

## SOCIOECONOMIC IMPROVEMENT OF FARMERS' LIVELIHOOD THROUGH PRACTICING AGROFORESTRY IN NORTHWEST REGION OF BANGLADESH

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### Abstract

Agroforestry has been expanding rapidly in northwest region of Bangladesh because of its benefits in income generation and livelihood improvement of the farmers. But the contribution of agroforestry to the socioeconomic conditions has yet not well documented. This study was conducted to assess the socioeconomic benefits of the agroforestry based land use system in northwest region of Bangladesh. Socioeconomic profile of the respondent farmers stated that most of them were middle age having primary to secondary education. Agriculture was the main occupation and farmers were categorized mainly by large and small groups. Across the region, Eucalyptus (*Eucalyptus camaldulensis*), Mahogany and Tal based agroforestry systems are dominantly found in Dinajpur, Bogra and Kustia, respectively. Straight bole and quick return; quality timber and high price; and traditional practice and high return were major reasons for selecting trees in these regions. Rice was the major crop grown under those agroforestry systems. Eucalyptus and Mahogany trees are found mostly along the border of the crop fields, while Tal and Khejur trees are grown inside the fields. The benefit cost ratio (BCR) was more than double in agroforestry systems due to high overall production. The study demonstrated that the income of the farmers was significantly increased by 53.50, 38.76 and 16.72% in Dinajpur, Bogra and Kustia locations, respectively, by practicing agroforestry systems which having positive impact on their overall income and livelihood. Farmers are highly satisfied with the access of food and drinking water due to increased income from agroforestry practices.

**Keywords:** Agroforestry, practice, socio-economic improvement.

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## Introduction

Bangladesh has been constantly facing the challenges of rampant poverty because of high growing population rate over the last few decades. Especially, environmental impacts due to anthropogenic and natural calamity on the socio-economic indicators have added new dimension to these challenges. As one of the least developing countries, it is threatened by both natural hazards and over exploitation of resources with low land-man ratio and low resource base (Masum and Akhir, 2009). On the out-set, forest productivity is also extremely low for both plantation and natural forests (ADB, 1999). The impacts of environmental hazards and demand for food, timber, fuel wood, fodder, fruits and poles production from the same land management unit have attracted significant attention, which needs to be addressed. This is true that multiple productions from homesteads and croplands are essential, especially, agroforestry system having multipurpose tree plantation help increase soil fertility, provides fuel wood, creates employment opportunity and improves socioeconomic conditions of the farmers (Alam, 2004). Moreover, agroforestry systems provide multiple production including fruits, vegetables, cereals, fuel wood, fodder

etc. to contribute in livelihoods of the households.

In Bangladesh, agroforestry is an integral part of the rural livelihood systems for centuries and has been playing a key role in providing household food and energy security, income and employment opportunities, investment opportunities and at the same time environmental protection (Miah et al., 2002). Various traditional and systematic agroforestry systems are found in different ecosystems of Bangladesh. Northwest region is one of the most important areas with best agro-ecosystem for crop production in Bangladesh. Due to climate change and human activity, the productivity of production systems is being decreased in this region, although there are some traditional agroforestry practices found in this region. In recent decades, several modern agroforestry production systems based on timber species have been practiced by the farmers (Miah and Hussain, 2005). More importantly, Eucalyptus and Mahogany based agroforestry systems are expanding rapidly. Therefore, it is needed to record the nature, types of interactions among the components, resource use and performances of the suitable agroforestry practices. The aims of this study were to examine the extent of expansion of the agroforestry based

land use system in the northwest region of Bangladesh and to investigate the socio-economic benefits of the agroforestry based land use system.

### **Methodology**

The study was conducted in three districts namely Dinajpur, Kustia and Bogra of northwest region of Bangladesh. One union under each district was selected with consultation of the concern organizations and experts. A list of farmers who were practicing agroforestry was collected from the Department of Agricultural Extension (DAE) of each study area; then 90 farmers (30 from each location) were selected randomly. Participatory rural appraisal (PRA), focal group discussion (FGD) and questionnaire survey were done to collect primary data. In order to collect reliable and valid information from the farmers, an interview schedule (questionnaire) was prepared carefully keeping the objectives of the study in mind. The interview schedule contained both open and closed form questions. Appropriate scales were also developed to operationalize the selected characteristics of the agroforestry farming.

Considering the importance of data collection as the key factors to the survey and the success of the study,

direct interview method was followed to collect data through face-to-face with the respondents. The researcher took utmost care to establish rapport with the respondents. Before interviewing a brief introduction of the aims and objectives of the study were explained to each respondent. The questions were explained and clarified whenever any respondent felt difficulty to understand properly. After completion of each interview, the questionnaire was checked and verified to be sure that the information were properly collected. Data were collected in the local units and then converted to the standard units and then later on. Data were collected from the respondents between June to December 2011.

