Effect of variety and planting density on weed dynamics and yield performance of transplant *Aman* rice

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ARTICLE INFO	Abstract
	The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during *Aman* season from June to November 2016 to find out the effect of variety and planting density on weed dynamics and yield performance of transplant *Aman* rice. The experiment consisted of four varieties viz. Binadhan-7, BR25, BRRI dhan56 and BRRI dhan62 and four planting density viz. 25 cm × 15 cm, 25 cm × 10 cm, 20 cm × 15 cm and 20 cm × 10 cm. The experiment was laid out in a randomized complete block design with three replications. Variety exerted significant effect on weed density and dry weight at different days after transplanting (DAT). The lowest weed density and dry weight were observed in BR25 and the highest ones were observed in Binadhan-7. Weed population was not significantly affected by planting density while weed dry weight was significantly affected and closer spacing produce the lowest weed dry weight. Yield and yield contributing characters of transplant *Aman* rice were significantly influenced by variety and planting density. BR25 showed produce the highest plant height (157.9 cm), panicle length (24.94 cm), grains panicle (103.10), sterile spikelets panicle^{-1} (29.36), grain yield (4.30 t ha^{-1}) and straw yield (8.99 t ha^{-1}) while BRRI dhan62 the highest number of total tillers hill^{-1} (14.75), effective tillers hill^{-1} (11.62), and non-effective tillers hill^{-1} (3.10). The highest 1000-grain weight (25.21g) was found in the variety Binadhan-7and the highest harvest index (53.50%) was obtained from BRRI dhan56. In case of planting density, the highest value of plant height (124.27 cm), total tillers hill^{-1} (13.53), effective tillers hill^{-1} (11.20), non-effective tillers hill^{-1} (2.32), panicle length (22.59 cm), grain yield (4.17 t ha^{-1}) and straw yield (5.75 t ha^{-1}) were obtained from 25 cm × 15 cm spacing. On the other hand, the highest number of grains panicle^{-1} (84.23) and harvest index (45.18 %) were obtained from 25 cm × 10 cm spacing, heaviest 1000-grain weight (23.83 g) from 20 cm × 15 cm spacing. Experimental results indicated that BR25 grown under 25 cm × 15 cm planting density appeared to be the best in order to get maximum grain yield as well as reducing weed infestation.

Introduction

Agriculture is the single largest producing sector of the economy of Bangladesh since it comprises about 17.20% of the gross domestic product (GDP) and employs more than 45 percent of total labor force (BBS, 2016). Bangladesh is one of the most important rice growing countries of the world. Bangladesh ranks fourth in terms of rice production. During the year 2014–2015 rice covered an area of 11420.65 thousand hectares with a production of 34710 thousand m. tons. *Aman* rice covers 13665 thousand acres with a production of 13190 thousand m. tons (BBS, 2016). *Aman* is the second largest rice crop in the country in respect to the volume of production while *boro* rice ranks top in production. *Aman* rice covers more than half of the rice area accounting 5.53 million hectares with a production of 12.70 million tons. Average yield of *Aman* rice during the year 2014–15 has been estimated 2.39 t ha^{-1} which is 1.27% higher than that of previous year but which is still much low compared to the national rice average yield of 2.92 t ha^{-1} (BBS, 2016).

Among various factors responsible for yield loss, weeds are the greatest yield-limiting constraint to rice

(WARDA, 1996). Globally, actual yield losses due to pests have been estimated approximately 40% of which weeds caused the highest loss (32%) (Rao *et al.*, 2007). The rice crops are severely infested with weeds which can reduce the grain yields up to 16−48% for *Aman* rice (IRRI, 1998). Variety is an important genetic factor which contributes a lot for producing higher yield. Variety is the key component to produce higher yield of rice depending upon their differences in genetic constituents, input requirements and response, growth process and off course the prevailing environmental conditions during the growing season. The growth process of rice plants under a given agro-climatic condition differs with variety. The potential for increasing rice production strongly depends on the ability to integrate a better crop management for the different varieties into existing cultivation systems (Mikkelsen *et al.*, 1995).

