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# Effect of shade of different trees on growth and yield of aman rice

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**Abstract**: A field experiment was conducted at the Agroforestry Farm, Department of Agroforestry, Bangladesh Agricultural University, Mymensingh during July 2010 to November 2010 to find out the effect of shading times(i.e. morning shade, noon shade, afternoon shade and shade free) of different trees (Akashmoni, Eucalyptus and Jhau) on growth and yield of transplanted aman rice (cv. BRRI dhan 30). Highest plant height of rice (126.667 cm) and lowest 1000- grain weight (21.247 g) and grain yield of rice (2.967 t $ha^{-1}$) was observed in the noon shade area of Akashmoni. Highest 1000-grain weight (35.363 g) and grain yield (6.197 t $ha^{-1}$) of rice was found in shade free area of Jhau which was statistically similar to grain yield (5.232 t $ha^{-1}$) in the afternoon shade area of Jhau. Biological yield of rice was found lowest (6.877 t $ha^{-1}$) in the noon shade area of Akashmoni; where highest (13-397 $tha^{-1}$) was observed on the shade free area of Jhau. Lowest grain yield reduction and maximum grain yield was found in the shade free area of Jhau which was statistically similar to grain yield in the afternoon shade area of Jhau. So, in consideration of shade casted by different trees, Jhau-Aman rice based system is found more suitable than Akashmoni and Eucalyptus tree rice based agroforestry system.
**Key words:** Yield, aman rice, shade.

## Introduction

Rice *(Oryza sativa L.)* is the principle food of Bangladesh and it is the world's second important food grain. It is grown worldwide on 150 million hectares (ha) with the total production of about 563 million tons of unmilled rough rice (FAO, 1999). Bangladesh is not only a rice growing country but also has a rice-eating people. It is the forth-largest country in the world with respect to rice area and production (IRRI, 2000). Rice is cultivated in Bangladesh throughout the year as aus, aman and boro. Among these transplanted aman is the most important and occupies about 46.30% of the total rice cultivated area. Agroforestry has been a collective term for land-use systems and practices in which woody perennials are deliberately integrated with crops and/or animals on the same land-management unit, either in a spatial mixture or a temporal sequence. The trees in agroforestry practices generally fulfill multiple purposes, involving the protection of the soil or improvement of its fertility, as well as the production of one or more products (Cooper *et al.* 1996). The domestication of these agroforestry trees should enhance their capacity to fulfill either or both of these service or production functions.

It is believed that tree shade is responsible for poor yields of associated crops except those loving shade or tolerant shade condition. This problem is more acute when the tree remains unpruned. Shade has pronounced effect on the growth of rice. It influences to increase plant height, decreases tiller and panicle number $hill^{-1}$ and grains $panicle^{-1}$ and decreases grain yield. Shade stimulates cellular expansion and rapid cell division resulting increase leaf length and plant height (Schoch, 1972). Shading treatment showed the tallest plants and on the other hand, smallest plants are observed under shade free area (Miah *et al*. 1999). Less yield of rice near the boundary plantation trees might be due to shading effect of trees. Again the trees compete with crop for water and nutrient also. Keeping this view in mind the research has been under taken to evaluate the shading effect (morning, noon, after noon) of trees such as Akashmoni, Eucalyptus and Jhau on the growth and yield of Aman rice (cv. BRRI dhan 30).

## Materials and Methods

The experiment was carried out at the experimental farm, Department of Agroforestry, Bangladesh Agricultural University, Mymensingh during the period from 1 July, 2010 to 30 November, 2010. The place is geographically located at about 24°75" North latitude and 90°50' East longitudes (Khan, 1997). The topography of the field was medium high land above flood level belonging to the Old Brahamaputra Floodplain, Agro Ecological Zone-9 (UNDP and FAO, 1988). It is characterized by non calcareous dark grey flood plain soil having pH value from 6.5 to 6.8 and the soil texture is silty loam.

