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Influence of variety and weeding regime on the yield of transplant aman rice

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Abstract

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh to evaluate the effect of variety and weeding regime on the yield of transplant *Aman* rice. The experiment consisted of three cultivars BRRI dhan49, BRRI dhan51 and BRRI dhan52 and six different weeding regimes such as no weeding, one hand weeding at 30 DAT, two hand weedings at 30 DAT and 45 DAT, three hand weedings at 30 DAT, 45 DAT and 60 DAT, application of Rifit 500 EC at 7 DAT and application of Rifit 500 EC at 7 DAT + One hand weeding at 30 DAT. The experiment was laid out in a randomized complete block design (RCBD) with three replications. Nine weed species belonging to five families infested the experimental plots. Weed population and weed dry weight were significantly affected by cultivar and weeding regimes. The maximum weed growth was noticed with the dwarf cultivar BRRI dhan51 and minimum with taller cultivar BRRI dhan52. BRRI dhan49 produced the higher grain and the straw yields. The highest loss of grain yield was obtained in no weeding treatment and the lowest was obtained in Rifit 500EC at 7 DAT + one hand weeding at 30 DAT treatments. The highest number of effective tillers hill^{-1}, number of grains panicle^{-1}, 1000-grain weight were observed in Rifit 500EC at 7 DAT + one hand weeding at 30 DAT treatment. Application of Rifit 500EC at 7 DAT + one hand weeding at 30 DAT was more effective and economic than the other weed control treatments in controlling weeds and in producing higher grain yield. So, in order to control weeds effectively and to get the economic yield in transplant *Aman* rice, application of Rifit 500EC at 7 DAT + one hand weeding at 30 DAT might be recommended.

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Introduction

Rice is the vital food for more than two billion people in Asia and four hundred millions of people in Africa and Latin America (IRRI, 2010). The people in Bangladesh depend on rice as staple food and rice has tremendous influence on agrarian economy of the country. About 84.67% of cropped area of Bangladesh is used for rice production, with annual production of 30.42 million tons from 10.4 million ha of land (BBS, 2013). Transplant *Aman* rice covers 5.24 million ha (50.38% of total rice area) of land with a production of 12.89 million tons (BBS, 2013). The average yield of rice in Bangladesh is 2.92t ha^{-1}, which is very much low (BBS, 2013). Geographic and agronomic conditions of Bangladesh are favourable for rice cultivation. The average yield of rice is almost less than 50% of the world average. The increasing rate of population is 1.37% (BBS, 2013) and decreasing rate of agricultural land by 1% per annum (Hussain *et al.*, 2006) limit the horizontal expansion of rice area. So, the only avenue left is to increase the production of rice through vertical expansion where the use of improved varieties are the most effective means to increase the yield of transplant *Aman* rice.

Among the various factors reducing the rice yield weeds are considered as a major constraint. Weed is one of the most important agricultural pests. In Bangladesh, weed infestation reduces the grain yield by 70-80% in *Aus* rice (early summer), 30-40% for transplanted *Aman* rice (Autumn) and 22-36% for modern *Boro* rice varieties (Winter rice) (BRRI, 2008). There is no doubt that maximum benefit from costly inputs like fertilizers and pesticide in rice can be fully derived when the crop is kept free from weed infestation. Repeated hand weeding is done to keep the crop free from weed as far as practicable but the method is cumbersome, uneconomical and being more difficult day-by-day due to the scarcity of labour. Labour availability in agricultural operations has decreased in recent years due to migration of landless people towards the urban areas with a dream to earn more. High competitive ability of weeds exerts a serious negative effect on crop production causing significant losses in crop yield. Poor weed control is one of the major factors for yield reduction in rice, the extent of which depends on type of weed flora and their intensity of infestation. Yield losses due to weed infestation are greater than the combined losses of insect pests and diseases. The traditional method of weed control is hand weeding which is very much labourious and time consuming. Mechanical weeding and herbicides are the alternative to hand weeding. Herbicides are effective in controlling weeds alone or in combination with hand weeding (Ahmed *et al.*, 2005). Herbicides in combination with hand weeding would help to obtain higher crop yield with less efforts and cost (Prasad and Raffy, 1995; Sathyamoorthy *et al.*, 2004).

The best weeding regime need to be found out with a view to reducing losses due to weed infestation and thus getting maximum yield. A few work on the productivity of transplant *Aman* rice and weed growth due to variety and weeding regimes have been done in our country. The present study was, therefore, undertaken to evaluate the weed control efficiency of different weeding regimes and their effects on yield and yield components of transplant *Aman* rice.

Materials and methods

The experiment was carried out at the Agronomy Field Laboratory of Bangladesh Agricultural University, Mymensingh. The experimental site is located at 24°75' N latitude and 90°50' E longitude at an elevation of 18 m above the mean sea level. The experimental area is characterized by non-calcareous dark grey floodplain soil belonging to the Sonatola Soil Series under the Old Brahmaputra Floodplain, Agro-Ecological Zone 9 (UNDP and FAO, 1988). The soil of the experimental field was more or less neutral in reaction with pH value 6.8, low in organic matter and fertility level. The land type was medium high with silty loam in texture. The climate of the locality is tropical in nature and is characterized by high temperature and heavy rainfall during *Kharif* season (April to September) and scanty of rainfall associated with moderately low temperature during Rabi season (October to March). The treatments comprised of three BRRI released high yielding varieties viz., BRRI dhan49, BRRI dhan51 and BRRI dhan52 and six weeding regimes viz.; No weeding, one hand weeding

