. NS= Not significant; **= Significant at 1% level of probability; CV=Coefficient of variation

This observation is in agreement with the findings of Sarker (1979) who reported that tall variety produced lower weed population than the dwarf variety. Weed population m^{-2} was not significantly affected by nitrogen level at 25 DAT but significantly influenced at 35 and 45 DAT (Table 1). Rekha *et al.* (2002) reported that weed density was lower in all weeding practices compared to the control plot. Weed population were significantly affected by the interaction between variety and nitrogen level. The highest weed population was observed in BRRI dhan51 with 0 kg N ha^{-1} and the lowest was produced in BRRI dhan52 with 100 kg N ha^{-1} in weeding at 25 DAT (Table 2).

The yield performances of transplant *Aman* rice were influenced significantly and increased gradually to a certain level due to the interaction effect of variety and nitrogen level. The highest grain yield (3.54 t ha^{-1}) was obtained from BRRI dhan52 with 60 kg N ha^{-1} which was statistically identical with BRRI dhan51 with 100 kg N ha^{-1} (3.50 t ha^{-1}). On the other hand, the lowest one (2.82 t ha^{-1}) was produced by the interaction of BRRI dhan51 with 80 kg N ha^{-1}. Increment of grain yield by the application of nitrogen up to a certain level was reported by Jisan *et al*. (2014) and Metwally *et al*. (2011). The highest straw yield (5.63 t ha^{-1}) was produced by BRRI dhan52 with 60 kg N ha^{-1}. The lowest yield of straw (3.80 t ha^{-1}) was produced by BRRI dhan51 with 0 kg N ha^{-1} (Table 3). BRRI dhan52 fertilized with 60 kg N ha^{-1} produced greater yield of straw due to the maximum height and higher number of total tillers $hill^{-1}$. Interaction between varieties and nitrogen levels produced significant effect on biological yield (Table 2). Maximum biological yield (9.17 t ha^{-1}) was produced by the interaction of the variety BRRI dhan52 with 60 kg N ha^{-1} and BRRI dhan51 with 0 kg N ha^{-1} produced lowest biological yield (6.78 t ha^{-1}). Harvest index vary significantly due to interaction between variety and nitrogen level (Table 7). Maximum harvest index (43.99%) was recorded from the variety BRRI dhan51 in combination of 0 kg N ha^{-1} and minimum (37.81%) was observed in BRRI dhan49 with 0 kg N ha^{-1}.

Conclusion

The performance of BRRI dhan52 was the best among the tested varieties. The highest weed infestation (90.55%) was found in BRRI dhan51 with 0 kg N ha^{-1} and the lowest one (30.30%) in BRRI dhan52 fertilized with 100 kg N ha^{-1}. Higher grain yields was obtained from the combination, BRRI dhan52 fertilized with 60 kg N ha^{-1}. BRRI dhan52 fertilized with 60 kg N ha^{-1} appeared to be the promising combination for transplant *Aman* rice cultivation in terms of grain yield. Further study may be needed for ensuring the effect of the study in different AEZ of Bangladesh.

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