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Influence of planting methods and weed control measures on the weed population and dry weight

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Abstract: An experiment was carried out at the Agronomy Field Laboratory, Hajee Mohammad Danesh Science and Technology University, Dinajpur during the *aman* season of 2007 to study the effect of planting methods and weed control measures on the population and dry weight of weed. The experiment was laid out in a split plot design with three replications accommodating planting methods in main plot and weed control measures in sub-plot. The experimental field was infested by twelve weed species belonging to six families of which holdemutha (*Cyperus rotundus* L.) was the most dominant one. The other dominant species were susnisakh (*Marsilea crenata* L.), angta (*Panicum repens* L) and paneekachu (*Monochoria hastata* L.). On the other hand, minimum infesting weed species was durba (*Cynodon dactylon* L.). Weed population and weed dry weight were significantly affected by planting method and weed control measures. The highest weed population and dry weight were observed in case of transplanting method and two hand weeding at 21 and 42 DAS/DAT. Direct seeded thick row rice field having pre-emergence herbicide application with one hand weeding at 42 DAS/DAT reduced population and dry weight of weed effectively.
Key words: Planting method, weed control measures, weed population, dry weight, rice

Introduction

The weeds have higher competitive abilities, serious negative effect on crop production and responsible for marked losses in crop yield (Mamun *et al*., 1993). Weeds reduced grain yield by 16-48% in transplant *aus* rice, 68-100% in direct seeded *aus* rice, 45% in transplant *aman* rice and 22.36% in modern *boro* rice (Mamun, 1990). Weed infestation and the performance, of associated rice plant are strongly influenced by weed control measures. Aromatic rice is rated best in quality and fetches much higher price than high quality non-aromatic rice in the domestic and international market. The demand of aromatic rice for internal consumption and also for export is increasing day by day (Das and Baqui 2000). Dinajpur region is a native area of some indigenous aromatic rice cultivars. About 30% of rice land in Dinajpur is covered by aromatic rice varieties during a*man* season (Baqui *et al*., 1997). Due to low yield and limited market facilities farmers seem to have little interest to continue growing these aromatic rice cultivars. Among the various cultural practices, planting method and weed control measures are the important practices. Planting method and weed control measure are two important factors which are needed to be considered for rice cultivation. There are three major methods of rice crop establishment, namely transplanting, wet seeding and dry seeding (Pandey, 1994). Nearly 80% of the global rice growing area is under transplanted method. Direct seeding of sprouted seeds by using drum seeder in wet puddled field is an alternative method of rice cultivation. So, a suitable weed control measure is needed to be adopted with a view to reduce the cost of production for maximizing rice yield through less weed infestation. In Bangladesh, weeds are traditionally controlled by hand weeding but it is time-consuming, uneconomical and becoming more difficult due to scarcity of labours. Though hand weeding is effective, it is highly expensive. Moreover, heavy demand of labour during peak period and its scarcity necessitates the use of alternative method of weed control. Chemical weed control being cost effective and less labour dependent is recommended to overcome these constraints under direct seeded puddle rice. Therefore, proper weed management is essential for successful rice production in Bangladesh. Research works is limited on planting method and weeding practices of aromatic rice cultivation. In view of the above, the present investigation was undertaken to study the effect of planting method and weed control measures on weed population and dry weight in *aman* rice.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory, Hajee Mohammad Danesh Science and Technology University, Dinajpur, during *aman* season (July to December) 2007 to study the effect of planting method and weeds control measures on the weed population in *aman* rice. The experimental field is a medium high land having sandy loam soil with pH 5.35. The initial soil (0-15 cm depth) contains 0.10% total nitrogen, 1.06 % organic matter, 24.00 µg/g available phosphorus, 0.26 me/100g available potassium, 3.2 µg/g available sulphur and 0.27 µg/g boron. BRRI dhan34 was taken as a test crop. Two factors namely, planting method and weed control measures were included in the experiment. Planting methods were Transplanting method (P_1), Direct seeded thin row (P_2) and Direct seeded thick row (P_3). Weed control measures included Two hand weeding at 21 and 42 DAS/DAT (W_1), One weeding by Japanese rice weeder at 21 DAS/DAT + one hand weeding at 42 DAS/DAT (W_2) and Pre-emergence herbicide application at 4 DAS/DAT + one hand weeding at 42 DAS/DAT (W_3). Ronstar 25 EC at the rate of 2 L ha $^{-1}$ was applied as a pre-emergence herbicide at 4 DAS/DAT by hand sprayer in presence of 4 to 5 cm standing water in the plots and one hand weeding was done at 42 DAS/DAT. Direct sowing of seed was done by drum seeder on 7 July, 2007 in the specified plots. In case of transplanting 25 days old seedlings were transplanted on 1 August 2007 with three seedlings hill^{-1} at a spacing of 25 cm × 15 cm. The experiment was laid out in a sub-plot design with three replications accommodating planting method in main plot and weed control measures in split plot. The plot size was 4.0 m × 2.5 m. Urea, TSP, MOP, gypsum and zinc sulphate were applied at the rate of 150, 100, 70, 60 and 10 kg ha^{-1}, respectively. The whole amount of TSP, MP, gypsum and zinc sulphate were applied as basal dose at the time of final land preparation and mixed well with the soil. Urea was top dressed in three equal splits at 15, 30 and 45 DAS /DAT. Weeding of the rice field was done as