at 30 DAT, two hand weedings at 30 DAT and 45 DAT, three hand weedings at 30 DAT, 45 DAT and 60 DAT, Rifit 500 EC at 7 DAT and Rifit 500 EC at 7 DAT + One hand weeding at 30 DAT. The experiment was laid out in a randomized complete block design with three replications. The sprouted seeds were sown in the nursery bed on 27 June 2013. Proper care was taken to raise the healthy seedlings in the nursery bed. Weeds were removed and irrigation was given in the nursery bed as and when necessary. The main field was opened with a power tiller and subsequently ploughed four times with country plough followed by laddering. The layout of the field was made after final land preparation. The land was fertilized with urea, triple superphosphate, muriate of potash, gypsum and zinc sulphate as per recommendation of BRRI for BRRI dhan49, BRRI dhan51 and BRRI dhan52. Varieties BRRI dhan49, BRRI dhan51 and BRRI dhan52 were fertilized with 170-83-100-100-10kg ha^{-1} urea, triple superphosphate, muriate of potash, gypsum and zinc sulphate, respectively. The entire amounts of triple superphosphate, muriate of potash, gypsum and zinc sulphate were applied at the time of final land preparation. Urea was applied in three equal installments at 15 DAT, 30 DAT and 45 DAT. Seedlings were transplanted in the well prepared puddled field on 31 July 2013 at the rate of two seedlings $hill^{-1}$, maintaining row and hill distance of 25cm and 15cm, respectively. The experimental plots were irrigated as and when necessary and excess water was drained out at the time of heavy rainfall. Data on weed population were collected from each plot at 30 DAT, 45 DAT and 60 DAT of the rice plants by using 0.25m × 0.25m quadrate as per method described by Cruz *et al.* (1986). The crops were harvested at full maturity. The data of weed parameters were collected at 30, 45 and 60 DAT of rice plants. Weed parameters such as weed population (no. m^{-2}) and total weed dry weight (g m^{-2}) were collected. Crop characters such as, number of effective tillers $hill^{-1}$, number of grains $panicle^{-1}$, 1000-grain weight (g), grain yield (t ha^{-1}) and straw yield (t ha^{-1}) were recorded.

The collected data were compiled and tabulated for statistical analysis. Data were analyzed statistically for analysis of variance (ANOVA) following the method described by Gomez and Gomez (Gomez and Gomez, 1984). MSTAT C computer software was used to carry out statistical analysis. Partial economic analysis was done based on the prevailing market price.

Results and discussion

Weed parameters

Infested Weed Species in the Experimental Field

Nine weed species belonging to five families infested the experimental field. Among the nine species of weeds three were grasses, three were broad leaves and three were sedges. Local name, scientific name, family, morphological type and life cycle of the weed in the experimental plot have been presented in Table 1. The important weeds of the experimental plots were *Paspalum scrobiculatum*, *Echinochloa crusgalli*, *Digitaria sanguinalis*, *Oxalis europaea*, *Monochoria vaginalis*, *Nymphaea nouchali*, *Cyperus difformis, Scirpus juncoides* and *Fimbristylis miliacea*. Bari *et al.* (1995*)* in the experiment at BAU reported that the three important weeds of transplanted *Aman* rice fields were *Fimbristylis miliacea*, *Paspalum scrobiculatum* and *Lyperus rotundus*. But from the same location Mamun *et al.* (1993) reported that *Fimbristylis miliacea*, *Lindernia antipola* and *Eriocaulen cenerseem* were important species of weeds in transplant *Aman* rice field.

Table 1. Infesting weed species found growing in the experimental plots in transplant *Aman* rice.

SN	Local name	Scientific name	Family	Morphological type	Life cycle
1	Angta	*Paspalum scrobiculatum*	Gramineae	Grass	Perennial
2	Shama	*Echinochloa crus galli*	Gramineae	Grass	Annual
3	Anguli ghash	*Digitaria sanguinalis*	Gramineae	Grass	Perennial
4	Amrul shak	*Oxalis europaea*	Oxaledaceae	Broadleaved	Annual
5	Pani kachu	*Monochoria vaginalis*	Pontederiaceae	Broad leaved	Perennial
6	Pani shapla	*Nymphaea nouchali*	Nymphaeaceae	Broad leaved	Annual
7	Sabuj Nakphul	*Cyperus difformis*	Cyperaceae	Sedge	Annual
8	Chechra	*Scirpus juncoides*	Cyperaceae	Sedge	Perennial
9	Joina	*Fimbristylis miliacea*	Cyperaceae	Sedge	Annual

Total Weed Population

Weed population at 30, 45 and 60 days after transplanting (DAT) was significantly affected by variety (Table 2). The highest weed population (5.33m^{-2}) at 30 DAT, (9.39 m^{-2}) at 45 DAT and (14.44m^{-2}) at 60 DAT were found in BRRI dhan 51 and the lowest weed population was obtained in BRRI dhan 52 (3.33 m^{-2}) at 30 DAT (4.44m^{-2}) at 45 DAT and (11.22m^{-2}) at 60 DAT. This shows that higher weed population was found with the shortest variety BRRI dhan 51 and lower with the taller variety BRRI dhan 52. This observation is in agreement with the findings of Sarker (1979) who reported that tall variety produced lower weed population than the dwarf variety. Singlachar *et al.* (1978) also reported that dwarf plant with its erect leaf habit promoted more weed growth and caused more loss than the tall variety. Weed population m^{-2} was not significantly affected by weeding regimes at 30 DAT but significantly influenced at 45 and 60 DAT (Table 3). At 45 DAT, the highest weed population (12.33m^{-2}) was found in W_0 (No weeding) and the lowest (3.22m^{-2}) was found in W_5 (Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) treatment which was statistically similar with W_3 (Three hand weedings at 30, 45 and 60 DAT) treatment. The interaction between variety and weeding regime was found to be significant at 30, 45 and 60 DAT (Table 4). At 30 DAT, the highest weed population (10.33m^{-2}) was found in V_2W_0 (BRRI dhan 51 × No weeding) and the lowest (0.67 m^{-2}) was found in V_3W_5 (BRRI dhan 52 × Rifit 500EC at 7 DAT + one hand weeding at 30 DAT) which was statistically similar with V_1W_5 (BRRI dhan49 × No weeding) treatment. At 45 DAT, the highest weed population (14.00m^{-2}) was found in V_1W_0 (BRRI dhan49×No weeding) which was statistically similar with V_2W_0 (BRRI dhan 51×No weeding) treatment, the lowest one (1.00m^{-2}) in V_3W_5 (BRRI dhan 52× Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) which was statistically similar with V_3W_3 ((BRRI dhan 52× Three hand weedings at 30, 45 and 60 DAT). At 60 DAT, the highest weed population (23.00m^{-2}) was found in V_1W_0 (BRRI dhan 49×No weeding) and the lowest one (6.67m^{-2}) in V_1W_5 (BRRI dhan49× Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) which was statistically similar with V_3W_5 (BRRI dhan52× Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) treatment (Table 3).