Data were collected on demography of the farmers (age, education, occupation and far category); agroforestry practices (major agroforestry system, method of planting, reason of selecting trees and crop yield loss); and socioeconomic parameters (income, savings, food intake and access to drinking water). However, socioeconomic conditions of the farmers were compared between before and after practicing agroforestry. Data were analyzed using Statistical Package for Social Science (SPSS) computer software.

## Results and Discussion

### *Demography of the farmers*

**Age:** The age of an individual reflects his personality and this may play an important role in farmer's perception on farming activities regarding agroforestry practices. The respondent farmers were categorized

into three groups namely young (18-30 years), middle (31-50 years) and old (more than 50 years) aged (Table 1). The average age of the respondents was 39.32 years with the standard deviation of 10.32. Most of the respondents (63.3%) were middle aged (31-50 years) followed by young aged (23.3%) and old aged (13.3%).

**Table 1.** Distribution of the respondents according to age in the study areas

Category	Age group (years)	Respondent		Mean	SD
		Number	Percent		
Young aged	18-30	21	23.3	39.32	10.32
Middle aged	31-50	57	63.3		
Old aged	>50	12	13.3		
Total		90	100		

**Table 2.** Educational qualification of the respondents in the study areas

Educational status	Dinajpur	Kustia	Bogra	Average
Illiterate	10	13	10	11
Primary(I to V)	50	44	47	47
Secondary(Up to SSC)	30	36	36	34
Above Secondary	10	7	7	8
Total	100	100	100	100

**Education level:** Accepting new ideas are always challenging. Education level helps to develop mental and physical ability of a person to understand and make decision to adopt new ideas and practices. It also helps farmers to increase their power of observation and decision making ability. On an average, 47% respondents had primary education followed by secondary

education (34%) and above secondary education (8%). On the other hand, 11% respondents had no education. Likewise, most of the respondents had primary education regardless of location followed by secondary education (Table 2). Halim (1982) reported that farmers having up to secondary level of education contribute positively to the farm production.

**Occupation:** Agriculture was the major occupation and business was the secondary occupation in all the locations. On an average, 90% respondents practiced agriculture as their primary occupation followed by business (7%) and service (3%); while only 43% respondents had secondary occupation of which 22% were engaged in business followed by agriculture and other occupations. In Dinajpur, 90% and 20% respondents were engaged in agriculture as primary occupation and secondary occupation, respectively; while the corresponding values for

Kustia were 93 and 27%; and for Bogra were 87 and 17%, respectively (Table 3).

**Farm category:** The farmers were categorized into four groups (marginal, small, medium and large). On an average, 35.55% respondents were large in category followed by small (33.33%), marginal (15.56%) and medium (15.56%). In Dinajpur, the respondents were well distributed where 26.67% respondents were small and large; while in Kustia and Bogra, about 50% respondents were large and small, respectively (Table 4).

**Table 3.** Distribution of the respondents according to occupation in the study areas

Occupation	Respondents (%)					
	Dinajpur		Kustia		Bogra	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
Agriculture	90	10	93	7	87	13
Business	7	20	7	27	7	17
Service	3	0	0	0	6	3
Others	-	20	-	10	-	0
Total	100	50	100	44	100	33

**Table 4.** Distribution of the respondents according to farm category farmers in the study areas

Farm category	Respondents (%)		
	Dinajpur	Kustia	Bogra
Marginal	23.33	23.33	0
Small	26.67	23.33	50.00
Medium	23.33	0	23.33
Large	26.67	53.34	26.67
Total	100	100	100

**Agroforestry practices**

**Major agroforestry system:** Eight major agroforestry systems were identified in all the study areas (Table 5). Eucalyptus, Palmyra Palm and Mahogoni based agroforestry systems are dominated in Dinajpur, Kustia and Bogra, respectively. In Dinajpur, Eucalyptus - Aman rice - Boro rice was most dominant system (73.33%) followed by Eucalyptus - Aman rice- Maize (26.67%). In Kustia, Palmyra Palm - Jute- Boto rice (26.67%) and Palmyra Palm -Aman rice-Tobacco (26.67%); while Mahogoni- Aman rice (53.33%) and Mahogoni- Aman rice- Maize (46.67%) were the dominant

systems in Bogra.

**Method of tree planting:** Two methods for tree plantation were recorded in all the study areas namely across the boundary and inside the crop field. In Dinajpur and Bogra, trees were planted mostly across the boundary (80%) followed by inside the crop field (20%), whereas, cent percent trees were found inside the crop field in Kustia (Table 6). In Kustia, Palmyra Palm and Date Palm trees were dominated, which were grown naturally and farmers use to allow them to grow. Therefore, trees are widely found inside the crop fields in Kustia region.

