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# Effects of Herbicidal Weed Control Practices on Yield Performance of T. *Aman* Rice Varieties in Bangladesh

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**Abstract:** Using a weed control scheme could assist in reducing potential production losses caused by weeds in paddy fields. Due to certain undesirable adverse effects, there is currently no realistic alternative to chemical weed suppression approaches in rice. The present research aimed to assess how various herbicide-based weed control techniques influenced the weed profile, and crop production of T. *aman* rice varieties. The study was done employing a randomized complete block design with 3 trials. The investigation comprised three *aman* rice cultivars and four weeds control techniques such as control, pre-emergence herbicide, early post emergence and post emergence herbicide. On research sites, ten weed types from 5 families were revealed. The grass weed *Echinochloa gras-galli* had the highest summed dominance ratio (SDR: 42.05%), while the sedges *Scirpus mucronatus* had the lowest SDR of 0.81%. Post-emergence herbicide application provided the lowest weed biomass and density at all sampling dates and produced the greatest seed yields (4.25 t ha$^{-1}$), straw yield (5.41 t ha$^{-1}$) and harvest index (43.87%) because of minimal crop-weed competition. In the case of interaction, BRRI dhan49 coupled with post emergence herbicide attained maximum output (4.80 t ha$^{-1}$) followed by BRRI dhan49 with early post emergence. Due to ability for reducing weeds population, usage of post emergence herbicide could be considered as an efficient weed control approach in BRRI dhan49.

**Keywords:** Herbicide; *Aman* rice; Weed control; Yield.

## INTRODUCTION

The worldwide use of rice has been predicted to grow by 25 percent between 2001 and 2025 to deal with demographic expansion (Maclean et al., 2002) and consequently, it appears to be a challenging task to satisfy growing rice requirements substantially with dwindling environmental assets. Depending on fluctuations in seasonal parameters, Bangladesh has three separate rice-producing periods like *aus*, *aman*, and *boro*. *Aman* accounts for 56.2 lac ha of area (48.06% of entire farmland) and produces 1.49 core tons of rice (38.39% of total rice yield) (BBS, 2021). Among several reasons responsible for rice yield reduction, weed is the most significant biogenic factor. Since the beginning of agriculture, farmers have known that weeds interfere with agricultural production (Ghersa et al., 2000), which contributes to the development of agro-ecosystems and weed control strategies (Ghersa et al., 1994). Nearly 40 percent of total yield reduction from pests was reported around the world, with weeds accounting for the largest of these losses (32%) (Rao *et al.*, 2007). More than animal pests (18%) or diseases (16%), weeds have the ability to decrease agricultural productivity by 34%, making them the hazardous pest with the greatest potential to reduce crop yields (Abbas *et al*., 2018). Weed infestations in rice fields may lower rice output by up to 16–48% for *aman* rice (IRRI, 1998). Grain output reduction may vary from nation to nation. Koch, (1992) reported that weeds often cause output losses of 25% and 5%, respectively, in developing and developed countries. In Bangladesh, weed invasions decreased seed yields up to 30-40% in T. *aman* rice (BRRI, 2008). Weed hinders the development, productivity, and quality of crops through the competition for different environmental assets like sunshine, moisture, land, and nutrients (Ashiq and Aslam, 2014; Rao, 2000). The majority of Bangladeshi farmers use time and labor intensive conventional weeding techniques such as manual hand weeding with nirani, or mechanical weeding with rice weeders). Due to the labor shortage during the peak season, these procedures has currently become a challenging task and ultimately minimize significant amount of yield (Hasanuzzaman *et al.,* 2009; Rashid *et al.,* 2007). As a result, rice growers of Bangladesh are encouraged to utilize herbicide-based weed management methods due to their quick results in controlling weeds, affordability, minimum time investment, and better cost-effectiveness. Hence, the country as a whole has experienced a 37-times rise in the usage of herbicides during the last 30 years (BBS, 2017). However, prolonged application of similar weedicides may cause environmental risks, the evolution of weedicide-tolerant weeds, and changes in weed vegetation (Aktar *et al.*, 2009; Holt, 1994). Despite these undesirable side effects, there is currently no practical alternative to rice's chemical reliance on weed management. According to recent studies (Mahajan *et al.,* 2009; Chauhan and Johnson, 2011; Anwar *et al.,* 2012) herbicide-based weed management approaches are currently regarded as a potential substitute for or addition to conventional weeding. However, early flushes of weed can be controlled by pre-emergence herbicide and the late flushes can be controlled by post-emergence herbicides. Besides, *aman* season generally experiences heavy rainfall, and water depth has a strong impact on weed flora. Begum et al. (2006) stated that longer exposure to greater water depths exerted a higher antagonistic impact on both weed species' emergence and development. In this backdrop, the recent investigation included single spray of pre-emergence and post-emergence herbicide. Moreover, efficient weed management techniques should be used in order to maximize grain yield by increasing optimal crop growth and reducing crop-weed competition. Therefore, the investigation was designed to assess how various herbicide-based weed control techniques influenced the weed profile, and crop production of T. *aman* rice varieties.