Table 2. Weed population and total dry weight at 30, 45 and 60 DAT in transplant *Aman* rice as influenced by cultivar.

Variety	Weed population (Number m^{-2})			Weed dry weight (g m^{-2})			Infestation (%)
	30 DAT	45DAT	60 DAT	30DAT	45DAT	60DAT	
BRRI dhan49	4.28b	8.67b	14.17ab	3.67ab	4.67a	8.46	52.71b
BRRI dhan51	5.33a	9.39a	14.44a	3.93a	3.95b	6.69	65.59a
BRRI dhan52	3.33c	4.44c	11.22b	3.53b	4.07ab	7.09	49.79b
CV (%)	8.47	9.47	10.23	11.47	12.45	12.69	6.25
Level of significance	**	**	*	**	**	NS	**

In a column, values having similar letter do not differ significantly whereas values with dissimilar letter differ significantly as per DMRT.

**= Significant at 1% level of probability

*= Significant at 5% level of probability

Total Weed Dry Weight

Variety showed significant effect on total weed dry weight at 30 and 45 DAT but showed non-significant effect on total weed dry weight at 60 DAT (Table 2). At 30 DAT, the highest total weed dry weight (3.93g m^{-2}) was found in BRRI dhan 51 which was statistically similar with BRRI dhan49 (3.67g m^{-2}) and the lowest one in BRRI dhan 52 (3.53g m^{-2}) (Table 2). At 45 DAT, the highest total weed dry weight (4.67g m^{-2}) was found in BRRI dhan 49 which was statistically similar with BRRI dhan 52 (4.07g m^{-2}) and the lowest one in BRRI dhan 51 (3.95g m^{-2}). It was evident that higher weed dry weight m^{-2} was observed in the dwarf variety BRRI dhan 51 and lower dry weight m^{-2} was observed in the taller variety BRRI dhan 52. This might be due to higher competitive

ability of tall rice variety BRRI dhan 51 than dwarf variety against weed. There was significant effect on total weed dry weight due to weeding regimes at 30 and 45 DAT and non-significant effect on total weed dry weight at 60 DAT (Table 3). Significant variation was found on weed dry weight due to interaction between variety and weeding regime at 30, 45 and 60 DAT (Table 4). At 30 DAT, the highest weed dry weight (5.31g m^{-2}) was found in V_2W_0 (BRRI dhan51× No weeding) treatment and the lowest (2.87g m^{-2}) in V_3W_5 (BRRI dhan 52× Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) which was statistically similar with V_1W_5 (BRRI dhan49× Rifit 500EC at 7 DAT +one hand weeding at 30 DAT). At 45 DAT, the highest weed dry weight (6.01g m^{-2}) was found in V_1W_0 (BRRI dhan49× No weeding) and the lowest (3.14g m^{-2}) found in V_3W_5 (BRRI dhan 52× Rifit 500EC at 7 DAT +one hand weeding at 30 DAT).

At 60 DAT, the highest weed dry weight (10.76g m^{-2}) was found in V_1W_0 (BRRI dhan49× No weeding) which was statistically similar with V_1W_1 (BRRI dhan49× One hand weeding at 30 DAT) and the lowest (5.46g m^{-2}) found in V_3W_5 (BRRI dhan 52× Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) treatment (Table 4).

Table 3. Weed population and total dry weight at 30, 45 and 60 DAT in transplant *Aman* rice as influenced by weeding regime.

Weeding regime	Weed population (Number m^{-2})			Weed dry weight (g m^{-2})			Infestation (%)
	30 DAT	45 DAT	60 DAT	30 DAT	45 DAT	60DAT	
W_0	8.22	12.33a	18.11a	4.60a	4.61a	7.96	81.72a
W_1	5.11	8.33b	17.78a	3.90b	4.36ab	7.77	67.54b
W_2	3.22	6.53c	10.22c	3.60b	4.30b	7.22	57.17b
W_3	2.56	3.44d	8.22d	3.22c	3.55c	6.77	42.93d
W_4	4.78	8.00b	13.33b	3.85b	4.14b	7.66	49.19c
W_5	2.00	3.22d	8.00d	3.12c	3.48c	7.09	37.21d
CV (%)	8.53	9.53	10.53	11.53	12.53	13.53	6.25
Level of significance	NS	**	**	**	**	NS	**

In a column, values having similar 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

Here,

W_0= No weeding

W_1= One hand weeding at 30 DAT

W_2= Two hand weedings at 30 DAT and 45 DAT

W_3= Three hand weedings at 30, 45 and 45 DAT

W_4= Rifit 500EC at 7 DAT

W_5= Rifit 500EC at 7 DAT+ One hand weeding at 30 DAT

Table 4. Weed population and total dry weight at 30, 45 and 60 DAT in transplant *Aman* rice as influenced by interaction of variety and weeding regime.

Interaction	Weed population (Number m^{-2})			Weed dry weight (g m^{-2})			Infestation (%)
	30 DAT	45 DAT	60 DAT	30 DAT	45 DAT	60 DAT	
$V_1×W_0$	8.33b	14.00a	23.00a	4.46b	6.01a	10.76a	80.42b
$V_1×W_1$	3.33fg	7.33de	17.67bc	3.50cd	4.11b-e	10.45a	60.61def
$V_1×W_2$	3.33fg	7.67de	9.00hij	3.32cd	4.87b	7.97b	46.97f-i
$V_1×W_3$	3.33fg	3.67fg	8.52hij	4.16bc	4.37bcd	7.23bcd	40.91hij