per experimental specifications. Data on weed population were recorded from each plot at 30 and 40 DAS/DAT by using 0.5 m x 0.5 m quadrat as per method described by Cruz *et al*. (1986). The quadrat was placed in three spots at random outside 1 m^2 area kept in the middle of each plot for taking yield data. The weeds inside each quadrat were counted species wise and their average value was converted to number m^{-2} multiplying by four. The weeds inside each quadrat were uprooted, cleaned and separated species-wise after counting. The collected weeds were sun dried and thereafter, dried in an electrical oven for 72 hours at a temperature of 80°C. After drying, the weight of individual species was taken by an electrical balance and expressed in g m^{-2}. The collected data were compiled and tabulated for statistical analysis. Analysis of variance (ANOVA) was done following factorial Split-plot design with the help of a computer package MSTAT-C (Russel, 1986). Differences among the treatment means were determined using the Duncan's Multiple Range Test (DMRT) comparison method (Gomez and Gomez, 1984).

Results and Discussion

The experimental field was infested by twelve weed species belonging to six families of which holdemutha (*Cyperus rotundus* L.) was the most dominant species. The other dominant species were susnisakh (*Marsilea crenata* L.), angta (*Panicum repens* L) and paneekachu (*Monochoria hastata* L.). On the other hand, durba *Cynodon dactylon* L. was found as the minimum infesting weed.

Effect of planting method

Weed population m^{-2}: Weed population was significantly affected by planting methods at all the counting dates 20, 35, 50 and 65 DAS / DAT (Table 1). The highest weed population was found in transplanting and the lowest weed population was found in direct seeding thin row at 20 DAS/DAT. The lowest weed population was found in direct seeding thin row at 35 DAS/DAT. At 50 DAS/DAT, the lowest weed population was found in direct seeding thick row. The highest weed population was found in transplanting method and the lowest was found in direct seeding thick row At 60 DAS/DAT. Higher weed population was recorded due to higher weed competition and due to wider spaces between rows in transplanting method.

Weed dry weight (g m^{-2}): Weed dry weight was significantly affected by planting method (Table 1). The highest weed dry weight was found in direct seeding thin row followed by transplanting. The lowest weed dry weight was found in transplanting method. At 35 DAS / DAT, the highest weed dry weight was found in direct seeding thin row followed by single thick row. The lowest weed dry weight was found in single thick row. The lowest weed dry weight was found in direct seeding thick row at 50 DAS/DAT. The highest weed dry weight was found in single thin row followed by direct seeding thick row At 65 DAS / DAT. The lowest weed dry weight was found in direct seeding thick row. This might be due to higher crop weed competition and due to wider spaces between rows in direct seeding thin row and transplanting method.