## MATERIALS AND METHODS

### Study Location

The study was performed from June to December 2016 at the Agronomy Field Laboratory of Bangladesh Agricultural University at Mymensingh (Figure 1). Location of study is under Agro-ecological Zone-9 (Old Brahmaputra Floodplain). The experimental soil was composed of non-calcareous darkish gray alluvial sediments. The soil of the area was medium high having pH of 6.5, silty-loam texture, and included 20% sands, 67% silt, and 13% clay. The land's bulk density is 1.35 g $cm^{-3}$, and its organic matter content is only 1.96%. (Islam et al. 2017). During summer, the area was subjected to elevated temperatures, higher humid condition, heavier precipitation, and sporadic gusts of wind; it was sparsely rained upon and a little bit chilly during winter.

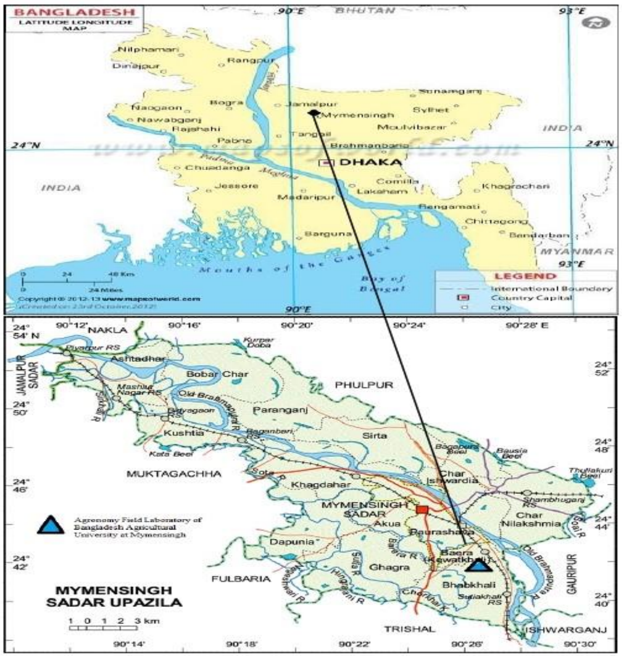


Figure 1. Research site revealing Bangladesh Agricultural University, Mymensingh and Bangladesh (Source: Banglapedia and mapofworld.com)

### Designs and Treatments

The study was carried out in the combination of four *aman* cultivars *viz*., BRRI dhan34, BRRI dhan49 and BRRI dhan52, and four herbicide practices viz. control, pre-emergence, early post emergence as well as post emergence. Here, pre-emergence herbicide (butachlor 5G @ 25 kg $ha^{-1}$) was treated towards all intended sites at six days following transplanting (DAT), early post-emergence pretilachor @ 1 liter $ha^{-1}$ at 15 DAT, and post-emergence herbicide (pyrazosulfuron ethyl @ 150 g $ha^{-1}$) was sprayed on the fields at 25 DAT. Table 1 gives an concise overview about various herbicides applied under the investigation. The study was set up using a randomized complete block design (RCBD) with three trials.