The experiment was designed to study the shading effect of different tree species on the rice yield in Aman season. Two factor RCBD design was followed with three replications. Two factors i.e. different shading times (i.e. morning shade, noon shade, afternoon shade and shade free) and different tree species (Akashmoni, Eucalyptus and Jhau) were included in the study. The unit plot size was 1.5mx1.5 m ($2.25m^2$). Before transplanting, the land was well pulverized by spading and fertilized by using fertilizer rate 180 kg/ha Urea, 100 kg/ha TSP, 70 kg/ha MP and 5-7 ton cow dung, respectively. Urea fertilizer was used 3 times in equal portion $1^{st}$ application during final land preparation, $2^{nd}$ application 15 DAT and finally 45 DAT in top dressing method followed by irrigation. Seeds of rice were sown in the wet nursery bed on 1 July 2010 and transplanted in main plots on 10 August 2010. After transplanting necessary intercultural operations (weeding, irrigation and pesticide applications) were done accordingly. At each sampling, ten selected hills from each treatment i.e. ten hills from each shading condition and ten hills from shade free area under each trees were up-rooted from each unit plot for recording different data. Plant height, number of tillers $hill^{-1}$ and number of leaves $hill^{-1}$ were counted at vegetative stage and the data on plant height, number of effective tillers $hill^{-1}$, number of non-effective tillers $hill^{-1}$, number of panicle $hill^{-1}$, panicle length, filled grain $panicle^{-1}$, unfilled grain $panicle^{-1}$, panicle weight (g), straw weight (g), 1000 grains weight (g), grain yield, straw yield (t $ha^{-1}$), biological yield (t $ha^{-1}$) and

harvest index were recorded at final harvest. The data were analyzed statistically and means were adjudged by Duncan's Multiple Range Test (DMRT).

## Results and Discussion

**Effect of trees on yield contributing characters:** Plant height, total no. of tillers/hill, no. of effective tillers/hill and grains / panicle of rice was significantly affected by different trees. Highest plant height (120.417 cm) was found under Akashmoni tree and highest total no. of tillers/hill (10.833), no. of effective tillers/hill (10.667) and grains / panicle (172.333) was recorded under Jhau tree (Table 1). No significant variation was observed in case of no. of non effective tillers/hill, panicle length and sterile spikelets / panicle due to effect of different trees. Highest no. of non effective tillers/hill (0.250) and sterile spikelets / panicle (18.417) were found under Akashmoni tree and highest panicle length (25.083 cm) was found under Jhau tree. Lowest non effective tillers/hill (0.667) and sterile spikelets/ panicle (13.417) were found under Jhau tree.

**Table 1.** Effect of different trees on yield contributing characters of Aman rice (BRRI dhan 30)

| Tree species | Plant height (cm) | Total no. of tillers/hill | No. of effective tillers/hill | No. of non effective tillers/hill | Panicle length(cm) | Grains / Panicle | Sterile spikelets / panicle |
|---|---|---|---|---|---|---|---|
| $T_1$ (Akashmoni) | 120.417 a | 9.500 b | 9.250 b | 0.250 | 24.250 | 157.583 b | 18.417 |
| $T_2$ (Eucalyptus) | 116.500 b | 10.417 a | 10.000 a | 0.167 | 24.667 | 162.000 ab | 16.417 |
| $T_3$ (Jhau) | 118.583 ab | 10.833 a | 10.667 a | 0.667 | 25.083 | 172.333 a | 13.417 |
| CV (%) | 2.94 | 9.49 | 7.94 | 26.78 | 6.34 | 9.52 | 24.98 |
| Level of significance | ** | * | ** | NS | NS | * | NS |

* = 5% level of significance, ** = 1% level of significance and, NS = Non significant

**Table 2.** Effect of different trees on yield of Aman rice (BRRI dhan 30)

| Tree species | 1000 grain weight (g) | Grain yield (t/ha) | Straw yield (t/ha) | Biological yield (t/ha) | Harvest index (%) |
|---|---|---|---|---|---|
| $T_1$ (Akashmoni) | 25.455 b | 3.834 c | 4.892 c | 8.726 bc | 43.049 ab |
| $T_2$ (Eucalyptus) | 25.783 b | 4.213 b | 5.774 b | 9.987 b | 41.723 b |
| $T_3$ (Jhau) | 27.530 a | 4.748 a | 6.201 a | 10.949 a | 43.790 a |
| CV (%) | 4.04 | 7.65 | 6.62 | 6.86 | 2.04 |
| Level of significance | * | * | * | * | * |

