

Varietal performance of transplanted aman rice under mango based agroforestry system

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Abstract: A field experiment was carried out at the agroforestry research field, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur during June to November 2012 to examine the performance of three aman rice variety under mango based agroforestry system. Three transplanted aman rice varieties viz. (Binadhan-7, BRRI dhan49 and Katari bhog) were used as test crop and the mango variety was Amropally. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The data were collected at 45, 60, and 75 DAT (days after transplanting) and finally after harvesting. Results showed significant variation among the varieties. The highest grain yield (3.66 t ha^{-1}) was found in Binadhan-7, which is followed by BRRI dhan 49 (3.41 t ha^{-1}) and the lowest grain yield (3.13 t ha^{-1}) was recorded in Katari bhog (V_3) when grown in sole crop. In case mango based production system, the highest grain yield (3.41 t ha^{-1}) was found in open condition (T_2) and the lowest grain yield (3.39 t ha^{-1}) was recorded in mango + rice production system (T_1). Finally, the grain yield (t ha^{-1}) was also influenced due to the interaction of production system and variety. The highest grain yield (3.68 t ha^{-1}) was found in sole cropping of BINadhan-7 and the lowest grain yield (3.03 t ha^{-1}) was recorded in mango+katari bhog based agroforestry system treatment combination.

Key words: Rice, aman variety, mango, agroforestry system.

Introduction

Bangladesh is one of the most densely populated countries of the world having agro based economy which situated in the North-Eastern part of south Asia with a tropical to sub-tropical climate. Now the population of Bangladesh is 15 billion in an area of 1,47,570 square kilometers (BBS, 2012a). This excessive population creates pressure on the cultivated land. The available per capita land is decreasing to an alarming rate of $0.005 \text{ ha crop}^{-1} \text{ yr}^{-1}$ (Hossain and Bari, 1996). Each year, nearly 1.94 million peoples are added to its population of about 122 millions (FAO, 1999a). Due to rapid growth of population, people migrate to forest area and are encroaching and cultivate food crops. The total forest land area of the country covers about 16.36% of the land area (BBS, 2012b). However according to forest master plan and surveys by multilateral donor agencies a total of 76,900 ha or 6% of the country land mass has actual tree coverage.

Agro-forestry has long 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 in temporal sequence. The trees in agro-forestry 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 agroforestry trees should enhance their capacity to fulfill either or both of these services or production functions. Domestication should also aim at increasing the social and economic benefits of agro-forestry through improved profitability, reduced risks and diversified sources of income to buffer against crop failure (Sanchez, 1995).

Rice (*Oryza sativa*, L.) is the principle food of Bangladesh and it is the world's second important food grain. It belongs to the family Gramineae. It is grown worldwide on 150 million hectares (ha) with the total production of about 563 million tons of unmilled rough rice (FAO, 1999b). Rice is cultivated in more than 10% of the earth arable land of the world. In Bangladesh it is cultivated throughout the year as Aush, Aman and Boro. Among these cropping, transplanted Aman is most important crop and it occupies about 46.30% of the rice cultivated land.

Modern transplanted Aman rice is grown in upland area. Total area under T-aman crop has been estimated at 5.61 million hectares in 2012-13 as compared to 5.58 million hectares in 2011-12 which is 0.54 percent higher (BBS, 2012c). Now a day, these lands are used for fruits and vegetables production.

In order to meet the food deficit of Bangladesh and to cope with the demand of food for the increasing population rice production need to increase. On the other hand fruit, fodder, fuel, timber, construction materials and raw materials requirement is a crying need. There is no scope to increase monoculture crop command area horizontally. So combined production of rice and forest species / fruit trees (agro-forestry) is the best alternative to meet the ever increasing demand. Before large scale production of transplanted rice under multipurpose tree species by farmer, tree- crop interaction effect must be studied from scientific point of view. Keeping this view in mind, the research has been under taken to determine the suitable transplanted aman rice variety in the mango based agroforestry system and the combine effect of production system and transplanted aman rice varieties.