Optimum plant density of rice plays indirect but key role for absorption of necessary nutrients, well tillering, higher leaf area, etc. Improper spacing reduces the yield up to 25–30 per cent. The optimum plant density ensures the plant to grow in their both aerial and underground

parts through efficient utilization of solar radiation and nutrients (Miah *et al.,* 1990). Planting density also exerts significant effect on reducing weed population (Rajkhowa *et al.*, 2004; Eshaghi *et al.*, 2013).

Rice variety plays a key role in suppressing weeds. Gogoi *et al.* (2000) reported that Akisali, a tall traditional cultivar, significantly reduced the weed dry matter accumulation compared with the other cultivars tested. Parvez *et al.* (2013) reported that weed population and dry weight were significantly affected by cultivar. They reported minimum weed growth in taller cultivar Nizershail and maximum weed growth in dwarf cultivar BRRI dhan41. Keeping the above points in views, the present study was, therefore, undertaken to find out the effect of variety and planting density on weed dynamics and yield performance of transplant *Aman* rice and to determine the interaction effect of variety and planting density on weed dynamics and the yield of transplant *Aman* rice.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the transplant *Aman* season from June to November 2016 to find out the effect of variety and planting density on weed dynamics and yield performance of transplant *Aman* rice. The experimental field belongs to the agro-ecological region of the Old Brahmaputra Floodplain (AEZ-9 (FAO, 1988). The experiment field was medium high land having sandy loam soil with pH value 6.8, low in organic matter and fertility level. The experiment included two factors, factor A— four varieties viz. Binadhan-7, BR25, BRRI dhan56 and BRRI dhan62 and factor B four planting density viz. 25 cm × 15 cm, 25 cm × 10 cm, 20 cm × 15 cm, 20 cm × 10 cm. The experiment was laid out in a two factorial randomized complete block design with three replications. The size of the unit plot was 10 m^2 (4.0 m × 2.5 m). Seeds of *Aman* rice variety Binadhan-7, BR25, BRRI dhan56 and BRRI dhan62 were collected from the Agronomy Field Laboratory, BAU, Mymensingh. Seedlings were raised in well prepared nursery bed at the Agronomy Field Laboratory, BAU, Mymensingh. The experimental land was first opened with a power tiller. Later on, the land was prepared by ploughing and cross-ploughing with a country plough and subsequently leveled by laddering. All weeds and stubble were removed from the land. The field layout was done according to the experimental design on 24 July 2016. The field was fertilized with urea, triple super phosphate (TSP), muriate of potash (MoP) and gypsum were used as the source of nitrogen, phosphorus, potassium and sulphur at the rate of 165, 60, 110, 70 kg

ha^{-1}, respectively. Twenty seven day old seedlings were uprooted from the nursery bed carefully and then transplanted on 25 July 2016 at the rate of three seedlings $hill^{-1}$ maintaining spacing as per experimental treatments. The crop was harvested at full maturity. Different varieties matured in different dates. The date of harvesting was confirmed when 90% of the grain became golden yellow in color. Binadhan-7 was harvested on 16 October, BRRI dhan56 and BRRI dhan62 on 20 October and BR25 on 06 November 2016. Five hills were randomly selected soon after transplanting and marked with bamboo sticks in each plot excluding border rows for determining growth parameters as well as yield and yield components. Data on weed population were collected from each plot at 20, 35 and 50 DATs by using 0.25 m × 0.25 m quadrate. The quadrate was placed three spots at random in each plots for recording weed data. The weeds within the quadrate were counted plot-wise and converted number m^{-2} by multiplying by four. The counted weeds $plot^{-1}$ were dried first in the sun and then kept in an electric oven for 72 hours at $80^{o}C$ temperature. The dry weight of each species was taken by an electrical balance and expressed in g m^{-2}. Data on different yield component were recorded from five consecutive selected hills from any row except border row in each plot. After sampling, a harvest area of central 1 m × 1 m was selected from each unit plot. The harvested crop of each unit area was separately bundled, properly tagged and then brought to the threshing floor. The harvested crop was threshed by pedal thrasher and the weight was adjusted in 14% moisture content and straw were sundried properly. Finally grain and straw yields per unit area were converted to t ha^{-1}. Data recorded for growth, yield and yield contributing characters were compiled and tabulated in proper form for statistical analyses. Analysis of variance was done with the help of MSTAT–C computer package programme developed by Russel (1986). The mean differences among the treatments were adjudged by DMRT test (Gomez and Gomez, 1984).