**Table 5.** Major agroforestry systems found in the study areas as practiced by the farmers

Agroforestry systems	% Respondents		
	Dinajpur	Kustia	Bogra
Eucalyptus- Aman rice- Boro rice	73.33	0	0
Eucalyptus - Aman rice- Maize	26.67	0	0
Date Palm- Aman rice- Boro rice	0	23.33	0
Mahogoni- Aman rice	0	0	53.33
Mahogoni- Aman rice- Maize	0	0	46.67
Palmyra Palm - Aman rice - Boro rice	0	23.33	0
Palmyra Palm - Jute- Boto rice	0	26.67	0
Palmyra Palm -Aman rice-Tobacco	0	26.67	0
Total	100	100	100

**Table 6.** Method of tree planting in cropland across the study areas

Location	Dominant agroforestry practice	Respondents			Average	Tree density/ha
		Across boundary	Inside field	Total		
Dinajpur	Eucalyptus	80	20	100	33.33	451
	Mahogany	80	20	100	33.33	148
Kustia	Palmyra Palm	0	76.67	76.67	25.55	64
	Date Palm	0	23.33	23.33	7.77	59

**Reason for selecting trees:** Besides the ecological adaptation, there are various reasons for selecting trees. This study showed that diversified output and good economic value, straight bole and good timber, short rotation and quick growing nature were some criteria of selecting tree species for agroforestry systems in Dinajpur. In Kustia, good price of wood, diversified output and good economic value, production of juice and fruit were main reasons for selecting trees; while good quality timber and high price, and good value for making furniture were reasons in Bogra (Table 7).

**Crop yield loss in agroforestry:** In general, crop yield loss is observed in an agroforestry system. However, the main benefit of agroforestry system is

that it increases overall production. Cent percent farmers of Kustia and Bogra opined that crop loss is occurred in agroforestry system, while 76.67% farmers observed crop yield loss in Dinajpur (Table 8). Farmers also gave their opinion regarding the yield loss. Competition between tree and crop for water, nutrient and light was the major cause of yield loss as opined by the farmers of Kustia and Bogra, while completion for only water and nutrient was the main cause in Dinajpur. In Dinajpur, root and shoot pruning of Eucalyptus tree is done regularly during crop production therefore light is not at all a limiting factor. Moreover, the crown of Eucalyptus tree is light, which also allows penetrating more light to the understory crops.

**Table 7.** Reason for selecting the tree species in agroforestry systems of the studyareas

Reason for selecting tree species	% Respondents		
	Dinajpur	Kustia	Bogra
Good return	0	50.00	0
Diversified output and good economic value	26.67	26.67	0
Straight bole and good timber	26.67	0	0
Good quality timber and high price	0	0	76.67
Short rotation	23.33	0	0
Good value for making furniture	0	0	23.33
Quick growing	23.33	0	0
Production of juice and fruit	0	23.33	0
Total	100	100	100

**Table 8.** Respondent opinion regarding crop yield loss due to tree plantation in crop field area

Crop yield reduction due to tree plantation	Respondents (%)		
	Dinajpur	Kustia	Bogra
Yes	76.67	100	100
No	23.33	0	0
If yes , reason crop yield loss			
Competition for water and nutrient	50.00	0	26.67
Competition for water, nutrient and light	0	46.66	46.66
Competition for water	26.67	26.67	0
Competition for light	0	26.67	26.67
Total	76.67	100	100

### ***Socioeconomic development***

Income: The income from agroforestry systems was the highest in Dinajpur followed by Kustia and Bogra (Table 9). Likewise, the benefit cost ratio (BCR) was the highest in Dinajpur (2.19), which was closely followed by Kustia (2.13) and Bogra (1.93). The

BCR was almost double in agroforestry systems indicated higher income compared to sole production system, might be due to increase in overall production under agroforestry system. On the contrary, high return in Dinajpur may be due to fast growing and short rotation nature of Eucalyptus tree.

**Savings:** In order to analyze the impact of agroforestry practices, the annual income and savings of the respondents were compared before and after practicing agroforestry practice that is presented in Table 10. It was found that before practicing agroforestry, the highest annual savings (9272.73 Taka) was noted in Bogra followed by Dinajpur (8933.33 Taka) and Kustia (6500.00 Taka); while the savings after practicing agroforestry was found the highest (18800.00 Taka) in Dinajpur followed by Bogra (15666.67 Taka) and Kustia (13166.67 Taka).