Table 1. Effect of planting methods and weed control measures on weed population and dry weight

Treatment	Weed population (m^{-2}) at different DAS/DAT				Weed dry weight (g m^{-2})) at different DAS/DAT			
	20	35	50	65	20	35	50	65
Planting method								
P_1	284.2a	439.4a	231.8a	254.9a	133.6a	216.9a	101.7a	116.7a
P_2	269.2c	374.0b	220.1b	244.0b	125.8b	186.8c	103.3a	113.9a
P_3	273.7b	436.7a	206.2c	228.8c	123.9c	208.1b	93.22b	104.6b
Weed control measures								
W_1	359.6a	575.4a	304.9a	331.6a	176.2a	289.2a	151.3a	165.4a
W_2	357.8a	554.0b	241.2b	278.2b	175.8a	277.6b	121.7b	135.2b
W_3	109.8b	120.7c	112.0c	117.9c	31.22b	45.00c	25.22c	34.44c
CV%	1.47	0.97	2.33	0.51	1.18	1.52	7.03	5.70

In a column, figures bearing same or no letter (s) do not differ significantly at 5% level of significance by Duncan's Multiple Range Test (DMRT)
Note: P_1: Transplanting method, P_2: Direct seeding thin row, P_3: Direct seeding thick row; W_1: Two hand weeding at 21 and 42 DAS/DAT, W_2: Weeding by Japanese rice weeder at 21 DAS/DAT + one hand weeding at 42 DAS/DAT, W_3: Weeding by pre-emergence herbicide at 4 DAS/DAT + one hand weeding at 42 DAS/DAT

Effect of weed control measures

Weed population m^{-2}: Weed population was significantly affected by weed control measures at all the counting dates 20, 35, 50 and 65 DAS / DAT (Table 1). At 20 DAS/DAT, the highest weed population was found in one weeding by Japanese rice weeder at 21 DAS/DAT + one hand weeding at 42 DAS/DAT. The lowest weed population was found in pre emergence herbicide + one hand weeding at 42 DAS/DAT. Lowest weed population recoded due to effective control of weeds by pre emergence herbicide and highest population was obtained due to use of Japanese rice weeder. Similar result was obtained by Gogoi *et al.* (2000). At 35 DAS/DAT, the lowest weed population was found in pre-emergence herbicide + one hand weeding at 42 DAS/DAT. At 20 DAS/DAT, the highest weed population was found in two hand weeding at 21 and 42

DAS/DAT followed by Japanese rice weeder + one hand weeding at 42 DAS/DAT. The lowest weed population was found in pre emergence herbicide + one hand weeding at 42 DAS/DAT. At 65 DAS/DAT, the lowest weed population was found in pre emergence herbicide + one hand weeding at 42 DAS/DAT. This might be the due to minimum competition thrust from the weeds to the crop plants.

Weed dry weight (g m^{-2}): Weed dry weight was significantly affected by weed control measures (Table 1). At 20 DAS / DAT, It was evident that weed dry weight was significantly influenced by weed control measures. The highest weed dry weight was found in Japanese rice weeder + one hand weeding at 42 DAS/DAT. The result was identical in two hand weeding at 21 and 42 DAS/DAT. The lowest weed dry weight was found in pre emergence herbicide + one hand weeding at 42 DAS/DAT. At 35 DAS / DAT, the highest weed dry weight was found in Japanese rice weeder + one hand weeding at 42 DAS/DAT followed by two hand weeding at 21 and 42 DAS/DAT. The lowest weed dry weight was found in pre-emergence herbicide + one hand weeding at 42 DAS/DAT. Almost similar findings were reported by Bhol and Singh (1987). At 50 DAS / DAT, weed population was significantly influenced by planting method at 50 DAS/DAT. The lowest weed population was found in pre-emergence herbicide + one hand weeding at 42 DAS/DAT. This might be the due to minimum crop weed competition. Weed dry weight at 20, 40 and 60 DAS/DAT significantly affected the weeding regimes (Rafiquaddualla, 1999). It was evident that weed population was significantly influenced by weed control measures on weed dry weight at 65 DAS / DAT. The lowest weed dry weight was found in pre-emergence herbicide + one hand weeding at 42 DAS/DAT. This might be the due to minimum competition thrust from the weeds to the crop plants. Due to application of pre-emergence herbicide + one hand weeding at 42 DAS/DAT, no broad leaved weed was observed.