Materials and Methods

A field experiment was carried out at the agroforestry research field, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, during June to November 2012 to examine the performance of 3 transplanted aman rice variety under 2 production system viz rice in sole cropping and rice + mango based agroforestry system. The experiment was conducted in newly established mango (Amropally) orchard of multipurpose tree planted at $6 \text{ m} \times 6 \text{ m}$ spacing in the year 2007 (7 years old) The experiment included 3 recommended modern transplanted aman rice varieties viz, (Binadhan-7, BRRI dhan 49 and Katari bhog), the experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The unit plot size was $6 \text{ m} \times 6 \text{ m}$ (36 m^2). Before transplanting, the land was 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 1st application during final land preparation, 2nd 15 DAT and finally 45 DAT in top

dressing method followed by irrigation. Seeds of rice were sown 4th June 2012 in seed bed and 10th July transplanted in to the main plots. After transplanting, necessary intercultural operations were done accordingly. Five hills were randomly selected from each unit plot for recording different data in each plot on plant characters. The data were recorded two broad heads, i) growth stage ii) harvesting stage. The data were analyzed statistically and means were adjusted by DMRT (Duncan's Multiple Range Test).

Results and Discussion

Effect of variety on growth, yield and yield contributing characters of transplanted aman rice: Due to the varieties effect, the results showed that significant variation was found among the variety. Significantly, the highest plant height (80.42 cm) was found in V₃ (katari bhog) and the lowest plant height (76.05 cm) was observed in V₁ (Binadhan-7) at 45 DAT (Fig. 1). Similar trend of plant height was found in both 60 and 75 DAT while the highest plant heights (90.90 and 112.2 cm) were

recorded in V₃ (katari bhog). On other hand, the lowest plant height (84.95 and 102.2 cm) was found in V₃, respectively (Fig. 1). Partial result was found by Garrity *et al.*, (1992). At 60 DAT, the values few increased while the maximum number of effective tiller hill⁻¹ (12.03) was recorded in V₁ treatment and the minimum number of effective tiller hill⁻¹ (10.28) in V₃ treatment, respectively (Fig. 2). Significantly the highest number of grains panicle⁻¹ (154.0) was found in Bina dhan-7 (V₁) treatment whereas the lowest number of grains panicle⁻¹ (135.3) was found in V₃ treatment which was followed by V₂ (145.8). Chowdhury *et al.*, (1993) observed that number of sterile spikelets panicle⁻¹ differed due to varietal differences. The highest grain yield (3.66 tha⁻¹) was found in Binadhan-7 (V₁) treatment and the lowest grain yield (3.13 tha⁻¹) was recorded in Katari bhog (V₃) treatment (Table 1). Therefore, it will be mentioned that most of the transplanted aman rice variety suitable for yield in agro-forestry system; but their degree of suitability may be as Binadhan-7 > BRRI dhan49 > katari bhog.

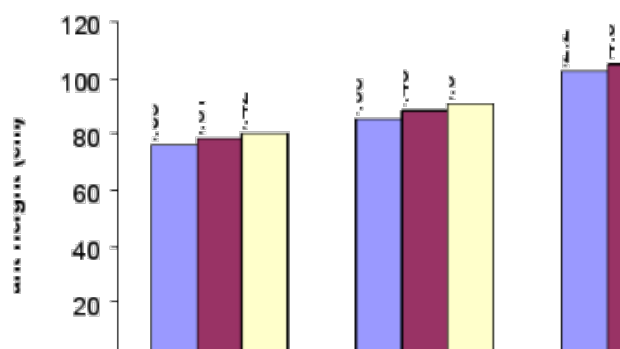


Fig. 1. Effect of variety on plant height (cm) of transplanted aman rice

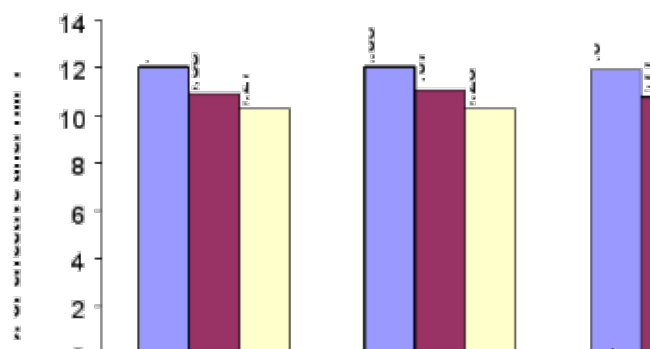


Fig. 2. Effect of variety on number of effective tiller hill⁻¹ of transplanted aman rice

Table 1. Varietal effect on yield and yield contributing characters of transplanted aman rice

Treatments	Panicle length (cm)	No of grain panicle ⁻¹	Unfilled grain panicle ⁻¹	1000 grain weight (g)	Yield plot ⁻¹ (kg)	Yield t ha ⁻¹
V ₁	22.35 b	154.0 a	3.87 c	20.28 a	2.58 a	3.66 a
V ₂	23.02 b	145.8 b	6.87 b	19.57 b	2.38 a	3.40 b
V ₃	25.30 a	135.3 c	9.70 a	18.82 c	2.13 b	3.13 c
LSD _(0.05)	1.59	1.99	1.07	0.32	0.20	0.021

In a column, figures having the similar letter (s) or without letter (s) do not differ significantly as per DMRT.