- = 5% level of significance

**Table 3.** Effect of different shading times on yield contributing characters of Aman rice (BRRI dhan 30)

| **Shading times** | Plant height (cm) | Total no. of tillers/hill | No. of effective tillers/hill | No. of non effective tillers/hill | Panicle length (cm) | Grains / Panicle | Sterile spikelets / panicle |
|---|---|---|---|---|---|---|---|
| $L_0$ (Control) | 113.333 b | 11.778 a | 11.556 a | 0.000 | 28.778 a | 211.444 a | 10.222c |
| $L_1$(Morning shade) | 121.556 a | 9.556 c | 9.222 c | 0.333 | 24.556 b | 148.778 c | 13.000 bc |
| $L_2$(Noon shade) | 116.222 b | 9.111 c | 8.556 c | 0.222 | 21.556 c | 131.778 d | 22.111 a |
| $L_3$(Afternoon shade) | 122.889 a | 10.556 b | 10.556 b | 0.222 | 23.778 a | 163.889 b | 16.333 b |
| CV (%) | 2.94 | 9.49 | 7.94 | 26.78 | 6.34 | 9.52 | 24.98 |
| Level of significance | * | * | ** | NS | * | * | * |

* = 5% level of significance, ** = 1% level of significance and, NS = Non significant

**Table 4.** Effect of different shading times on yield of Aman rice (BRRI dhan 30)

| Shading times | 1000 grain weight (g) | Grain yield (t/ha) | Straw yield (t/ha) | Biological yield (t/ha) | Harvest index (%) |
|---|---|---|---|---|---|
| $L_0$ (Control) | 33.360 a | 5.746 a | 6.894 a | 12.640 a | 45.433 a |
| $L_1$(Morning shade) | 23.451 c | 3.652 c | 4.988 c | 8.640 c | 42.353 b |
| $L_2$(Noon shade) | 22.527 c | 3.400 c | 4.997 c | 8.397 c | 40.547 c |
| $L_3$(Afternoon shade) | 25.687 b | 4.263 b | 5.610 b | 9.873 b | 43.082 ab |
| CV (%) | 4.04 | 7.65 | 6.62 | 6.86 | 2.04 |
| Level of significance | * | * | * | * | * |

* = 5% level of significance

**Effect of trees on yield:** 1000 grain weight, grain yield, straw yield, biological yield and harvest index of rice was significantly affected by different trees (Akashmoni, Eucalyptus and Jhau) due to interaction between tree and rice. Highest 1000 grain weight (27.530g), grain yield (4.748 t/ha), straw yield (6.201 t/ha), biological yield (10.949 t/ha) and harvest index (43.790%) was recorded under Jhau tree (Table 2). It might be due to small canopy of Jhau which facilitate higher amount of penetrating sunlight for rice under Jhau tree and sunlight is the only source that provides energy for photosynthesis, which ultimately help to get good yield of rice. Lowest yield of rice was found under Akashmoni tree (Table 2).

**Effect of shade on yield contributing characters:** Plant height, total no. of tillers/hill, no. of effective tillers/hill, panicle length, sterile spikelets / panicle and grains / panicle of rice was significantly affected by different shading times. Highest plant height (122.889 cm) was found under afternoon shade and highest total no. of tillers/hill (11.778), no. of effective tillers/hill (11.556), panicle length (28.778 cm) and grains / panicle (211.444) was obtained under shade free area (Table 3). No significant response was observed in case of no. of non effective tillers / hill due to effect of different shading times. Highest no. of non effective tillers/hill (0.333) was found under morning shade. Lowest total no. of tillers/hill (9.111), no. of effective tillers/hill (8.556), panicle length (21.556 cm) and grains / panicle (131.778) were found under noon shade (Table 3). Lowest no. of non effective tillers/hill (0.222) and sterile spikelets / panicle (10.222) were recorded under control (shade free condition).

**Effect of shade on yield:** 1000 grain weight, grain yield, straw yield, biological yield and harvest index of rice was significantly affected by different shading times (Morning, noon and afternoon shade). Highest 1000 grain weight (33.360 g), grain yield (5.746 t/ha), straw yield (6.894 t/ha), biological yield (12.640 t/ha) and harvest index (45.433%) was recorded under control i.e., shade free condition (Table 4) because shade free condition provide sufficient sunshine intensity for photosynthesis which lead good grain filling, subsequently good yield. Lowest 1000 grain weight (22.527 g), grain yield (3.400 t/ha), biological yield (8.397 t/ha) and harvest index (40.547%) of rice was found under noon shade and lowest straw yield (4.988 t/ha) was recorded under morning shade (Table 4). Yield of rice produced in the shade area was lower compare to shade free area (Table 4). The reason of lesser yield under shade condition might be due to shortfall of required assimilates for grains which resulted from lesser or no photosynthesis.