**Table 1.** An overview shows different herbicide utilized during research trial.

| Trade name | Generic name | Mode of action | Selectivity | Application period | Merchandiser | Manufactured by |
|---|---|---|---|---|---|---|
| Ravchlor 5G | Butachlor | Systemic | Selective for rice weeds | Pre–emergence | Raven Agro Chemical Limited | Kunshun Sinovid Tech. Co. Ltd) |
| Superhit 500 EC | Pretilachor | Systemic | Selective for rice weeds | Early post–Emergence | Haychem (Bangladesh Limited) | Shanghai Bosman Industrial Co. Ltd). |
| Herbikil 10 WP | Pyrazosulfu-ron-ethyl | Systemic | Selective for rice weeds | Post-emergence | Haychem (Bangladesh Ltd.) | Reful Holding Co. Ltd. China |

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**Crop Management**

Bangladsh Rice Research Institute (BRRI), Gaziur provided the grains for BRRI dhan34, BRRI dhan49, and BRRI dhan52 varieties. Germinated grains of studied cultivars were broadcasted in wet nursery bed separately. Seedlings were raised with proper care. Thirty days old rice pants were transferred to the main plot on 26 July 2016. Excluding urea (rate: 150 kg ha$^{-1}$), all other fertilizers such as TSP @ 97, MoP @ 70, gypsum @ 60 and zinc sulphate @ 12 kg ha$^{-1}$ were broadcasted at the end of land cultivation. At 30, 50, and 70 days following transplantation, urea was broadcasted in three equal amounts. Using a spacing of 25 cm × 15 cm, three seedlings per hill were transplanted as per layout. Due to the ample precipitation, rice was produced as a rain-fed crop. All agronomic practices were done as per requirement.

**Data Collection and Statistical Analysis**

Following the procedure outlined by Cruz et al., (1986) data on weed density were gathered per plot at 30 DAT and 60 DAT by utilizing 0.25 m$^2$ quadrate. The weed flora collected from the study area was identified and their summed dominance ratio (SDR) was determined with the equation below.

$$SDR = \frac{RD + RDW}{2} \times 100$$

Where SDR= Summed dominance ratio, RD = Relative Density, RDW = Relative Dry Weight

The following equation was employed to compute RDW:

$$RWD = \frac{\text{Weight of a given oven dried weed species}}{\text{Weight of all oven dried weed species}} \times 100$$

RD was estimated by the equation below:

$$RD = \frac{\text{Density of individual weed species in the community}}{\text{Total density of all the weed species in the community}} \times 100$$

Five plants (other than boundary plants) were chosen randomly from each plot and uprooted before harvest in order to record the yield contributing data in accordance with Ray *et al.*, (2015). Pedal threshers were used to collect and thresh the crops from each plot's center one square meter section. After cleaning, the grains were exposed to sunlight for drying. The grain weight was corrected to 14% moisture content (MC) with the equation below.

$$MC\ \% = \frac{\text{Fresh weight} - \text{Oven dry weight}}{\text{Fresh weight}} \times 100$$

$$\text{Corrected yield at 14\% MC} = \frac{\text{Fresh weight} \times (100 - MC\%)}{100 - 14} \times 100$$

Harvest index (HI) was determined with the following equation:

$$HI\ (\%) = \frac{\text{Grain yield (t/ha)}}{\text{Biological yield (t/ha)}} \times 100$$

The software program MSTAT-C was employed to perform the analysis of variance (ANOVA). Duncan's Multiple Range Test was utilized to estimate the average deviations among the treatments (Gomez and Gomez, 1984).