Interaction	Weed population (Number m^{-2})			Weed dry weight (g m^{-2})			Infestation (%)
	30 DAT	45 DAT	60 DAT	30 DAT	45 DAT	60 DAT	
$V_1 \times W_4$	5.33de	11.00bc	15.33cd	3.52cd	4.62bcd	7.60bc	53.03e-h
$V_1 \times W_5$	2.00gh	4.33fg	6.67j	3.05d	4.05b-e	6.77bcd	33.33ij
$V_2 \times W_0$	10.33a	13.33a	18.00bc	5.31a	4.64bc	7.95b	90.55a
$V_2 \times W_1$	7.67bc	12.00ab	20.00b	3.32cd	3.77cde	6.77bcd	81.82b
$V_2 \times W_2$	5.00de	9.33cd	12.67d-g	4.04bc	4.30bcd	7.14bcd	65.15de
$V_2 \times W_3$	3.33fg	4.33fg	7.67ij	3.44cd	3.89b-e	6.55bcd	57.58d-g
$V_2 \times W_4$	5.33de	9.67cd	14.33de	4.02bc	4.68bc	7.69bc	53.03e-h
$V_2 \times W_5$	3.33fg	4.33fg	10.00ghi	3.44cd	3.89b-e	6.55bcd	45.45ghi
$V_3 \times W_0$	6.00cd	9.67cd	13.33def	4.02bc	4.68bc	7.69bc	74.21cd
$V_3 \times W_1$	4.33def	5.67ef	15.67cd	3.40cd	3.58de	6.10bcd	60.21def
$V_3 \times W_2$	3.33fg	3.67fg	9.00hij	3.44cd	3.89b-e	6.55bcd	59.41def
$V_3 \times W_3$	3.00fg	2.33gh	8.67hij	3.44cd	3.89b-e	6.55bcd	33.15ij
$V_3 \times W_4$	3.67efg	3.33fg	10.33f-i	4.02bc	4.68bc	7.69bc	41.51hij
$V_3 \times W_5$	0.67h	1.00h	7.33ij	2.87d	3.14e	5.46d	30.30j
CV(%)	8.47	9.47	10.23	11.47	12.45	12.69	6.25
Level of significance	**	**	*	**	**	**	**

In a column, values having similar letter do not differ significantly whereas values with dissimilar letter differ significantly as per DMRT.

**= Significant at 1% level of probability, *= Significant at 5% level of probability CV= Coefficient of variation

Here,

V_1= BRRI dhan49

V_2= BRRI dhan51

V_3= BRRI dhan52

W_0= No weeding

W_1= One hand weeding at 30 DAT

W_2= Two hand weedings at 30 DAT and 45 DAT

W_3= Three hand weedings at 30, 45 and 45 DAT

W_4= Rifit 500EC at 7 DAT

W_5= Rifit 500EC at 7 DAT+ One hand weeding at 30 DAT

Rice Phenotype

Number of effective tillers hill^{-1}

Number of effective tillers hill^{-1} was significantly influenced by variety (Table 5). The higher no. of effective tillers hill^{-1} (8.26) was found in BRRI dhan 51 than BRRI dhan 49 (7.34) and BRRI dhan 52 (7.22) (Table 5). Number of effective tillers hill^{-1} was significantly influenced by different weeding regimes (Table 6). The highest number of effective tillers hill^{-1} (8.75) was produced by W_5 (Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) treatment which was statistically similar with W_3 (Three hand weedings at 30, 45 and 60 DAT) treatment. The lowest number of effective tillers hill^{-1} (6.35) was produced by W_0 (No weeding) treatment (Appendix VII and Fig. 6). Results of the study proved that no weeding treatment did not encourage the rice plant to produce more number of effective tillers hill^{-1}. Similar research findings were also reported by Chowdhury *et al.* (1998) and Islam (2003). Significant variation was found in number of effective tillers hill^{-1} due to interaction between variety and weeding regimes (Table 7). The highest number of effective tillers hill^{-1} (9.87) was produced by BRRI dhan 51 in W_5 (Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) treatment which was statistically similar with W_3 (Three hand weedings at 30, 45 and 60 DAT) treatment, while the lowest number of effective tillers hill^{-1} (5.80) was produced by BRRI dhan52 in W_0 (No weeding) treatment, which was statistically similar with BRRI dhan49 in W_0 (No weeding) treatment and BRRI dhan51 in W_0 (No weeding) treatment.

Table 5. Effect of variety on yield contributing characters of transplant *Aman* rice.

Variety	Effective tillers hill^{-1} (no.)	Grains panicle^{-1} (no.)	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
BRRI dhan49	7.34b	130.74a	17.81	4.77a	5.33a
BRRI dhan51	8.26a	131.05a	18.46	4.10c	4.77c
BRRI dhan52	7.22b	118.13b	22.49	4.43b	5.07b
CV (%)	4.25	4.6	4.54	4.49	4.53
Level of significance	**	**	NS	**	**

In a column, values having similar letter do not differ significantly whereas values with dissimilar letter differ significantly as per DMRT.

**= Significant at 1% level of probability

NS= Not significant

CV=Coefficient of variation

Number of grains panicle^{-1}

Number of grains panicle^{-1} was significantly influenced by different varieties (Table 5). The highest number of filled grains panicle^{-1} (131.05) was observed in BRRI dhan51 which was statistically similar with BRRI dhan49 and the lowest one (118.13) was found in BRRI dhan52. Singh *et al.*,1989 reported variable number of grains panicle-^{1} among the varieties. Varietal differences regarding the number of grains panicle-^{1} might be due to differences in genetic constituents. Number of grains panicle^{-1} was significantly influenced by different weeding regimes (Table 6). The highest number of grains panicle^{-1} (131.87) was produced by W_5 (Rifit 500EC at 7 DAT + one hand weeding at 30 DAT) treatment which was statistically similar with W_3 (Three hand weedings at 30, 45 and 60 DAT) while the lowest number of grains panicle^{-1} (116.63) was produced by W_0 (No weeding) treatment. It indicated that weed free condition encouraged the number of filled grains panicle^{-1} and negative effect of weeds on plant growth resulted in decreased number of filled grains panicle^{-1}. De Datta (1990) observed that effective weed management increased number of filled grains panicle^{-1} due to more availability of water, nutrients and light. Similar results were supported by Singh *et al.* (1999). Number of grains panicle^{-1} was significantly influenced by the interaction between varieties and weeding regimes (Table 7). The highest number of grains panicle^{-1} (138.04) was produced by V_1W_5 (BRRI dhan49 × Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) treatment, while the lowest number of grains panicle^{-1} (107.14) was produced by V_3W_0 (BRRI dhan52 × No weeding) treatment.