Effect of production system on growth, yield and yield contributing characters of transplanted aman rice: Rice grown under mango based agro-forestry system was more vigorous than those grown in sole cropping i.e. in full sun light conditions (Fig 4). It exhibited considerably higher height under mango based agro-forestry system. At 45 DAT the highest plant height (78.89 cm) was observed in mango + rice based agro-forestry system (T₁) where as the lowest plant height (77.63 cm) was observed in sole cropping of rice (T₂). Again at 60 DAT the highest plant height (89.29 cm) was observed in mango + rice based agro-forestry system (T₁) on the other hand the lowest plant height (86.90 cm) was observed in sole cropping of rice (T₂). Significantly at 75 DAT the highest plant height (108.30 cm) was observed in mango + rice based agro-forestry system (T₁) on the other hand the lowest plant

height (104.5 cm) was observed in sole cropping of rice (T₂) (Fig. 3). Hillman (1984) reported that, plant grown in low light levels was found to be more apical dominant than those grown in high light environment resulting in taller plants under shade. Number of effective tiller hill⁻¹ of transplanted aman rice was significantly observed in different production system (Fig 4). At 45 DAT the maximum number of effect tiller hill⁻¹ (11.40) was recorded in sole cropping of rice (T₂) where as the minimum number of effect tiller hill⁻¹ (10.70) was recorded in mango + rice based agro-forestry system (T₁). Again at 60 DAT the maximum number of effect tiller hill⁻¹ (11.54) was observed in sole cropping of rice (T₂) on the other hand the minimum number of effect tiller hill⁻¹ (10.71) was recorded in mango + rice based agro-forestry system. Finally at 75 DAT the maximum number of effect

tiller hill⁻¹ (11.04) was recorded in sole cropping of rice (T₂) where as the minimum number of effect tiller hill⁻¹ (10.68) was recorded in mango + rice based agro-forestry

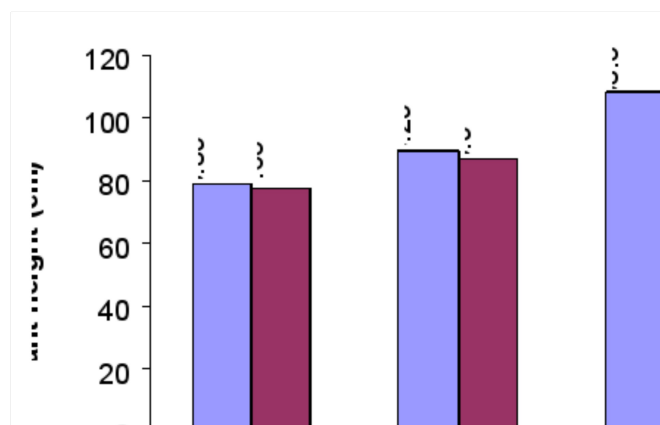


Fig. 3. Effect of production system on plant height (cm) of transplanted aman rice

The highest panicle length was (23.88 cm) was obtained in mango + rice based agro-forestry system (T₁) and the lowest panicle length was (23.31 cm) in sole cropping (T₂). Significantly the highest number of grains panicle⁻¹ (146.7) was found in sole cropping (T₂) and the lowest number of grains per panicle⁻¹ (143.3) was found in mango + rice based agro-forestry system (T₁). The unfilled grain panicle⁻¹ was varied significantly by the production system. The maximum unfilled grain panicle⁻¹ (7.37) was found in mango + rice based agro-forestry system (T₁) while the minimum number of unfilled grain panicle⁻¹ (6.26) was recorded in sole cropping (T₂) treatment, respectively. The 1000 grain weight of transplanted aman rice was influenced significantly by the production

system (T₁) (Fig. 4). The panicle length of rice was not significantly affected by the production system.