## RESULTS AND DISCUSSIONS

**Weed Composition**

The study area was overrun by a naturally occurring weeds population that includes grass, broad-leaved, and sedge weeds. Table 2 displays weeds appearance at research sites. Ten weeds types (four sedges, four broadleaves, and two grasses) comprising five families were present within my study site. The grass weed *Echinochloa crusgalli* (SDR: 42.50%) and broadleaf weed *Monochoria hastate* (SDR: 25.1%) were the most predominant weeds in T. *aman* rice in this particular research area. On the other side, *Scirpus mucronatus*, a sedge weed, had the lowest (0.81%) SDR of all the dominant weed species, followed by *Cyperus esculentus* (0.97%) (Table 2). Both Islam et al. (2018) and Popy et al. (2017) found *Echinochloa crusgalli* and *Monochoria hastate* as the most predominant weeds in the same location. Normally, environmental factors, weed seed bank, weed suppression techniques and farming strategy in former crop plants, and crop rotation mostly determine the weed community of a field (Anwar et al. 2013).

**Table 2.** Weeds identified in research plots of T. *aman* rice

| Scientific name | Family name | Morphological type | SDR (%) |
|---|---|---|---|
| *Echinochloa crusgalli* | Poaceae | Annual grass | 42.50 |
| *Monoochoria hastate* | Pontederiaceae | Annual broadleaf | 25.06 |
| *Fimbristylis miliacea* | Cyperaceae | Annual sedge | 7.61 |
| *Cyperus difformis* | Cyperaceae | Annual sedge | 6.56 |
| *Digitaria sanguinalis* | Poaceae | Annual grass | 5.45 |
| *Oxalis europaea* | Oxalidaceae | Annual broadleaf | 4.94 |
| *Panicum repens* | Poaceae | Perennial grass | 4.52 |
| *Ludwigia hyssopifolia* | Onagraceae | Annual broadleaf | 1.58 |
| *Cyperus esculentus* | Cyperaceae | Perennial sedge | 0.97 |
| *Scirpus mucronatus* | Cyperaceae | Perennial sedge | 0.81 |

**Weed Density and Biomass**

Herbicide had a significant impact on the weeds density (no. m$^{-2}$). The maximum weed population (99.33 m$^{-2}$ at 30 DAT and 172.43 m$^{-2}$ DAT) had been observed at control, whereas the least weed population (13.22m$^{-2}$ at 30 DAT and 18.22 m$^{-2}$ at 60 DAT) has been reported in the post-

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emergence (Table 3). Rekha et al. (2003) similarly noted that weeds densities were reduced under all weeds control approaches in comparison to the control field. Various herbicide' influence upon weed suppression had a substantial impact on biomass of various weeds species.

**Table 3.** Impact of herbicide on weed density and biomass

| Treatments | Weed density (no. $m^{-2}$) | | Weed dry mass (g $m^{-2}$) | |
|---|---|---|---|---|
| | 30 DAT | 60 DAT | 30 DAT | 60 DAT |
| Control | 99.33 | 172.43 | 43.29 | 135.72 |
| Pre-emergence | 55.67 | 78.66 | 23.74 | 55.69 |
| Early post-emergence | 35.55 | 53.99 | 15.02 | 37.90 |
| Post- emergence | 13.22 | 18.90 | 5.52 | 13.43 |

The post-emergence had the least weeds biomass (5.52 g $m^{-2}$ at 30 DAT and 13.43 g $m^{-2}$ at 60 DAT), whereas the control had the maximum weeds biomass (43.29 g $m^{-2}$ at 30 DAT, 135.72 g $m^{-2}$ at 60 DAT) (Table 3). According to Hia et al. (2017), the post-emergence herbicide showed the best weed control efficacy compared to others. Weed density and biomass at the early crop's growth phases had greater importance compared to the subsequent stages (Bedmar et al. 1999; Popy et al. 2017). Numerous studies have revealed that the timeframe of weed species' emergence is crucial (Singh et al. 2017; Ciuberkis et al. 2007). (Popy et al. 2017) documented that appearance of weeds at the same time as or soon after crop emergence severely reduce yields even at minimal density. As a result, post-emergence herbicide application is the most efficient weed management approach since it successfully suppresses weeds at initial stages of crop establishment.