**Interaction effect of trees and shading times**

**Plant height:** Highly significant response was observed in case of plant height during harvest due to shading effect of different tree species. Rice plant height varied significantly due to different trees and shading times (morning shade, noon shade, afternoon shade and shade free area). In case of all trees, highest rice plant height (126.667 cm) was recorded in the noon shade area under Akashmoni which was statistically dissimilar to other treatments. Under Eucalyptus tree, rice plant grown in the noon shade area possessed lesser height (112.000cm) than rice grown in other shade condition (Table 5). Plant height of rice grown under Jhau was lowest (111.000 cm) in the shade free area.

**Total number of tillers hill$^{-1}$:** Number of total tillers hill$^{-1}$ means the sum total of effective tillers and non bearing tillers. Results revealed that total tillers hill$^{-1}$ was not significantly affected by the shading times (morning shade, noon shade, afternoon shade and shade free area). The highest number of total tillers hill$^{-1}$ (12.667) was found in the shade free area of Jhau. The lowest number of total tillers hill$^{-1}$ (8.667) was found in the morning and noon shade area of Akashmoni.

**Number of effective tillers hill$^{-1}$**: Effective tillers hill$^{-1}$ was found higher (12.333) under shade free area of Jhau and lower (8.000) in the noon shade area of Akashmoni. Effective tillers hill$^{-1}$ of rice grown under Eucalyptus was highest (11.667) in the shade free area and was lowest (8.333) in the noon shade area (Table 5). Sharma and Tiware (1992) reported that the vegetative parameter affected by shade.

**Number of non-effective tillers hill$^{-1}$**: Results of the study revealed that non-effective tillers hill$^{-1}$ of rice was affected non-significantly in different shading times under different trees. Nil number of non effective tillers hill$^{-1}$ was found in the afternoon shade area and shade free area of all tree species (Akashmoni, Eucalyptus and Jhau) and noon shade area of Jhau. The number of non effective tillers hill$^{-1}$ was highest (0.667) in the noon shade area of Akashmoni and Eucalyptus. Vitryakon *el al.* (1993) determined shade increase plant height and non-effective tillers, decrease tiller and panicle number hill$^{-1}$ and grains panicle$^{-1}$ and decreased grain yield.

**Panicle length:** Panicle length was non-significantly affected due to sunshine condition under different tree species. Panicle length was highest (29.667 cm) in the shade free area of Eucalyptus and was lowest (21.333 cm) in the noon shade area of Eucalyptus. Baevre (1990) reported that reducing incoming light by 30 and 60% resulted in significant reductions in the number of flowers, percent fruit set, fruit size and yield.

**Grains panicle$^{-1}$**: Grains panicle$^{-1}$ varied significantly due to different shading times under different tree species. Higher grains panicle$^{-1}$ (217) was produced in the shade free area of Jhau which was statistically similar to the treatments in the shade free area of Akashmoni and Eucalyptus. Shade free condition provided sufficient sunshine intensity for assimilation, transfer assimilates to grain which lead good grain filling. This information was similar to Vitryakon *et al.* (1993). Rice produced in the noon shade area of Akashmoni possesses lower grains panicle$^{-1}$ (104.667) which was statistically dissimilar to other treatments (Table 5).

**Sterile spikelets panicle$^{-1}$**: Shading times (i.e. morning shade, noon shade, afternoon shade and shade free) under different trees had significant effect on unfilled grain panicle$^{-1}$. Shade condition produced the highest sterile spikelets panicle$^{-1}$ compared with shade free area. Insufficient sunshine intensity under

shade condition could not provide enough sunlight for photosynthesis resulted in sterile grains in the panicle. Similar information was found by Jadhav (1987). Highest sterile spikelets panicle$^{-1}$ (25.667) was recorded in the rice produced in the noon shade area of Akashmoni and the lowest sterile spikelets panicle$^{-1}$ (7.333) was recorded in the rice produced in shade free area of Jhau tree.

**1000-grian weight (g):** 1000-grain weight (g) was observed significant due to different shading times under different tree species. Lowest 1000-grain weight of rice (21.247 g) was found in the rice produced in the noon shade area of Akashmoni which was statistically similar to the treatments in the noon shade area of Eucalyptus and highest 1000-grain weight of rice (35.363 g) was observed in the rice produced in shade free area of Jhau which was statistically dissimilar to other treatments. Shukla *et al.* (2008) stated that various plant growth parameters viz., shoot length, dry weight and phosphorus (P) uptake were adversely affected by low light intensity.

