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PROSPECTS AND RETROSPECTS OF LAND USE SYSTEM THROUGH AGROFORESTRY PRACTICES IN MEHERPUR DISTRICT, BANGLADESH

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Abstract

The study aims to explore the prospects and retrospects of land use system through agroforestry practices in Meherpur district, Bangladesh. It particularly focuses on some aspects of land uses of the study area like land use pattern, land ownership, choices of species for agroforestry, farmers' perceptions towards agroforestry, status and prospects of agroforestry practices. This study was carried out by using mixed method followed by a semi-structure questionnaire. A total of 100 respondents were selected by using snowball purposive sampling method. The study revealed that agriculture was the major occupation (50%) of the selected respondents. Of the total land used by selected respondents, 21% land were used for agroforestry, 69% for agriculture and remaining 10% for homestead purposes. Most of the farmers (60%) were small landholders (1 to 5 acres) and 18% had lesser than 1 acre land. Among them 76% had their own land followed by 8% leased land and 16% both own and leased land. They preferred agroforestry in their homestead (92%), agricultural land (65%), water body (31%) and fallow land (18%). The farmers were practicing different types of agroforestry such as cropland, homestead and aquaculture with boundary plantation by mixing trees, agricultural crops and vegetables in their farmlands to receive diversified outcomes. A remarkable change in land use pattern was found after adopting agroforestry practices in this study area. Maximum respondents practiced agro-forestry in their homestead and croplands. Most of the land (67%) was used for agriculture cultivation while a very small amount of land was used as agroforestry in the study area.

Keywords: Agroforestry, Choice of Species, Land Use, Ownership, Perception.

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Introduction

Agroforestry system provides notable contributions to sustainable agricultural production and ensuring food security for local people because of their potentiality to meet economic, social, ecological and institutional conditions for sustainable livelihoods (Nair, 2006). The ecological aspects of agroforestry practices are related to conservation of soil, water, nutrients and bio-diversity (Alam and Masum, 2005). It improves the socio-economic conditions of the farmers by increasing profitability, sustainability and crop security through the balance of land utilization and soil fertility preservation (Haque *et al*., 1996). Agroforestry land use system is getting popularity in Bangladesh day by day to meet-up the increased demand of foods and woods of the growing population. There are much potentials to practice agroforestry in all around the country to improve its socio-economic and ecological system. However, the land is the scarcest resource in this country, which is also treated as one of the opportunities to practice agroforestry to maximize multi-purpose land use system. Land use pattern is one of the indicators of reflecting the socio-economic condition of a country (Islam and Hassan, 2011).

Bangladesh is a developing economy (per capita income is $1316) and one of the most densely populated (154.4 million population) countries in the world having a total land area of 1,47,570 square kilometers (BBS, 2016). The per capita land holding is very meager which is less than 0.10 hectare, declining from 0.14 hectare in 1992 (FAO, 2015). Agricultural land is the most basic resource in Bangladesh which is the single largest production sector (about 70% people are dependent on it) of the economy and it contributes about 17% to the total Gross Domestic Product (GDP) of the country (BBS, 2016). Both the agricultural land and actual forest coverage of Bangladesh are decreasing continuously like many other countries of the world. Integrated land use planning provides an essential strategic framework for balancing different land uses (FAO, 2016). Bangladesh has 2.6 million hectares

of forest lands covering about 17.62% of the country's area. Bangladesh Forest Department controls, manages and protects only 10.84% (1.6 million hectares) of the total forest area (FD, 2016). Contrarily, Global Forest Resources Assessment indicates that total forest area of Bangladesh is 1.429 million hectares i.e. 11% of the land area of the country (FAO, 2015; Rahman, 2016). The per capita forest area in Bangladesh is less than 0.015 hectare against the world average of 0.60 hectare (Islam, 2013; FAO, 2015; Rahman, 2016).