Results and Discussion

Effect of variety on weed density and dry weight
Weed population and weed dry weight were significantly influenced by variety. The highest weed population (31.83) was found at 50 DAT from the variety Binadhan-7 and the lowest one was observed at 20 DAT (17.49) from the variety BR25. Maximum dry weight (23.05) was also found at 50 DAT from the variety Binadhan-7 and minimum dry weight (7.02) was observed at 20 DAT from the variety BR25 (Table 1).

Table 1. Effect of variety on weed population and dry weight at different days after transplanting

Variety	Weed population m^{-2} (no.)			Dry weight m^{-2} (g)		
	20 DAT	35 DAT	50 DAT	20 DAT	35 DAT	50 DAT
Binadhan-7	17.49a*	26.91a	31.83a	9.22a	13.70a	23.05a
BR25	12.08b	21.73b	28.59c	7.02b	10.96b	17.56b
BRRI dhan56	16.36a	26.74a	29.86bc	8.55a	12.66a	20.64a
BRRI dhan62	16.90a	25.26a	30.50ab	8.83a	13.96a	21.58a
CV (%)	14.14	12.51	6.08	3.28	15.16	14.92
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01

*Mean values in a column having the same letter(s) do not differ significantly whereas mean values having different letter(s) differ significantly as per DMRT

Effect of planting density on weed density and dry weight

Weed density was influenced significantly at 20 DAT but non-significantly influenced at 35 DAT and 50 DATs by planting density. Weed dry weight was significantly influenced by planting density. However, the highest weed population (30.71) was found at 50 DAT in 25 cm × 15 cm spacing and the lowest one was observed at 20 DAT (15.35) from 20 cm × 10 cm spacing. Maximum weed dry weight (21.04) was also found at 50 DAT from spacing of 20 cm × 15 cm and minimum weed dry weight (7.58) was observed at 20 DAT from planting density of 20 cm × 10 cm (Table 2).

Table 2. Effect of planting density on weed population and dry weight at different days after transplanting

Planting density	Weed population m^{-2} (no.)			Dry weight m^{-2} (g)		
	20 DAT	35 DAT	50 DAT	20 DAT	35 DAT	50 DAT
25×15 cm	16.84a*	26.58	30.71	9.29[a]	8.04bc	23.53[a]
25×10 cm	15.35ab	25.42	30.45	13.94[a]	12.50ab	19.90b
20×15 cm	16.41a	24.81	29.97	8.71ab	13.09ab	21.04ab
20×10 cm	14.23b	23.84	29.65	7.58c	11.74b	18.37b
CV (%)	14.14	12.51	6.08	13.28	15.16	14.92
Level of significance	0.05	NS	NS	0.01	0.05	0.01

*Mean values in a column having the same letter(s) do not differ significantly whereas mean values having different letter(s) differ significantly as per DMRT
NS= Not significant

Interaction effect of variety and planting density on weed density and dry weight

Weed density was significantly influenced and weed dry weight was influenced non-significantly at 20 DAT but significantly influenced at 35 DAT and 50 DAT by the interaction of variety × planting density. The highest weed density (33.16) was found at 50 DAT from Binadhan-7 at 25 × 15 cm spacing and the lowest weed population was observed at 20 DAT (10.48) from (BR25 at 25 cm × 10 cm spacing. The highest weed dry weight (26.19) was also found at 50 DAT from the variety Binadhan-7 at 20 cm × 15 cm spacing and the minimum weed dry weight (5.93) was observed at 20 DAT from BR25 at 25 cm × 10 cm spacing This was because of wider spacing had greater opportunity to grow more weeds due to availability of space, water nutrient and other growth requirements than closer spacing. Similar research findings were also reported by Rajkhowa *et al*. (2004) and Eshaghi *et al.* (2013) who reported that closer spacing had lowest weed density and dry weight than wider spacing.