## Yielding Characters

Rice variety, herbicide and their interaction all had a substantial impact upon number of effective tillers hill$^{-1}$ (ETH), grain number panicle$^{-1}$ (GP) and 1000-seed weight (TSW) except panicle length (PL) (Table 4, 5 and 6). PL considerably controlled only by rice variety. BRRI dhan49 had the highest effective tiller hill$^{-1}$ (9.47), while BRRI dhan34 had the lowest effective tiller hill$^{-1}$ (8.28) which is substantially similar to BRRI dhan52 (8.36) (Table 4). Ferdous et al. (2016) demonstrated that the substantial variation on number of productive tillers hill$^{-1}$ among the cultivars. Post-emergence herbicide produced the best ETH (10.21) compared to early post emergence (ETH: 8.58). Control had the least number of productive tiller hill$^{-1}$ (7.53) (Table 5). Control treatment had the fewest effective tiller hills$^{-1}$ because of intense crop-weed competition, whereas the post-emergence herbicide treatment had the greatest ETH because of minimal crop-weed competition. Weed management decreased the competitiveness between crops as well as weeds which facilitates crop plants to uptake available resources, such as moisture, nutrients, and sunlight effectively to develop higher tillers. The greatest ETH (11.6) was yielded from the interaction effect of BRRI dhan49 and post-emergence herbicide. Whereas, BRRI dhan49 with pre-emergence herbicide produced the second greatest ETH which was substantially similar with ETH achieved from BRRI dhan52 with post-emergence (9.56), and BRRI dhan34 with post-emergence herbicide (9.40). The BRRI dhan34 provided the largest panicle (24.64 cm), while the BRRI dhan52 produced the shortest panicle (22.22 cm) (Table 4). Additionally, Sarkar *et al.*, (2014) revealed that BRRI dhan34 had longer panicles than BRRI dhan49 and BRRI dhan52. Herbicide and its interactions with cultivar had no substantial effects on panicle length (Table 5 and 6). The genetic makeup among the varieties is what causes variance in panicle length (Ifftikhar *et al.*, 2009). The greatest (163.6) GP was obtained from BRRI dhan34, while the least value (104.3) was obtained from BBRI dhan52 which was identical with BRRI dhan49 (109.7) (Table 4). Additionally, Sarkar et al. (2014) noticed that there were variances in GP of varieties. Variance in their genetic make-up may be the cause of substantial fluctuation on GP. The post emergence treatment had the greatest GP (133.8) which appeared quantitatively equivalent to early post-emergence herbicide treatment (129.1). In control, the fewest grains panicle$^{-1}$ (117.5) were recorded (Table 5). Both Paul et al. (2014) and Khan et al. (2017) found similar findings. Experts claimed, as rice grown in weed-free conditions, generated the most seeds panicle$^{-1}$. The interaction among cultivars and weed management practices had no substantial impact on number of seeds panicle$^{-1}$ (Table 6). BRRI dhan52 generated thousand seed weight with the maximum values (23.08 g), whereas the least weight (11.52 g) was produced by BRRI dhan34 (Table 4). The variances in grain size between cultivars may be the cause of the variations in 1000-seed weight (TSW). Baloch et al. (2002) and Saha et al. (2015) also noticed the variation in the weight of thousand seeds among the varieties. The highest value (19.73 g) of TSW was observed in post emergence treatment. In a weedy plot, the lowest 1000-seed weight (18.20 g) was determined. Khan et al. (2017) showed that no weeding considerably decreased the weight of 1000 seeds. The interaction effect of variety and herbicide application had substantial impact on the TSW (Table 6). The maximum TSW was achieved in BRRI dhan52 with post-emergence application (23.36 g) while that of the least value was recorded in BRRI dhan34 with control (11.03 g).