1000-grain weight

Weight of 1000-grain was not significantly affected by different varieties of T. *Aman* rice (Table 5). However, numerically the highest number of thousand grain weight (22.49) was found in BRRI dhan52 and the lowest one was found (17.81) in BRRI dhan 49. This might be due to coarse grains of BRRI dhan 52. Rafey *et al.* (1989) who stated that weight of 1000 grains differed due to varietal differences. Weight of 1000-grain was not significantly affected by weeding regime (Table 6). However, numerically the highest weight of 1000 grains (19.88g) was recorded in W_5 (Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) treatment. Weight of 1000-grain was not significantly affected by the interaction between variety and weeding regime (Table 7). Apparently the highest weight of 1000 grains (22.65 g) was recorded in V_3W_5 (BRRI dhan52 × Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) treatment.

Grain yield

The variety studied differed significantly in respect of grain yield (Table 5). The highest grain yield (4.77t ha^{-1}) was obtained in BRRI dhan49 (Table 5). The increased yield might be due to lowest number of sterile spikelets panicle^{-1}. The lowest grain yield (4.10t ha^{-1}) was obtained in BRRI dhan 51. This difference was observed due to different varietal characteristics of rice plant. BRRI (1995) also reported variation in grain yield among the varieties.

Grain yield was significantly influenced by different weeding regimes (Table 6). The highest grain yield

(5.07t ha^{-1}) was produced by W_5 (Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) treatment. However W_3 (Three hand weedings at 30, 45 and 60 DAT) (4.90t ha^{-1}) treatment was similar to W_5 in respect of grain yield. The lowest grain yield (3.06 t ha^{-1}) was produced by W_0 (No weeding) treatment (Table 6). The weeds compete with the crop for nutrient, water, air, sunlight and space. The increased yield was contributed in Rifit 500EC at 7 DAT +one hand weeding at 30 DAT treatment by higher number of effective tillers hill^{-1}, higher number of grains panicle^{-1} over no weeding treatment.

These might be due to the fact that the weeding kept the rice field weed free and soil was well aerated which facilitated the crop for absorption of greater amount of plant nutrients, moisture and greater reception of solar radiation for better growth. Grain yield was significantly influenced by the interaction between varieties and weeding regimes (Table 7). The highest grain yield (5.65 t ha^{-1}) was produced by V_1W_5 (BRRI dhan49 × Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) treatment which was statistically identical with V_1W_3 (BRRI dhan 49 × Three hand weedings at 30, 45 and 60 DAT) treatment, while the lowest grain yield (2.41 t ha^{-1}) was produced by V_2W_0 (BRRI dhan 51 × No weeding) treatment. The integrated approach like herbicides + hand weeding performed better than herbicides or hand weeding alone, such as Application of Rifit 500EC + one time hand weeding at 30 DAT. The lowest grain yield in the no weeding practices might be due to the poor performance of yield contributing characters like number of tillers hill^{-1} and grains panicle^{-1}. Because severe weed infestation occurred in the plots which competed with rice for moisture and nutrients. Similar results were also observed by Gogoi *et al.* (2000), Islam (2001), Attalla and Kholosy (2002).

Straw yield

Straw yield was significantly influenced by three varieties (Table 5). The highest straw yield (5.33t ha^{-1}) was found in BRRI dhan 49 and the lowest straw yield (4.77t ha^{-1}) was found in BRRI dhan 51. These results are in conformity with that obtained by Chowdhury *et al.* (1993) who reported the differences in straw yield among the varieties.

Straw yield was significantly influenced by different weeding regimes (Table 6). The highest straw yield (5.54t ha^{-1}) was observed in W_5 (Rifit 500EC at 7 DAT +one hand weeding at 30 DAT) treatment which was statistically identical with W_3 (Three hand weedings at 30, 45 and 60 DAT) (5.47t ha^{-1}) treatment and the lowest straw yield (4.68t ha^{-1}) was observed in W_0 (No weeding) treatment. Straw yield was significantly influenced by the interaction between variety and weeding regime (Table 7).

The highest straw yield (5.67t ha^{-1}) was produced by V_1W_3 (BRRI dhan 49 × Three hand weedings at 30, 45 and 60 DAT) treatment, while the lowest straw yield (3.81t ha^{-1}) was produced by V_2W_0 (BRRI dhan 49 × No hand weeding) treatment.

Table 6. Effect of weeding regime on yield contributing characters of transplant *Aman* rice.

Weeding regime	Effective tillers hill^{-1} (no.)	Grains panicle^{-1} (no.)	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
W_0	6.35c	116.63d	19.08	3.06c	4.68d
W_1	7.3b	123.36c	19.14	4.10b	5.14c
W_2	7.64b	126.36b	19.61	4.60b	5.20bc
W_3	8.43a	131.52a	19.76	4.90a	5.47ab
W_4	7.51	128.78b	19.64	4.53b	5.40abc
W_5	8.75a	131.87a	19.88	5.07a	5.54a
CV (%)	4.25	4.6	4.54	4.49	4.53
Level of significance	**	**	NS	**	**

In a column, values having similar letter do not differ significantly whereas values with dissimilar letter differ significantly as per DMRT.

**= Significant at 1% level of probability

NS= Not significant, CV=Coefficient of variation

Here,

W_0= No weeding W_3= Three hand weedings at 30 DAT 45 DAT and 65 DAT

W_1= One hand weeding at 30 DAT W_4= Rifit 500EC at 7 DAT

W_2= Two hand weedings at 30 DAT and 45 DAT W_5= Rifit 500EC at 7 DAT + One hand weeding at 30 DAT

Economics of different weeding regime treatments

It could be seen from Table 8 that the application of Rifit 500EC at 7 DAT + one hand weeding at 30 DAT (W_5) maximized (60022Tk. ha^{-1}) the net income and the second highest (53326Tk. ha^{-1}) net income was obtained from the treatment application of Rifit 500EC at 7 DAT (W_4) in BRRI dhan 49. The lowest net income (23670Tk. ha^{-1}) was achieved from the no weeding (W_0) treatment in BRRI dhan 51 (Table 8). From this experiment, it should be clear that combination of hand weeding with herbicides can increase yield and lowers farmers cost of production. Therefore, it can be concluded that application of Rifit 500EC at 7 DAT + one hand weeding at 30 DAT (W_5) is the best treatment for controlling weeds and for having considerable yield increase in transplant *Aman* rice.