The country's population is projected over about 193.4 to 247.0 million by the years of 2030 and 2050 respectively (Mujeri, 2014). With the medium variant of population increase, the total food grains will have to be produced extra 21 to 24% in 2030 and 2050 higher than in 2010 (Timsina *et al*., 2016). In Bangladesh, over 90% of the state-owned forest land is concentrated mostly in 12 districts in the eastern and south-western regions of the country and out of 64 districts, 32 districts have no state-owned forest at all. Meherpur district is one of the districts where there is no state-owned natural forest (BBS, 2016). The economy of Meherpur district is predominated by agriculture and all land used wholly or partly for agricultural production purposes. Many farmers introduced different types of fruit and timber species with agricultural cultivation in their farmlands in this area. They were adopting integrated land use systems to increase their agricultural production and cash income (BBS, 2013). The main reasons of conducting this study were why the people were adopting agroforestry practices in their farmlands and find out the land use patterns of them and which types of land and species they preferred to use for practicing agroforestry. Considering the background, the study was focused on some aspects of land uses of the study area like land distribution, types of land use pattern, land ownership pattern, choices of species for agroforestry, farmers' perceptions and attitudes towards agroforestry, present status and prospects of agroforestry.

Materials and Methods

Selection of study area

Meherpur was deliberately selected as the study area for this research due to practicing agroforestry land use system in this area. The study was located (latitude 23°44' to 23°59' N and longitude 88°34' to 88°53' E) at the mid-western part of Bangladesh under Khulna Division. Out of total area, 751.6 sq. km. of Meherpur district, systematic and organized forestry practice is almost absent (BBS, 2016). Gangni and Meherpur Sadar upazilas were selected purposively as the study area. A total of 10 unions (five from each upazila) and 10 villages (one village from each union) were selected randomly where agroforestry was practiced (Fig. 1). The climate is classified as humid sub-tropical (dry winter, hot summer), with sub-tropical moist forest bio-zone. Rainfall and other precipitation have no distinct peak month. Annual average highest and lowest temperature are 37.1°C and 11.2°C respectively with 1,467 mm annual rainfall (BBS, 2013).

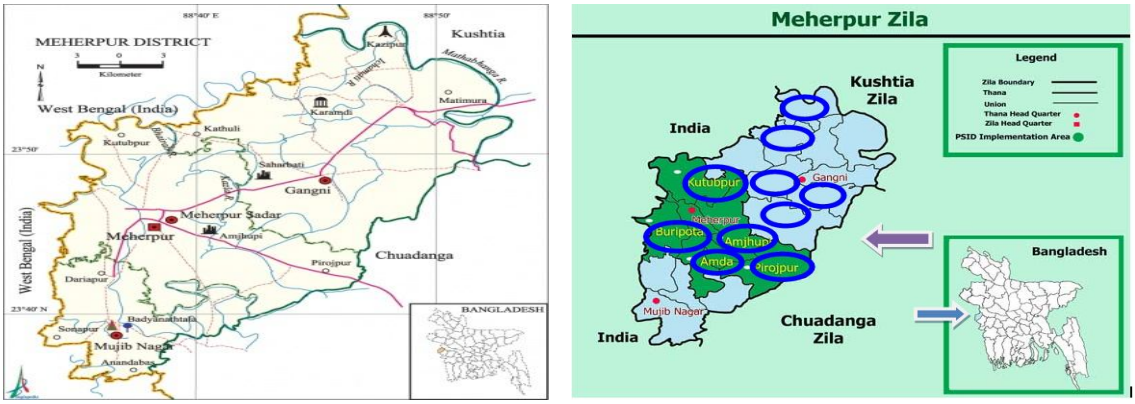

Fig. 1. The maps showing the location of the study area (arrow signs indicate location and circle signs indicate specific Unions of the study area). *Source:* Banglapedia, 2016; BBS, 2016.

Sampling, data collection and data analysis method

The farmers of this study area were the target population for the study. The sample size was 100 respondents who practiced agroforestry in the study area. They were selected from 10 villages (10 respondents from each village) by using snowball purposive sampling method. Random sampling was not possible in the field situation due to unavailable reliable data on the respondents in this study area. The primary data were collected from the respondents through face-to-face interviews using mixed method followed by a semi-structure questionnaire. They

were all male members as usually males used to practice agriculture in their farmlands. They were asked different questions related to land uses to collect required information to fulfill the objective of this study. All the collected data and information were reviewed, sorted and analyzed carefully and systematically according to the objectives to present the findings of the study. The study was carried out during 2012-2013. A preliminary survey was done to administer the questionnaire.