## Grain and Straw Yield

Rice varieties, several herbicide treatments as well as their combination all had significant impact on the yield of T. *aman* (Table 06). BRRI dhan49 had the maximum rice output (3.88 t ha$^{-1}$), while BRRI dhan34 recorded the least rice output (2.47 t ha$^{-1}$). (Islam et al. 2012, Tyeb et al. 2013) reported equivalent conclusions and also suggested that cultivar provided substantial influence on rice output and their attributes as well. Similarly, Yoshida (1994) and Siddeque et al. (2002) recorded a substantial difference in seed output induced by cultivars. The post emergence treatment was reported to produce the maximum seed output (4.25 t ha$^{-1}$) compared to the early post-emergence herbicides (3.81 t ha$^{-1}$). Due to maximum production of

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effective tillers hill$^{-1}$ provided the maximum yield in this treatment. Treatment control produced the least grain output (2.66 t ha$^{-1}$) (Table 5). As per Mahajan and Chauhan (2015), there is an extremely confined timeframe of applying pre-emergence herbicide, and farmers occasionally fail to apply it at the ideal moment. Therefore, post-emergence herbicide was applied in succession rather than one at a time offering better weed control over late flushes (Mahajan and Chauhan, 2013). The greatest straw output (5.12 t ha$^{-1}$) was yielded from BRRI dhan49, but BRRI dhan34 provided the least straw output (3.98 t ha$^{-1}$). The Post emergence treatment produced the greatest straw output (5.41 t ha$^{-1}$), while the control plot produced the least straw output (3.79 t ha$^{-1}$). The interaction between cultivars and herbicide produced substantial impact upon grain as well as straw output (Table 6). BRRI dhan49 with post emergence herbicide produced the maximum grains and straw output 4.80 t ha$^{-1}$ and 5.92 t ha$^{-1}$, respectively, whereas BRRI dhan49 with early post-emergence ranked second in producing seed and straw output compared to pre-emergence herbicide with BRRI dhan49. The possible cause of this result would be that the presence of abundant rain water in crop land before spraying of herbicides might suppress weeds' establishment at the early growing period. The least value of seed and straw output was recorded in control with BRRI dhan34 as weed flora rendered a strong competition throughout the season.

### Harvest Index

Herbicide-based management had a significant influence on harvest index (HI), whereas rice cultivars and their interactions had no such influence (Table 4, 5 and 6). BRRI dhan52 produced the highest (43.02%) harvest index, while BRRI dhan34 had the lowest harvest index (42.65%) (Table 4). Post emergence herbicide resulted in the greatest HI (43.87 %) that indicated numerically identical to early post emergence (43.49 %). In a control plot, the harvest index was found to be the minimum (41.19%) (Table 5). The combination of variety and weed treatment had no substantial impact on harvest index (Table 6). Similar results found in Islam et al. (2018).

**Table 4.** Influence of cultivar upon yield as well as on yield attributes of T. *aman* rice

| Cultivar | Productive tiller hill$^{-1}$ | Panicle length (cm) | Seeds panicle$^{-1}$ | 1000-seed weight | Seed yield (t ha$^{-1}$) | Straw yield (t ha$^{-1}$) | Harvest index (%) |
|---|---|---|---|---|---|---|---|
| BRRI dhan34 | 8.28b | 24.64a | 163.6a | 11.52c | 2.97c | 3.98c | 42.65 |
| BRRI dhan49 | 9.47a | 21.83b | 109.7b | 22.07b | 3.88a | 5.12a | 42.92 |
| BRRI dhan52 | 8.36b | 22.22b | 104.3c | 23.08a | 3.64b | 4.78b | 43.02 |
| Significant levels | ** | ** | ** | ** | ** | ** | NS |
| CV (%) | 4.00 | 4.75 | 3.07 | 4.92 | 3.27 | 3.58 | 3.62 |

Figures in a column having, identical letters (s) may never significantly differ at 1% probability levels according to DMRT, NS = Not significant