**Table 5.** Interaction effect between different trees and shading times on yield contributing characters of Aman rice (BRRIdhan30)

| Tree species | Shade condition | Plant height (cm) | Total no. of tillers / hill | No. of effective tillers/hill | No. of non effective tillers/hill | Panicle length (cm) | Grains / panicle | Sterile spikelets / panicle |
|---|---|---|---|---|---|---|---|---|
| | $L_0$ (Control) | 114.667 de | 11.000 | 10.667 | 0.000 | 28.333 | 204.667 a | 13.000 bcd |
| $T_1$ | $L_1$ (Morning shade) | 120.000 bcd | 8.667 | 8.333 | 0.667 | 23.000 | 143.667 cde | 18.333 b |
| (Akashmoni) | $L_2$ (Noon shade) | 126.667 a | 8.667 | 8.000 | 0.333 | 21.667 | 104.667 f | 25.667 a |
| | $L_3$ (Afternoon shade) | 120.333 abcd | 9.667 | 9.667 | 0.000 | 24.000 | 155.000 bcd | 15.000 bc |
| | $L_0$ (Control) | 114.333 de | 11.667 | 11.667 | 0.000 | 29.667 | 212.667 a | 11.667 bcd |
| $T_2$ | $L_1$ (Morning shade) | 123.000 abc | 10.000 | 9.667 | 0.333 | 25.667 | 162.333 bcd | 18.000 b |
| (Eucalyptus) | $L_2$ (Noon shade) | 112.000 e | 9.333 | 8.333 | 0.667 | 21.333 | 119.000 ef | 23.333 a |
| | $L_3$ (Afternoon shade) | 116.667 cde | 10.667 | 10.667 | 0.000 | 23.667 | 176.333 b | 12.000 bcd |
| | $L_0$ (Control) | 111.000 e | 12.667 | 12.333 | 0.000 | 28.333 | 217.000 a | 7.333 d |
| $T_3$ | $L_1$ (Morning shade) | 121.333 abc | 10.000 | 9.667 | 0.333 | 25.000 | 165.000 bc | 15.667 bc |
| (Jhau) | $L_2$ (Noon shade) | 116.667 cde | 9.333 | 9.333 | 0.000 | 21.667 | 135.667 de | 20.333 ab |
| | $L_3$ (Afternoon shade) | 125.333 ab | 11.333 | 11.333 | 0.000 | 23.667 | 171.667 bc | 10.333 cd |
| CV (%) | | 2.94 | 9.49 | 7.94 | 26.78 | 6.34 | 9.52 | 24.98 |
| Level of significance | | ** | NS | NS | NS | NS | * | * |

* = 5% level of significance, ** = 1% level of significance and, NS = Non significant

**Table 6.** Interaction effect between different trees and shading times on yield of Aman rice (BRRI dhan 30)

| Tree species | Shade condition | 1000 grain weight (g) | Grain yield (t/ha) | Straw yield (t/ha) | Biological yield (t/ha) | Harvest index (%) |
|---|---|---|---|---|---|---|
| | $L_0$ (Control) | 31.860 b | 5.040 b | 6.090 bc | 11.130 b | 45.237 ab |
| $T_1$ | $L_1$ (Morning shade) | 23.857 ef | 3.503 de | 4.573 e | 8.077 de | 43.347 cde |
| (Akashmoni) | $L_2$ (Noon shade) | 21.247 g | 2.967 e | 3.910 f | 6.877 e | 38.910 h |
| | $L_3$ (Afternoon shade) | 24.857 def | 3.827 cd | 4.993 de | 8.820 cd | 43.343 cde |
| | $L_0$ (Control) | 32.857 b | 6.000 a | 7.393 a | 13.393 a | 44.813 abc |
| $T_2$ | $L_1$ (Morning shade) | 23.150 fg | 3.773 cd | 5.460 cd | 9.233 cd | 40.817 fg |
| (Eucalyptus) | $L_2$ (Noon shade) | 21.757 g | 2.993 e | 4.607 e | 7.600 d | 43.233 cde |
| | $L_3$ (Afternoon shade) | 25.370 cde | 4.087 cd | 5.637 bcd | 9.723 c | 41.877 ef |
| | $L_0$ (Control) | 35.363 a | 6.197 a | 7.200 a | 13.397 a | 46.250 a |
| $T_3$ | $L_1$ (Morning shade) | 25.957 cd | 4.217 c | 5.593 bcd | 9.810 c | 43.010 de |
| (Jhau) | $L_2$ (Noon shade) | 22.967 fg | 3.703 cd | 5.810 bc | 9.513 c | 39.383 gh |
| | $L_3$ (Afternoon shade) | 26.833 c | 5.232 a | 6.200 b | 11.077 b | 44.027 bcd |
| CV (%) | | 4.04 | 7.65 | 6.62 | 6.86 | 2.04 |
| Level of significance | | * | * | * | ** | * |