Results and Discussion

Demographic and socio-economic status of the respondents

The age of the respondents were categorized into three groups. Most of the respondents (about 69%) were the middle aged (31-50 years old) followed by about 20% old-aged (above 50 years old) and only 11% (up to 30 years old) were young. It was remarkable that most of the respondents (78%) were literate (Table 1). According to Tripp (1993), education is an important socio-economic variable that may make a farmer more receptive to advice from an extension agency or more able to deal with technical recommendations that require a certain level of literacy. The average household size of the respondent was 5.4 members. About 38% of them had small family size up to 4 members and majority of them (about 62%) had large size between 5-10+ members (Table 1). The average family size of Bangladesh is 4.5 members, which indicate large family size of the study area (BBS, 2016). Agriculture was their main occupation (50%) followed by businesses (28%), services (14%) and others (8%). Most of the respondents (44%) annual income range was Tk. 50,000-1,00,000, about 16% of them had Tk. 1,00,001-1,50,000, 14% had above Tk. 1,50,000 and the rests (about 26%) had below Tk. 50,000 (Table 1).

Table 1. Demographic and socio-economic status of the respondents of the study.

Age distribution		**Household size**	
Categories	(%)	Categories	(%)
Young aged (up to 30 years)	11	Small size (1-4 members)	38
Middle aged (31-50 years)	69	Medium size(5-10 Members)	55
Old-aged (Above 50 years)	20	Large size (10+ members)	7
Educational status		**Main occupation**	
Categories	(%)	Categories	(%)
Elementary/Basic	28	Agriculture	50
Secondary	34	Business	28
Above secondary	16	Service	14
Illiterate	22	Others	8
Annual family income		**Cropland agroforestry practices**	
Income range	(%)	Categories	(%)
Below Tk. 50,000	26	Boundary plantation	16
Tk. 50,000-1,00,000	44	Alley cropping	20
Tk. 1,00,001-1,50,000	16	Random plantation	12
Above Tk. 1,50,000	14	Mixed (alley + boundary)	52

Source: Field Survey, 2012-2013.

Land distributions and type of land use patterns

Land holding status is one of the indicators of economic condition of the respondents (Islam *et al*., 2012). The respondents who were practicing agroforestry in their farmlands, majority lands (68.83% i.e. 279.17 acres) had agricultural lands, followed by agroforestry lands (20.57%) and homesteads (10.35%). The size of land holding and land use pattern were categorized according to the guideline provided by Alam and Masum (2005); Abedin and Quddus (1988). Among 100 respondents, 60% farmers had land ranging between 1 to 5 acres, 12% from 6 to 10 acres, 10% above 10 acres and 18% less than 1 acre in terms of the size of the land. This study revealed that most of the farmers' economic condition was good in terms of their total land holding capacity (Fig. 2).

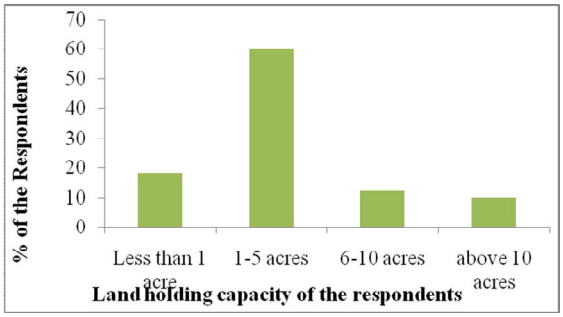

Fig. 2. Size of land holding capacity of the respondents.