Table 3. Interaction effect of variety and planting density on weed population and dry weight at different days after transplanting

Interaction (variety × planting density)	Weed population m^{-2} (no.)			Weed Dry weight m^{-2} (g)		
	20 DAT	35 DAT	50 DAT	20 DAT	35 DAT	50 DAT
V$_1$×S$_1$	17.97	30.20	33.16	9.70	14.55ab*	23.42ab
V$_1$×S$_2$	16.60	26.19	30.52	8.78	12.77abcd	22.27abc
V$_1$×S$_3$	19.77	26.38	31.33	10.22	15.51a	26.19a
V$_1$×S$_4$	15.62	24.88	32.29	8.10	11.96abcd	20.31abcdef
V$_2$×S$_1$	14.82	22.74	28.81	9.47	14.69ab	24.27ab
V$_2$×S$_2$	10.48	22.53	29.21	5.93	9.473d	15.21ef
V$_2$×S$_3$	11.74	21.11	28.87	6.55	9.507d	15.86def
V$_2$×S$_4$	11.27	20.53	27.45	6.11	10.16cd	14.90f
V$_3$×S$_1$	16.66	28.52	30.54	8.61	11.57bcd	22.58abc
V$_3$×S$_2$	16.29	27.45	30.82	8.44	13.20abcd	20.45abcdef
V$_3$×S$_3$	16.29	25.87	28.94	8.53	12.28abcd	18.48bcdeg
V$_3$×S$_4$	16.19	25.12	29.16	8.62	13.59abc	21.05abcde
V$_4$×S$_1$	17.92	24.84	30.35	9.38	14.97ab	23.84ab
V$_4$×S$_2$	18.02	25.47	31.24	9.00	14.55ab	21.66abcd
V$_4$×S$_3$	17.82	25.89	30.73	9.53	15.07ab	23.63ab
V$_4$×S$_4$	13.86	24.83	29.68	7.40	11.26bcd	17.20cdef
CV (%)	14.14	12.51	6.08	13.28	15.16	14.92
Level of significance	NS	NS	NS	NS	0.05	0.05

*Mean values in a column having the same letter(s) do not differ significantly whereas mean values having different letter(s) differ significantly as per DMRT
NS= Not significant

Effect of variety on yield and yield components of transplant *Aman* rice

All the studied of crop and yield and yield contributing characters were significantly influenced by variety at 1% level of level of probability (Table 4). The tallest plant (157.9 cm) was obtained in variety BR25 and the shortest one (99.72 cm) was obtained in BRRI dhan62. The variation in plant height might be due to the heredity or varietal character. Similar results were also reported by Islam *et al.,* 2012 and Tyeb *et al.*, 2013. The highest number of total tillers hill^{-1} (14.75) was obtained from BRRI dhan62 and the lowest one (7.82) was found in BR25. The highest number of effective tillers hill^{-1} (11.62) was obtained from BRRI dhan62. The lowest number of effective tillers hill^{-1} (6.89) was found in BR25. Tyeb *et al*. (2013) showed that among four varieties of rice BRRI dhan52 showed superior performance over the other varieties (viz. BRRI dhan41, BRRI dhan46 and BRRI dhan51) in respect of number of effective tillers hill^{-1}. The longest panicle (24.94 cm) was found in BR25 which was statistically identical with Binadhan-7. The shortest panicle (21.26 cm) was obtained from BRRI dhan62. Variation in panicle length among varieties was also reported by Kabir *et al.* (2004). The highest number of grains panicle^{-1} (103.1) was found in BR25, while the lowest one (58.65) from Binadhan-7 which was statistically similar with BRRI dhan62. Similar research finding was also reported by