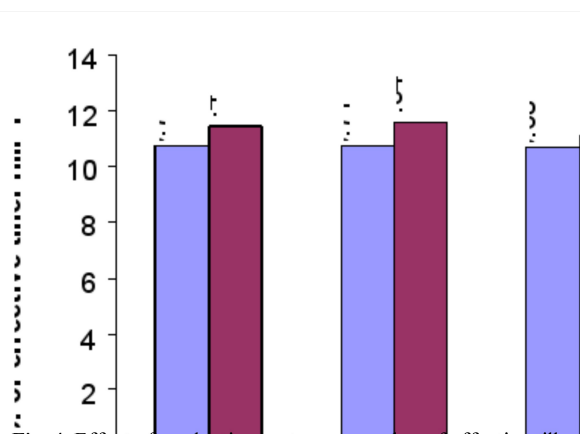


Fig. 4. Effect of production system on number of effective tiller hill⁻¹ of transplanted aman rice

system. Significantly the highest 1000 grain weight (19.73 g) was obtained from mango + rice based agro-forestry system (T₁) treatment and the lowest 1000 grain weight (19.38 g) was found in sole cropping (T₂) treatment, respectively. The result showed that the grain yield plot⁻¹ was not varied significantly by the production system. The highest yield plot⁻¹ (2.42 kg) was found in sole cropping (T₂) treatment and the lowest (2.31 kg) was recorded in mango + rice based agro-forestry system (T₁) treatment, respectively. The highest grain yield (3.41 t ha⁻¹) was found in sole cropping (T₂) treatment and the lowest grain yield (3.39 t ha⁻¹) was recorded mango + rice based agroforestry system (T₁) treatment (Table 2).

Table 2. Effect of production system on yield and yield contributing characters of transplanted aman rice

Treatments	Panicle length (cm)	No of grain panicle ⁻¹	Unfilled grain panicle ⁻¹	1000 grain weight (g)	Yield plot ⁻¹ (kg)	Yield t ha ⁻¹
Mango+rice (T ₁)	23.88	143.3 b	7.37 a	19.38 b	2.31	3.39
Open (T ₂)	23.31	146.7 a	6.26 b	19.73 a	2.42	3.41
LSD _(0.05)	1.59	1.99	1.07	0.32	0.20	0.021

In a column, figures having the similar letter (s) or without letter (s) do not differ significantly as per DMRT

Table 3. Combine effect of production system and variety on yield and yield contributing characters of transplanted aman rice

Treatment combination		Panicle length (cm)	No of grain panicle ⁻¹	Unfilled grain panicle ⁻¹	1000 grain weight (g)	Yield plot ⁻¹ (kg)	Yield t ha ⁻¹
Mango+rice (T ₁)	V ₁	22.53 b	152.7 a	5.03 c	20.33 a	2.53 b	3.63 b
	V ₂	23.47 ab	145.0 b	7.03 b	19.40 bc	2.33 d	3.43 c
	V ₃	25.40 a	132.7 d	10.03 a	18.40 d	2.07 f	3.10 f
Open (T ₂)	V ₁	22.17 b	155.3 a	2.7 d	20.23 a	2.63 a	3.68 a
	V ₂	22.57 b	146.7 b	6.7 b	19.73 b	2.43 c	3.37 d
	V ₃	25.20 a	138.0 c	9.37 a	19.23 c	2.20 e	3.17 e
LSD _(0.05)		2.247	2.809	1.515	0.4594	0.096	0.030

In a column, figures having the similar letter (s) or without letter (s) do not differ significantly as per DMRT

Combine effect of production system: In the combine effect the highest number of grain/panicle (155.30) was found in T₂V₁ combination and second highest number of grain (146.7) T₂V₂ combination, the highest 1000 grain

weight (21.73 gm) was found T₁V₂ and followed by (21.70) obtain from T₂V₂ combination (Table 3). The highest grain yield (3.58 tha⁻¹) was found in T₂S₂ treatment combination and the lowest grain yield (3.30 tha⁻¹) was

recorded in T₁S₃ and T₂S₃ treatment combination, respectively (Table 3). The highest grain yield (3.68 tha⁻¹) was found in T₂V₁ treatment combination and the lowest grain yield (3.10 tha⁻¹) was recorded in T₁V₃ treatment combination, respectively (Table 3).

From the results and foregoing discussion, it is clear that transplanted aman rice is highly influenced by variety and production system. Based on the findings of the experiment it will be concluded that variety Binadhan-7 appears as the best than other variety. The results of this experiment also clearly included that Binadhan-7 rice variety for rice + mango based agroforestry cultivation system is very much acceptable.

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