Table 7. Effect of interaction between variety and weeding regime on yield contributing characters of T. *Aman* rice.

Interaction	Effective tillers hill^{-1} (no.)	Grains panicle^{-1} (no.)	1000- grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
$V_1 \times W_0$	6.33de	124.92fg	17.18	3.28h	4.88fgh
$V_1 \times W_1$	7.20b-e	125.95fg	17.35	4.37def	5.49bc
$V_1 \times W_2$	7.27b-e	130.30cde	18.05	5.14ab	5.58b
$V_1 \times W_3$	7.47bcd	134.17bc	18.10	5.41a	5.67a
$V_1 \times W_4$	7.53bcd	130.68cde	17.90	5.00ab	5.60b
$V_1 \times W_5$	8.27bc	138.44a	18.27	5.65a	5.55b
$V_2 \times W_0$	6.93cde	117.83h	18.02	2.41i	3.81i
$V_2 \times W_1$	7.87bcd	129.80de	18.27	4.06efg	4.60h
$V_2 \times W_2$	8.37bc	134.32bc	18.60	4.51dfe	4.80gh
$V_2 \times W_3$	9.70a	135.13b	18.62	4.67cde	5.43def
$V_2 \times W_4$	8.07bc	133.27bcd	18.53	4.09efg	5.00e-h
$V_2 \times W_5$	9.87a	135.93b	18.72	4.86def	4.97e-h
$V_3 \times W_0$	5.80e	107.14i	22.35	3.52gh	5.36d-g
$V_3 \times W_1$	6.83cde	114.33h	22.42	3.98fg	5.31d-g
$V_3 \times W_2$	7.53bcd	114.46h	22.48	4.66bcd	5.03e-h
$V_3 \times W_3$	8.13bc	125.26fg	22.58	4.81bcd	4.68h
$V_3 \times W_4$	6.93cde	122.39g	22.50	4.51cde	5.15e-h
$V_3 \times W_5$	8.13bc	125.25fg	22.65	5.08abc	5.45c-f
CV(%)	4.25	4.6	4.54	4.49	4.77
Level of significance	**	**	NS	**	**

In a column, values having similar letter do not differ significantly whereas values with dissimilar letter differ significantly as per DMRT.

**=Significant at 1% level of probability, *=Significant at 5% level of probability

NS=Not significant, CV=Coefficient of variation**=Significant at 1% level of probability, *=Significant at 5% level of probability

NS=Not significant, CV=Coefficient of variation

Table 8(a). Partial budget analysis for cost and return from transplant *Aman* rice cv. BRRI dhan49 under different weeding Regimes.

SN	Item	No weeding (W_0)		One hand weeding at 30 DAT (W_1)		Two hand weedings at 30 DAT and 45 DAT (W_2)	
A.	Variable cost		taka		taka		taka
1	Seed bed preparation and seeding	5×180+2×180	1260	5×180+2×180	1260	5×180+2×180	1260
2	Land preparation, ail making and fertilizer application	20×180+10×180	5400	20×180+10×180	5400	20×180+10×180	5400

SN	Item	No weeding (W_0)		One hand weeding at 30 DAT (W_1)		Two hand weedings at 30 DAT and 45 DAT (W_2)	
A.	Variable cost		taka		taka		taka
3	Seedling uprooting and transplanting	35×180	6300	35×180	6300	35×180	6300
4	Weeding	-	-	24×180	4320	45×180	8100
5	Herbicide application	-	-	-	-	-	-
6	Irrigation	2×180	360	2×180	360	2×180	360
7	Topdressing of urea	3×180	540	3×180	540	3×180	540
8	Insect control	2×180	360	2×180	360	2×180	360
9	Harvesting	25×180	4500	25×180	4500	29×180	5220
10	Post-harvest operation	25×180	4500	25×180	4500	27×180	4860
11	Mechanical	-	1050	-	1050	-	1050
12	Seed	-	644	-	644	-	644
13	Fertilizer: Urea+ TSP+ MP+Gypsum+$ZnSO_4$	-	8426	-	8426	-	8426
14	Herbicide	-	-	-	-	-	-
15	Insecticide	-	1200	-	1200	-	1200
	Total A		34540		38860		42520
B.	Gross return						
1	Grain @ 16000 Tk. t^{-1}	3.28×16000	52480	4.27×16000	68320	5.14×16000	82240
2	Straw @ 1800 Tk. t^{-1}	4.88×1800	8784	5.49×1800	9882	5.78×1800	10404
	Total B		61264		78202		92644
	Net income= Total B - Total A		26724		39342		50124

One man-day labour and two animal-day labour were valued at 180 taka each respectively 23kg seed = 644Tk. @ 28Tk. Kg^{-1} 100kg MP= 1500Tk. @ 15Tk. Kg^{-1} Rifit 500EC (1L) = 900Tk. @ 90Tk. $100ml^{-1}$ 170kg Urea= 3400Tk. @ 20Tk. Kg^{-1} 100kg Gypsum= 500Tk. @ 5Tk. Kg^{-1} 83kg TSP= 1826Tk. @ 22Tk. Kg^{-1} 10kg ZnS04= 1200Tk. @ 120Tk. Kg^{-1}

Table 8(a). Contd.

SN	Item	Three hand weedings at 30, 45 and 60 DAT (W_3)		Application of Rifit 500EC at 7 DAT (W_4)		Application of Rifit 500EC at 7 DAT + One hand weeding at 30 DAT (W_5)	
A.	Variable cost		taka		taka		taka
1	Seed bed preparation and seeding	5×180+2×180	1260	5×180+2×180	1260	5×180+2×180	1260
2	Land preparation, ail making and fertilizer application	20×180+10×180	5400	20×180+10×180	5400	20×180+10×180	5400
3	Seedling uprooting and transplanting	35×180	6300	35×180	6300	35×180	6300
4	Weeding	75×180	13500	-	-	20×180	3600
5	Herbicide application	-	-	2×180	360	2×180	360
6	Irrigation	2×180	360	2×180	360	2×180	360
7	Topdressing of urea	3×180	540	3×180	540	3×180	540
8	Insect control	2×180	360	2×180	360	2×180	360
9	Harvesting	29×180	5220	30×180	5400	25×180	4500
10	Post-harvest operation	27×180	4860	30×180	5400	25×180	4500
11	Mechanical	-	1050	-	1050	-	1050
12	Seed	-	644	-	644	-	644
13	Fertilizer: Urea+ TSP+ MP+Gypsum+$ZnSO_4$	-	8426	-	8426	-	8426
14	Herbicide	-	-	-	900	-	900
15	Insecticide	-	1200	-	1200	-	1200
	Total A		49120		37600		39400
B.	Gross return						
1	Grain @ 16000 Tk. t^{-1}	5.41×16000	86560	5.00×16000	80000	5.54×16000	88640
2	Straw @ 1800 Tk. t^{-1}	6.49×1800	11682	6.07×1800	10926	5.99×1800	10782
	Total B		98242		90926		99422
	Net income= Total B - Total A		49122		53326		60022