Niu *et al.* (2001) where the authors observed variation in grains panicle^{-1} among the varieties. The highest number of sterile spikelets panicle^{-1} (29.36) was obtained from BR25 and the lowest one (17.93) was found in Binadhan-7 which was statistically similar with BRRI dhan62. Tyeb *et al*. (2013) showed variable number of sterile spikelets panicle^{-1} among varieties. The highest 1000-grain weight (25.21 g) was found from Binadhan7 and the lowest one (21.86 g) from BRRI dhan56 which was statistically at par with BR25 and BRRI dhan62. The highest grain yield (4.30 t ha^{-1}) was obtained from BR25, whereas the lowest grain yield (3.37 t ha^{-1}) was recorded from Binadhan-7. The highest grain yield in BR25 might be due to the result of longest panicle and highest number of grains panicle^{-1}. The highest straw yield (8.99 t ha^{-1}) was obtained from BR25. On the other hand, the lowest straw yield (3.42 t ha^{-1}) was obtained from BRRI dhan56. The highest straw yield was obtained in BR25 might be due to the tallest plant height in BR25. Hossain *et al.* (2010) also obtained highest straw yield in BRRI dhan29 rice due to tallest plant and highest number of tillers hill^{-1}. The highest harvest index (53.50%) was obtained from BRRI dhan56 which was statistically at par with BRRI dhan62. The lowest harvest index (33.07%) was recorded from BR25. Sultana *et al.* (2012) also reported variation in harvest index among the varieties.

Table 4. Effect of variety on the crop character and yield component of transplant *Aman* rice

Variety	Plant height (cm)	Total tillers hill^{-1} (no).	Effective tillers hill^{-1} (no).	Panicle length (cm)	Grains panicle^{-1} (no).	Sterile spikelets panicle^{-1} (no).	1000-grain weight (g)	Grain Yield (t ha$^{-1)}$	Straw Yield (t ha^{-1})	Harvest index (%)
Binadhan-7	111.6b*	11.75b	9.68b	221.85a	58.65c	17.93c	25.21a	3.37b	5.07b	41.38b
BR25	157.9a	7.82c	6.89c	24.94a	103.1a	29.36a	22.45b	4.30a	8.99a	33.07c
BRRI dhan56	117.4b	11.82b	9.43b	21.47b	88.11b	23.20b	21.86b	4.01a	3.42c	53.50a
BRRI dhan62	99.72b	14.75a	11.62a	21.26b	64.02c	18.53c	23.40b	4.12a	4.25bc	49.57a
CV (%)	11.52	16.28	13.97	5.81	18.42	23.20	8.09	16.22	27.73	12.67
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

*Mean values in a column having the same letter(s) do not differ significantly whereas mean values having different letter(s) differ significantly as per DMRT

**= Significant at 1% level of probability

Effect of planting density on yield and yield components of transplant *Aman* rice
Planting density had no significant effect on plant height. Numerically the tallest plant (124.27 cm) was obtained from 205 cm ×15 cm) spacing and the shortest one (199.33 cm) was produced the shortest plant (119.33 cm). Number total tillers hill^{-1} was significantly influenced by spacing. The highest number of total tillers hill^{-1} (13.50) was obtained from 25 cm × 15 cm spacing and the lowest one (10.61) was found in 20 cm × 10 cm spacing. The production of effective tillers hill^{-1} was significantly influenced by spacing. The highest number of effective tillers hill^{-1} (11.20) was obtained from 25 cm × 15 cm spacing and the lowest one (8.43) was found in 20 cm × 10 cm spacing. The highest number of total and effective tillers hill^{-1} in wider spacing might be due to having more sunlight thus more photosynthesis more space for producing more number of tillers. Spacing had no significant effect on panicle length. Numerically the longest panicle (22.59 cm) was found in 25 cm × 15 cm spacing and the smallest one (20.05 cm) from 20 cm × 10 cm spacing. Numerically the highest number of grains panicle^{-1} (84.23) was found in 25 cm × 10 cm spacing and the lowest one (74.50) was found from 20 cm × 10 cm spacing.

Numerically, the highest number of sterile spikelets panicle^{-1} (23.43) was obtained from 20 cm × 10 cm spacing and the lowest number of sterile spikelets panicle^{-1} (20.03) was produced from 25 cm × 15 cm spacing. 1000-grain weight was not significantly influenced by spacing. Alam (2004) reported that plant spacing had no influence on grain size because grain size was mainly controlled by gene not by environment. Spacing had significant effect on grain yield. The highest grain yield (4.17 t ha^{-1}) was obtained from 25 cm × 15 cm spacing whereas the lowest grain yield (3.54 t ha^{-1}) was recorded from 20 cm × 10 cm spacing. This highest grain yield might be due to highest number of total and effective tillers hill $^{-1}$ in 25 cm × 15 cm spacing. Significant variation on straw yield was not observed in transplant *Aman* rice due to the influence of spacing. Numerically the highest straw yield (5.75 t ha^{-1}) was obtained from 25 cm × 15 cm spacing. On the other hand the lowest straw yield (4.85 t ha^{-1}) was obtained from 20 cm × 10 cm) spacing. It was found that spacing had no significant effect on harvest index. Numerically the highest harvest index (45.18 %) was obtained from 25 cm × 10 cm spacing and the lowest one (43.68 %) from 20 cm × 10 cm spacing.