**Table 9.** Benefit and cost of agroforestry systems in different study areas

Item	Dinajpur	Kustia	Bogra	Group Total
Total return (Tk/ha)	299238	262959	245026	269074
Total cost (Tk/ha)	136441	123604	126781	128942
Net return (Tk/ha)	162797	139355	118246	140132
BCR	2.19	2.13	1.93	2.09

**Table 10.** Income and savings (Taka per year) of respondents before and after practicing agroforestry in the study area

Location	Before practicing agroforestry		After practicing agroforestry	
	Annual income (Tk)	Annual savings (Tk)	Annual income (Tk)	Annual savings (Tk)
Dinajpur	116833	8933	179333	18800
Kustia	100667	6500	117500	13167
Bogra	112667	9273	156333	15667
Mean	110056	8134	151056	15878

**Food intake:** The difference between food intake before and after practicing agroforestry was remarkable. Before practicing agroforestry, none of the respondent was found highly satisfied with food intake, whereas, 41.11% respondents were highly satisfied with food intake after practicing agroforestry (Table 11). After practicing agroforestry, 73.33, 26.67 and 23.33% respondents were highly satisfied with food intake in Bogra, Kustia and Dinajpur, respectively. This might be due to high income generation by practicing agroforestry. This indicates improvement of lifestyle due to higher

income and production under agroforestry practices.

**Access to drinking water:** Drinking water is normally a problem in the northwest region of Bangladesh. Before practicing agroforestry, on an average 33.33% (50, 23.33 and 26.67% respondents in Dinajpur, Kustia and Bogra) were dependent on pond for drinking water, while no farmer was found using pond for drinking water

after practicing agroforestry. The dependency on common tubewell reduced from 34.45% to 24.44% after practicing agroforestry, while 58.89% farmers could able to establish own tubewell for drinking water. Surprisingly, 26.67 and 23.33% respondents in Dinajpur and Bogara, respectively, were able to establish pump to lift groundwater for drinking purpose (Table 12).

**Table 11.** Food intake of respondents before and after practicing agroforestry\*

Location	Before practicing agroforestry (Respondents)					After practicing agroforestry (Respondents)				
	Highly satisfied	Satisfied	Less Satisfied	Not Satisfied	Total	Highly satisfied	Satisfied	Less Satisfied	Not Satisfied	Total
Dinajpur	0 (0.00)	15 (50)	15 (50)	0 (0.00)	30 (100)	7 (23.33)	23 (76.67)	0 (0.00)	0 (0.00)	30 (100)
Kustia	0 (0.00)	8 (26.67)	22 (73.33)	0 (0.00)	30 (100)	8 (26.67)	15 (50)	7 (23.33)	0 (0.00)	30 (100)
Bogra	0 (0.00)	22 (73.33)	8 (26.67)	0 (0.00)	30 (100)	22 (73.33)	8 (26.67)	0 (0.00)	0 (0.00)	30 (100)
Mean	0 (0.00)	45 (50.00)	45 (50.00)	0 (0.00)	90 (100)	37 (41.11)	46 (51.11)	7 (7.78)	0 (0.00)	90 (100)

\* Figure in parenthesis indicate percentage

**Table 12.** Access to drinking water of the respondents before and after practicing agroforestry\*

Location	Before practicing agroforestry (Respondents)				After practicing agroforestry (Respondents)				
	Common tubewell	Pond	Own Tubewell	Total	Common tubewell	Pond	Own Tubewell	Pump	Total
Dinajpur	8 (26.67)	15 (50.00)	7 (23.33)	30 (100)	7 (23.33)	0 (0.00)	15 (50.00)	8 (26.67)	30 (100)
Kustia	23 (76.67)	7 (23.33)	0 (0.00)	30 (100)	7 (23.33)	0 (0.00)	23 (76.67)	0 (0.00)	30 (100)
Bogra	0 (0.00)	8 (26.67)	22 (73.33)	30 (100)	8 (26.67)	0 (0.00)	15 (50.00)	7 (23.33)	30 (100)
Mean	31 (34.45)	30 (33.33)	29 (32.22)	90 (100)	22 (24.44)	0 (0.00)	53 (58.89)	15 (16.67)	90 (100)

\* Figure in parenthesis indicate percentage

### Conclusion

In recent years, agroforestry is widely found throughout Bangladesh, but cropland agroforestry is very common in northwest region. This study emphasized the agroforestry practices and their role on the socioeconomic conditions of the farmers in the northwest region of Bangladesh. It was observed that tree species was area specific such as Eucalyptus, Mahogany and Palmyra Palm based agroforestry systems were dominantly found in Dinajpur, Bogra and Kustia, respectively. Although most of the farmers opined that crop loss occurred due to competition between tree and crop for growth resources, the BCR was more than double due to increase in overall production under agroforestry practices. The income was increased by 53.50, 38.76 and 16.72% in Dinajpur, Bogra and Kustia, respectively, by practicing agroforestry. High income and overall production made farmers satisfied with food intake and access to drinking water. However, in-depth study should be undertaken to know the contribution of agroforestry on livelihood and food security at different agro-ecosystems of Bangladesh.

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