One man-day labour and two animal-day labour were valued at 180 taka each respectively 23kg seed = 644Tk. @ 28Tk. Kg^{-1} 100kg MP= 1500Tk. @ 15Tk. Kg^{-1} Rifit 500EC (1L) = 900 Tk. @ 90 Tk. $100ml^{-1}$ 170kg Urea= 3400Tk. @ 20Tk. Kg^{-1} 100kg Gypsum= 500Tk. @ 5Tk. Kg^{-1} 80kg TSP= 1826Tk. @ 22Tk. Kg^{-1} 10 kg ZnS04= 1200Tk. @ 120Tk. Kg^{-1}

Table 8(b). Partial budget analysis for cost and return from transplant *Aman* rice BRRI dhan 51 under different weeding regimes.

SN	Item	No weeding (W_0)		One hand weeding at 30 DAT (W_1)		Two hand weedings at 30 DAT and 45 DAT (W_2)	
A.	Variable cost		taka		taka		taka
1	Seed bed preparation and seeding	5×180+2×180	1260	5×180+2×180	1260	5×180+2×180	1260
2	Land preparation, ail making and fertilizer application	20×180+10×180	5400	20×180+10×180	5400	20×180+10×180	5400
3	Seedling uprooting and transplanting	35×180	6300	35×180	6300	35×180	6300
4	Weeding	-	-	24×180	4320	45×180	8100
5	Herbicide application	-	-	-	-	-	-
6	Irrigation	2×180	360	2×180	360	2×180	360
7	Topdressing of urea	3×180	540	3×180	540	3×180	540
8	Insect control	2×180	360	2×180	360	2×180	360
9	Harvesting	25×180	4500	25×180	4500	29×180	5220
10	Post-harvest operation	25×180	4500	25×180	4500	27×180	4860
11	Mechanical	-	1050	-	1050	-	1050
12	Seed	-	644	-	644	-	644
13	Fertilizer: Urea+ TSP+ MP+Gypsum+$ZnSO_4$	-	7600	-	7600	-	7600
14	Herbicide	-	-	-	-	-	-
15	Insecticide	-	1200	-	1200	-	1200
	Total A		33714		38034		41694
B.	Gross return						
1	Grain @ 16000 Tk. t^{-1}	2.41×16000	48960	4.06×16000	65600	4.51×16000	73600
2	Straw @ 1800 Tk. t^{-1}	3.80×1800	8424	4.60×1800	9252	4.80×1800	9360
	Total B		57384		74852		82960
	Net income= Total B - Total A		23670		36818		41266

One man-day labour and two animal-day labour were valued at 180 taka each respectively 23kg seed = 644Tk. @ 28Tk. Kg^{-1} 80kg MP= 1050Tk. @ 15Tk. Kg^{-1} Rifit 500EC (1L) = 900Tk. @ 90Tk. $100ml^{-1}$ 190kg Urea= 3600Tk. @ 20Tk. Kg^{-1} 60 kg Gypsum= 300Tk. @ 5Tk. Kg^{-1} 50kg TSP= 2200 k. @ 22Tk. Kg^{-1} 10kg ZnSO4= 1200Tk. @ 120Tk. Kg^{-1}

Table 8(b). Contd.

SN	Item	Three hand weedings at 30, 45 and 60 DAT (W_3)		Application of Rifit 500EC at 7 DAT (W_4)		Application of Rifit 500EC at 7 DAT + One hand weeding at 30 DAT (W_5)	
A.	Variable cost		taka		taka		taka
1	Seed bed preparation and seeding	5×180+2×180	1260	5×180+2×180	1260	5×180+2×180	1260
2	Land preparation, ail making and fertilizer application	20×180+10×180	5400	20×180+10×180	5400	20×180+10×180	5400
3	Seedling uprooting and transplanting	35×180	6300	35×180	6300	35×180	6300
4	Weeding	75×180	13500	-	-	20×180	3600
5	Herbicide application	-	-	2×180	360	2×180	360
6	Irrigation	2×180	360	2×180	360	2×180	360
7	Topdressing of urea	3×180	540	3×180	540	3×180	540
8	Insect control	2×180	360	2×180	360	2×180	360
9	Harvesting	29×180	5220	30×180	5400	25×180	4500
10	Post-harvest operation	27×180	4860	30×180	5400	25×180	4500
11	Mechanical	-	1050	-	1050	-	1050
12	Seed	-	644	-	644	-	644
13	Fertilizer: Urea+ TSP+ MP+Gypsum+$ZnSO_4$	-	7600	-	7600	-	7600
14	Herbicide	-	-	-	900	-	900
15	Insecticide	-	1200	-	1200	-	1200

	Total A		50244		38724		40524
B.	Gross return						
1	Grain @ 16000 Tk. t^{-1}	4.67×16000	74720	4.09×16000	65440	4.86×16000	77760
2	Straw @ 1800 Tk. t^{-1}	5.43×1800	9774	5.00×1800	9000	4.97×1800	8946
	Total B		84494		74440		86706
	Net income= Total B - Total A		34250		35716		46182

One man-day labour and two animal-day labour were valued at 180 taka each respectively 23kg seed = 644Tk. @ 28Tk. Kg^{-1} 80kg MP= 1050Tk. @ 15Tk. Kg^{-1} Rifit 500EC (1L) = 900Tk. @ 90Tk. 100ml^{-1} 190kg Urea= 3600Tk. @ 20Tk. Kg^{-1} 60kg Gypsum= 300Tk. @ 5Tk. Kg^{-1} 50kg TSP= 2200Tk. @ 22Tk. Kg^{-1} 10kg ZnSO4= 1200Tk. @ 120Tk. Kg^{-1}

Table 8(c). Partial budget analysis for cost and return from transplant *Aman* rice cv. BRRI dhan 52 under different weeding regimes.