Table 5. Effect of planting density on the crop character and yield component of transplant *Aman* rice

planting density	Plant height (cm)	Total tillers hill^{-1} (no).	Effective tillers hill^{-1} (no).	Panicle length (cm)	Grains panicle^{-1} (no).	Sterile spikelets panicle^{-1} (no).	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
25×15 cm	124.27	13.5a	11.20a	22.59	76.95	20.03	23.35	4.17a	5.75	44.39
25×10 cm	121.43	11.05b	8.73b	22.47	84.23	22.99	22.97	4.03ab	5.42	45.18
20×15 cm	121.58	10.96b	9.27b	22.42	78.20	22.57	23.83	4.05ab	5.71	44.26
20×10 cm	119.33	10.61b	8.43b	22.05	74.50	23.43	22.78	3.54b	4.85	43.68
CV (%)	11.52	16.28	13.97	5.81	18.42	23.20	8.09	16.22	27.73	12.67
Level of significance	NS	0.01	0.01	NS	NS	NS	NS	0.05	NS	NS

*Mean values in a column having the same letter(s) do not differ significantly whereas mean values having different letter(s) differ significantly as per DMRT

NS = Not significant

Interaction effect of variety and planting density on yield and yield components of transplant *Aman* rice
Plant height was not significantly influenced by the interaction of variety and spacing. Numerically the tallest plant (165.60 cm) was found in BR25 at 25 cm × 10 cm spacing and the smallest one (96.87 cm) in BRRI dhan62 at 20 cm × 10 cm spacing. The result of the study is in agreement with that of the finding of Akando

(2007) who also observed insignificant influence of interaction of variety and spacing on plant height. Interaction of variety and spacing exhibited significant influence on number of total tillers hill^{-1}. The highest number of total tillers hill^{-1} (15.93) was found from interaction of BRRI dhan62 at 25 cm × 15 cm spacing which was statistically at par with Binadhan-7× (25 cm × 15 cm) spacing, BRRI dhan56 × (25 cm × 15 cm spacing, BRRI dhan62 × 20 cm × 15 cm spacing and BRRI dhan62 × (25 cm × 10 cm) spacing. The lowest number of total tillers hill^{-1} (5.97) was noticed in BR25 at 20 cm ×10 cm spacing (Table 6). This research finding collaborates the finding of Tyeb *et al.* (2013) where they observed the highest number of tillers hill^{-1} with BRRI dhan46 at (25 cm × 15 cm) spacing. Number of effective tillers hill^{-1} varied significantly due to the interaction of variety and spacing. It was observed that the highest number of effective tillers hill^{-1} (13.40) was obtained from the interaction of Binadhan-7 at 25 cm×15 cm spacing and the lowest number of effective tillers hill^{-1} (5.30) in BR25 at 20 cm × 10 cm spacing. Tyeb *et al.* (2013) observed that BRRI dhan46 at 25 cm × 15 cm spacing produced the highest number of effective tillers hill^{-1}. Panicle length was significantly influenced by the interaction of variety and spacing. The highest panicle (25.55 cm) was resulted in BR25 at 20 cm × 10 cm spacing which was statistically par with BR25 × (25 cm × 10 cm) spacing and BR25 at 25 cm × 15 cm spacing. The smallest panicle (20.31 cm) was