Interaction of planting method and weed control measures

Weed population (m^{-2}): The interaction effect of planting method and weed control measures exerted significant influence on number of weeds m^{-2} at 20, 35, 50 and 65 DAS / DAT (Table 2). At 20 DAS/DAT, the highest number of weeds m^{-2} (373.7) was in P_1W_1 which was identical to P_1W_2. The lowest weed population m^{-2} (103.0) was found in P_3W_3 which was statistically similar to P_1W_3. The highest number of weeds m^{-2} (602.7) was recorded in P_1W_1 which was statistically similar P_3W_1 and P_1W_2 at 35 DAS/DAT. The lowest weed population m^{-2} (113.7) was recorded in P_3W_3 that was identical to P_1W_3. At 50 DAS/DAT, the highest number of weeds m^{-2} (335.3) was recorded in P_1W_1. The lowest weed population m^{-2} (105.3) was recorded in P_3W_3 which was statistically similar to P_1W_3. The highest number of weed population m^{-2} (351.3) was recorded in P_1W_1 and the lowest weed population m^{-2} (110.0) in P_3W_3 at 65 DAS/DAT. Result showed the lowest weed population m^{-2} in all planting methods under pre-emergence herbicide application and one hand weeding at 42 DAS/DAT. This might be due to the higher control efficiency of the pre-emergence herbicide.

Weed dry weight (g m^{-2}): The interaction effect of planting method and weed control measures was significant in respect of dry weight of weeds m^{-2} at 20, 35, 50 and 65 DAS / DAT (Table 2). At 20 DAS/DAT, the highest dry weight of weeds (185.7 g m^{-2}) was recorded in P_1W_1 which was statistically similar to P_1W_2 and the lowest dry weight of weeds (24.33 g m^{-2}) was recorded in P_3W_3.

The highest dry weight of weeds (307.3 g m^{-2}) was recorded in P_1W_1 and the lowest dry weight of weeds (31.33 g m^{-2}) was recorded in P_3W_3 at 35 DAS/DAT. At 50 DAS/DAT, the highest dry weight of weeds (160.7 g m^{-2}) was recorded in P_1W_1 and the lowest dry weight of weeds (21.33 g m^{-2}) was recorded in P_3W_3 which was statistically similar to P_1W_3 and P_2W_3. The highest dry weight of weeds (173.3 g m^{-2}) was observed in P_1W_1 which was statistically similar to P_2W_1 and the lowest dry weight of weeds (28.0 g m^{-2}) was recorded in P_3W_3 at 65 DAS/DAT (Table 2).

Table 2. Interaction of planting method and weed control measures on weed population (m^{-2}) and dry weight (g m^{-2})

Treatment	Weed population (m^{-2}) at different DAS/DAT				Weed dry weight (g m^{-2}) at different DAS/DAT			
	20	35	50	65	20	35	50	65
$P_1 \times W_1$	373.7a	602.7a	335.3a	351.3a	185.7a	307.3a	160.7a	173.3a
$P_1 \times W_2$	371.0a	596.3ab	249.3d	296.0d	184.7a	296.7b	120.3c	143.7c
$P_1 \times W_3$	108.0e	119.3f	110.7g	117.3h	30.33g	46.67f	24.00d	33.00ef
$P_2 \times W_1$	343.7c	521.3c	304.0b	331.7b	168.0d	262.3c	156.3a	167.3a
$P_2 \times W_2$	345.7c	471.7d	236.3e	274.7e	164.7e	241.0d	123.3c	132.0d
$P_2 \times W_3$	118.3d	129.0e	120.0f	125.7g	39.00f	57.00e	30.33d	42.33e
$P_3 \times W_1$	361.3b	602.3a	275.3c	311.7c	175.0c	298.0b	137.0b	155.7b
$P_3 \times W_2$	356.7b	594.0b	238.0e	264.0f	178.0b	295.0b	121.3c	130.0d
$P_3 \times W_3$	103.0e	113.7f	105.3g	110.7i	24.33h	31.33g	21.33d	28.00f
CV%	1.47	0.97	2.33	0.51	1.18	1.52	7.03	5.70

In a column, figures bearing same or no letter (s) do not differ significantly at 5% level of significance by Duncan's Multiple Range Test (DMRT)

Note: P_1: Transplanting method, P_2: Direct seeding thin row, P_3: Direct seeding thick row; W_1: Two hand weeding at 21 and 42 DAS/DAT, W_2: Weeding by Japanese rice weeder at 21 DAS/DAT + one hand weeding at 42 DAS/DAT, W_3: Weeding by pre-emergence herbicide at 4 DAS/DAT + one hand weeding at 42 DAS/DAT

From the above results and discussions, direct seeded thick row rice field having pre-emergence herbicide application with one hand weeding at 42 DAS/DAT reduced population and dry weight of weed effectively. So, direct seeded thick row rice under pre-emergence herbicide application with one hand weeding at 42 DAS/DAT would be promising for effective weed control.

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