SN	Item	No weeding (W_0)		One hand weeding at 30 DAT (W_1)		Two hand weedings at 30 DAT and 45 DAT (W_2)	
A.	Variable cost		taka		taka		taka
1	Seed bed preparation and seeding	5×180+2×180	1260	5×180+2×180	1260	5×180+2×180	1260
2	Land preparation, ail making and fertilizer application	20×180+10×180	5400	20×180+10×180	5400	20×180+10×180	5400
3	Seedling uprooting and transplanting	35×180	6300	35×180	6300	35×180	6300
4	Weeding	-	-	24×180	4320	45×180	8100
5	Herbicide application	-	-	-	-	-	-
6	Irrigation	2×180	360	2×180	360	2×180	360
7	Topdressing of urea	3×180	540	3×180	540	3×180	540
8	Insect control	2×180	360	2×180	360	2×180	360
9	Harvesting	25×180	4500	25×180	4500	29×180	5220
10	Post-harvest operation	25×180	4500	25×180	4500	27×180	4860
11	Mechanical	-	1050	-	1050	-	1050
12	Seed	-	644	-	644	-	644
13	Fertilizer: Urea+ TSP+ MP+Gypsum+$ZnSO_4$	-	9550	-	9550	-	9550
14	Herbicide	-	-	-	-	-	-
15	Insecticide	-	1200	-	1200	-	1200
	Total A		34764		39984		44844
B.	Gross return						
1	Grain @ 16000 Tk. t^{-1}	3.52×16000	56320	3.98×16000	63680	4.66×16000	83614
2	Straw @ 1800 Tk. t^{-1}	5.36×1800	9648	5.31×1800	9558	5.03×1800	9054
	Total B		65968		73238		92668
	Net income= Total B - Total A		31204		33254		47824

One man-day labour and two animal-day labour were valued at 180 taka each respectively 23kg seed = 644Tk. @ 28Tk. Kg^{-1} 80kg MP= 1050Tk. @ 15Tk. Kg^{-1} Rifit 500EC (1 L) = 900 Tk. @ 90 Tk. 100 ml^{-1} 190kg Urea= 3600Tk. @ 20Tk. Kg^{-1} 60kg Gypsum= 300Tk. @ 5Tk. Kg^{-1} 50kg TSP= 2200Tk. @ 22Tk. Kg^{-1} 10kg ZnSO4= 1200Tk. @ 120Tk. Kg^{-1}

Table 8(c). Contd.

SN	Item	Three hand weedings at 30, 45 and 60 DAT (W_3)		Application of Rifit 500EC at 7 DAT (W_4)		Application of Rifit 500EC at 7 DAT + One hand weeding at 21 DAT (W_5)	
A.	Variable cost		taka		taka		taka
1	Seed bed preparation and seeding	5×180+2×180	1260	5×180+2×180	1260	5×180+2×180	1260
2	Land preparation, ail making and fertilizer application	20×180+10×180	5400	20×180+10×180	5400	20×180+10×180	5400
3	Seedling uprooting and transplanting	35×180	6300	35×180	6300	35×180	6300
4	Weeding	75×180	13500	-	-	20×180	3600
5	Herbicide application	-	-	2×180	360	2×180	360
6	Irrigation	2×180	360	2×180	360	2×180	360
7	Topdressing of urea	3×180	540	3×180	540	3×180	540

8	Insect control	2×180	360	2×180	360	2×180	360
9	Harvesting	29×180	5220	30×180	5400	25×180	4500
10	Post-harvest operation	27×180	4860	30×180	5400	25×180	4500
11	Mechanical	-	1050	-	1050	-	1050
12	Seed	-	644	-	644	-	644
13	Fertilizer: Urea+ TSP+ MP+Gypsum+$ZnSO_4$	-	9550	-	9550	-	9550
14	Herbicide	-	-	-	900	-	900
15	Insecticide	-	1200	-	1200	-	1200
	Total A		50244		33324		40524
B.	Gross return						
1	Grain @ 16000 Tk. t^{-1}	4.81×16000	76960	4.51×16000	72160	5.08×16000	81280
2	Straw @ 1800 Tk. t^{-1}	4.68×1800	8424	5.15×1800	9270	5.45×1800	9810
	Total B		85384		81430		91090
	Net income= Total B - Total A		35140		48106		50566

One man-day labour and two animal-day labour were valued at 180 taka each respectively 23kg seed = 644Tk. @ 28Tk. Kg^{-1} 80kg MP= 1050Tk. @ 15Tk. Kg^{-1} Rifit 500EC (1L) = 900Tk. @ 90Tk. 100ml^{-1} 190kg Urea= 3600Tk. @ 20Tk. Kg^{-1} 60kg Gypsum= 300Tk. @ 5Tk. Kg^{-1} 50kg TSP= 2200 Tk. @ 22Tk. Kg^{-1} 10kg ZnS04= 1200Tk. @ 120Tk. Kg^{-1}

W_0= No weeding

W_1= One hand weeding at 30 DAT

W_2= Two hand weedings at 30 DAT and 45 DAT

W_3= Three hand weedings at 30 DAT, 45 DAT and 60 DAT

W_4= Application of Rifit 500EC at 7 DAT

W_5= Application of Rifit 500EC at 7 DAT + One hand weeding at 30 DAT

Conclusion

It can be concluded from the study that, the highest net income was obtained from BRRI dhan 49 under the treatment of Rifit 500EC + one hand weeding at 30 DAT. Application of Rifit 500EC + one hand weeding at 30 DAT was effective and economic than the other weed control treatments in controlling weeds and in producing the highest grain yield. Therefore, for the control of weeds in effective manner and in order to get considerable amount of grain yield in transplant *Aman* rice, application of Rifit 500EC + one hand weeding at 30 DAT might be recommended.

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