obtained from Binadhan-7 at 20 cm × 10 cm spacing. The interaction effect of variety and spacing showed significant effect on straw yield at 5% level of probability. The highest straw yield (10.50 t ha^{-1}) was obtained from the interaction of BR25 at 25 cm × 15 cm spacing, while the lowest straw yield (3.21 t ha^{-1}) was found from the interaction of BRRI dhan56 at 25 cm × 10 cm spacing. Due to close spacing highest number of plant population of BR25 produced highest straw yield at 25 cm × 15 cm spacing. Moreover, taller plant of BR25 also favored the production of highest straw yield. Interaction of variety and spacing exhibited non-significant influence on harvest index. Numerically the highest harvest index (56.65%) was found from BRRI dhan56 at 20 cm × 15 cm spacing and the lowest one (30.30%) was observed from the interaction of BR25 at 25 cm × 10 cm spacing. From the results of the study it may be concluded that BR25 grown under 25 cm × 15 cm planting density appeared to be the best in order to get maximum grain yield as well as reducing weed infestation in T. *Aman* rice field. From this experimental result, it may be concluded that the highest grain yield (5.10 t ha^{-1}) and straw yield (10.50 t ha^{-1}) was recorded from the interaction of $V_2 × S_1$ (BR25 at 25 cm × 15 cm spacing). This result indicated that BR25 grown under 25 cm × 15 cm planting density appeared to be the best in order to get maximum grain yield as well as reducing infestation.

Table 6. Interaction effect of variety and planting density on the crop character and yield component of transplant *Aman* rice

Interaction (variety × planting density)	Plant height (cm)	Total tillers hill^{-1} (no).	Effective tillers hill^{-1} (no).	Panicle length (cm)	Grains panicle^{-1} (no).	Sterile spikelets panicle^{-1} (no).	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
$V_1×S_1$	107.67	15.87a*	13.40a	22.94b-d	58.53	18.17	26.04	3.55	4.41c	44.35
$V_1×S_2$	107.07	11.53b-e	8.87de	20.99def	55.43	16.75	25.45	3.62	4.44c	44.71
$V_1×S_3$	130.20	9.07efg	7.93ef	23.17a-d	75.40	20.48	25.98	3.53	7.83b	32.51
$V_1×S_4$	101.33	10.53b-e	8.53de	20.31f	45.24	16.31	23.37	2.78	3.570c	43.94
$V_2×S_1$	163.20	8.80efg	7.73ef	25.08ab	102.7	22.397	22.20	5.10	10.50a	32.15
$V_2×S_2$	165.60	6.93fg	5.93fg	25.49a	111.5	28.88	22.23	4.31	9.96ab	30.30
$V_2×S_3$	144.93	9.57def	8.60de	23.65abc	88.41	28.93	23.27	4.10	7.71b	36.22
$V_2×S_4$	157.93	5.97g	5.30g	25.55a	109.8	37.24	22.12	3.67	7.80b	33.61
$V_3×S_1$	123.73	13.53ab	10.87bcd	20.89def	81.52	20.67	22.28	4.01	3.43c	54.22
$V_3×S_2$	111.93	10.53b-e	8.33e	22.13c-f	100.1	27.53	21.89	3.79	3.21c	53.68
$V_3×S_3$	114.33	9.93c-f	8.40de	21.07def	81.07	22.33	21.13	4.70	3.59c	56.65
$V_3×S_4$	119.67	13.27abc	10.13cde	21.79c-f	89.77	22.28	22.15	3.52	3.45c	49.44
$V_4×S_1$	102.47	15.93a	12.80ab	21.44c-f	65.0	18.89	22.87	4.03	4.66c	46.86
$V_4×S_2$	101.13	15.13a	11.80abc	21.27c-f	69.88	18.80	22.31	4.40	4.07c	52.04
$V_4×S_3$	96.87	15.27a	12.13abc	21.79c-f	67.92	18.53	24.94	3.86	3.71c	51.66
$V_4×S_4$	98.40	12.67a-d	9.733cde	20.56ef	53.20	17.89	23.46	4.17	4.57c	47.72
CV (%)	11.52	16.28	13.97	5.81	18.42	23.20	8.09	16.22	27.73	12.67
Level of significance	NS	0.05	0.01	0.05	NS	NS	NS	NS	0.05	NS

*Mean values in a column having the same letter(s) do not differ significantly whereas mean values having different letter(s) differ significantly as per DMRT
NS= Not significant

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