* = 5% level of significance, ** = 1% level of significance

**Grain yield (t ha$^{-1}$):** Grain yield of rice was significantly affected due to different types of trees for account of shading effect. Numerically the lowest grain yield of rice (2.967 t ha$^{-1}$) was produced in the noon shade area of Akashmoni and highest grain yield (6.197 t ha$^{-1}$) in the shade free area of Jhau which was statistically similar to treatments in the shade free area of Eucalyptus and afternoon shade area of Jhau (Table 6). Grain yield of rice produced in the shade area was lower compare to shade free area. The reason of lesser grain yield under shade condition might be due to shortfall of required assimilates for grains which resulted from lesser or no photosynthesis. Nazir *et al.* (1993) reported that increasing duration at shading decreased, number of fertile tillers unit$^{-1}$ area, number of grains spike$^{-1}$, 1000-grain weight, grain protein concentration and grain yield. Similarly, Jiang *et al.* (1994) reported that tree crown affected total grain yield.

**Straw yield (t ha$^{-1}$):** Straw yield varied significantly due to shading times (morning shade, noon shade,

afternoon shade and shade free area) under different trees. In case of all trees, highest straw yield (7.393 t $ha^{-1}$) was recorded in the shade free area of Eucalyptus which was statistically similar to the treatment in the shade free area of Jhau. Under Eucalyptus tree, rice plant grown in the noon shade area possessed lower straw yield (4.607 t $ha^{-1}$) than rice grown in other shade condition (Table 6). Straw yield of rice grown under Akashmoni was lowest (3.910 t $ha^{-1}$) in the noon shade area. Nayak and Murty (1980) reported that yield reduction of rice by 47, 57 and 74 per cent in 75, 50 and 25 per cent of normal light, respectively. Healey *et al.* (1998) stated that level of incident radiation reduced by 25% under shade-cloth decreased final yield and final leaf index.

**Biological yield (t $ha^{-1}$):** Biological yield (t $ha^{-1}$) of rice was significant due to shading effect of different tree species. Lowest biological yield of rice (6.887 t ha-) was observed in the noon shade area of Akashmoni and highest biological yield (13.397 t $ha^{-1}$) was found in the shade free area of Jhau which was statistically similar to treatment in the shade free area of Eucalyptus (Table 6). Ravi *et al.* (2001) determined the effect of partial shading on the yield and yield attributes of wheat cultivar intercropped with sissoo tree and found that during the crop growing period, grain yield and biological yield decreased below tree canopies

**Harvest index (%):** Harvest index is an important yield component parameter which can lead sufficient idea to biomass and their economic parts in general cereal crops. Harvest index was found significant due to different shading times under different tree species. Lowest harvest index (38.910%) was found in the rice grown in the noon shade area under Akashmoni and highest harvest index (46.250%) was found in rice grown in the shade free area of Jhau which was statistically dissimilar to other treatments. In case of Akashmoni and Eucalyptus, highest harvest index was also found in rice grown in the shade free area (Table 6).

The rice grain yield reduction was the highest in morning shade of Eucalyptus (50.11% of the shade free condition) and lowest reduction in afternoon shade area of Jhau (15.57% of the shade free condition). Comparatively higher sunshine intensity existed in the afternoon shade area of Jhau than Akashmoni and Eucalyptus due to higher amount of penetrating light. Therefore, no significant difference in sunshine intensity between afternoon shade and shade free condition of Jhau trees was observed. This leads the almost similar yield and yield components of rice in afternoon shade and shade free area under Jhau tree. So, Jhau-Aman rice is found suitable than the other Akashmoni and Eucalyptus tree rice based agroforestry system. From the above findings it may be concluded that Akashmoni-Aman rice based agroforestry system is not suitable considering growth and yield contributing characters of Aman rice.

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