**Table 5.** Impact of herbicide upon yield and yield attributes of T. *aman* rice

| Herbicides application | Productive tillers hill$^{-1}$ (no.) | Panicle length (cm) | Seed panicle$^{-1}$ (no.) | 1000-grain weight (g) | Grain output (t ha$^{-1}$) | Straw output (t ha$^{-1}$) | Biological yield (t ha$^{-1}$) | Harvest index (%) |
|---|---|---|---|---|---|---|---|---|
| Control | 7.53c | 22.12b | 117.5d | 18.20b | 2.66d | 3.79d | 6.45d | 41.19b |
| Pre emergence | 8.49b | 22.65b | 123.0c | 18.58b | 3.27c | 4.38c | 7.65c | 42.80a |
| Early post emergence | 8.58b | 23.04ab | 129.1b | 19.05ab | 3.81b | 4.92b | 8.74b | 43.59a |
| Post emergence | 10.21a | 23.77a | 133.8a | 19.73a | 4.25a | 5.41a | 9.66a | 43.87a |
| Significant levels | ** | ** | ** | ** | ** | ** | ** | ** |
| CV (%) | 4.00 | 8.91 | 4.75 | 9.69 | 3.27 | 4.92 | 3.58 | 3.91 |

According to DMRT, results within the sheet having identical letters counts may never fluctuate noticeably from one other, however records using different letters parameter do. NS = non-significant, and ** = significance with the 1% degree of incidence.

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**Table 6.** Interaction effects of cultivar and herbicide application upon yield and yield attributes of T. *aman* rice

| Interaction Variety × Herbicide | | Effective tillers hill$^{-1}$ (no.) | Panicle length (cm) | Grains panicle$^{-1}$ (no.) | 1000-grain weight (g) | Grain output (t ha$^{-1}$) | Straw output (t ha$^{-1}$) | Harvest index (%) |
|---|---|---|---|---|---|---|---|---|
| BRRI dhan34 | Control | 7.40fg | 23.98 | 149.5d | 11.03 | 2.35j | 3.40i | 40.87 |
| | Pre-emergence | 7.93ef | 24.45 | 115.4 e | 11.33 | 2.90h | 3.72h | 43.80 |
| | Early post-emergence | 8.40cde | 24.92 | 110.2ef | 11.53 | 3.15fg | 4.13g | 43.28 |
| | Post emergence | 9.40b | 25.20 | 161.1c | 12.21 | 3.48e | 4.68e | 42.67 |
| BRRI dhan49 | Control | 8.00def | 21.25 | 104.4fgh | 20.97 | 2.97gh | 4.22fg | 41.33 |
| | Pre-emergence | 9.60b | 21.48 | 107.4fg | 21.30 | 3.68d | 4.96d | 42.60 |
| | Early post-emergence | 8.60cd | 22.02 | 111.6ef | 22.37 | 4.46b | 5.38bc | 42.98 |
| | Post emergence | 11.6a | 22.56 | 175.8a | 23.63 | 4.80a | 5.92a | 44.77 |
| BRRI dhan52 | Control | 7.20g | 21.12 | 98.67h | 22.60 | 2.65i | 3.75h | 41.37 |
| | Pre-emergence | 7.93ef | 22.03 | 100.6gh | 23.10 | 3.23f | 4.46ef | 42.00 |
| | Early post-emergence | 8.73c | 22.16 | 107.8f | 23.24 | 4.23c | 5.27c | 44.53 |
| | Post emergence | 9.56b | 23.57 | 168.0b | 23.36 | 4.06c | 5.63b | 44.18 |
| Level of significance | | ** | NS | * | NS | ** | ** | NS |
| CV (%) | | 4.00 | 4.75 | 3.07 | 4.92 | 3.27 | 3.58 | 3.62 |

According to DMRT, over the 1% level of certainty, values inside a table with a similar symbol (s) may not substantially difference among themselves.

## CONCLUSION

Weed management is still a challenging task regarding sustainable agricultural production. This is also true for T. *aman* rice because it is considered as one of the causes of grain yield reduction. The present study revealed that BRRI dhan49 produced the maximum grain yield compared to BRRI dhan52 and BRRI dhan34. Among the herbicide-based weed management approaches, post emergence herbicide produced the best seed yield followed by early post emergence. From the interaction of cultivar and weed management treatments it was revealed that BRRI dhan49 with post emergence produced the greatest seed yield followed by BRRI dhan49 with early post emergence. So, it may be concluded that BRRI dhan49 could be grown with the post emergence herbicides to achieve the maximum T. *aman* rice yields.

### Conflict of Interest

The researchers reveal that there are no competing interests.

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