Agriculture, agroforestry and homestead land use pattern of the respondents are presented in Table 2. In terms of agricultural land holdings, only 19% respondents had more than 4 acres land and

45% had 2.1 to 4 acres and 36% ranged up to 2 acres. Among them, 92% respondents occupied agroforestry land had range up to 2 acres where only 8% had range above 2 acres. The relationship among the different land use patterns indicated that agroforestry and homestead lands were small amount comparing to the total cultivated agricultural land in the study area. It was found that 92% of the respondents preferred agroforestry practice in their homesteads while 65% in their agricultural land, 31% along the water bodies (ponds) and only 18% in the fallow land. They provided multi-response for preferring agroforestry in their farmlands. Although these land use systems were distinct economic activities, farmers variously engaged in several of those land use forms on a concurrent basis. All of the respondents had below 5 acres of homestead land. Most of them (95%) had less than 2 acres homestead land and only 5% had more than 2 acres. These results indicated that there was low chance in expanding the homestead agroforestry in the study area. If they wanted to increase agroforestry practices in a large scale in their farmlands, agricultural land would be the only option as other types of land was very limited in the study area.

Table 2. Land distributions and types of land use patterns in the study area.

Land distribution and land use pattern of the respondents					
Agricultural land	%	Agroforestry land	%	Homestead land	%
Up to 2.0 acres	36	Up to 2.0 acres	92	Up to 2.0 acres	95
2.1-4.0 acres	45	2.1-4.0 acres	6	2.1-4.0 acres	5
4.1-6.0 acres	6	4.1-6.0 acres	2	4.1-6.0 acres	0
6.1-8.0acres	4	6.1-8.0acres	0	6.1-8.0acres	0
8.1-10.0 acres	3	8.1-10.0 acres	0	8.1-10.0 acres	0
10.1-12.0 acres	2	10.1-12.0 acres	0	10.1-12.0 acres	0
Above 12 acres	4	Above 12 acres	0	Above 12 acres	0

Source: Field Survey, 2012-2013

Land ownership status and ownership pattern

The result shows that 76% respondents used their own land for practicing various types of agroforestry practices because they thought agroforestry would be a reserve bank in future for them and their next generation. They thought it was secured for long-term benefits, which could be remained permanently as long-term basis in their own land rather than leased land. Of them 16% used both own and leased land and only 8% used their leased land. Moreover, 72% respondents had single land ownership and 28% had joined (both own and leased) ownership of their land use systems. By surveying the study area, it was found that the respondents (76%) who had sufficient own land for agriculture practice, were more interested in expanding their land use into agroforestry practice. However, those who had no sufficient own land (24%), were not interested to expand their agroforestry practice. They thought no need to have permanent or semi-permanent practices on their leased land resulted traditional monoculture practices.

Farmers' choices of trees and annual crops and experiences of agroforestry practices

Different types of fruit and timber trees with annual crops and seasonal vegetables were grown by the farmers in their farmlands. They used to plant mango, mahogany, coconut, neem, guava, lemon, wood apple with some seasonal vegetables in their homesteads. They chosen different types of trees with annual crops and vegetables in their croplands. They perceived that they received food, fruits, vegetables, fuel, fodder, timber, construction materials for their household demands, which was a reliable source of extra income from agroforestry practices. The study revealed that most of the farmers (56%) planted both fruit and tree crops in their farmlands while 16% of them planted timber and 28% planted only fruit species in their farmlands. For these, most of the respondents (51%) had up to 5 years of experience in agroforestry practices, 35% had 6-10 years, 10% had 11-15 years and only 4% had above 15 years. Most of the farmers (84%) collected seedlings from the nearby markets. Now-a-days, seedlings are available everywhere, in the nearby rural markets of Bangladesh. The farmers considered size and sound physical condition of those seedlings at the time of purchasing. On the other hand, only 16% of planting materials were collected from established nurseries and seedbeds of their lands. They collected seeds from available trees around their locality. Moreover, some farmers had established nursery to produce their required seedlings.

Farmers' perceptions and attitudes towards agroforestry practices

Farmers' perceptions indicate their awareness and understanding about the land use systems through agroforestry practices. They practiced agroforestry traditionally within their agricultural croplands as well as their homesteads. They

perceived the importance of trees both for its tangible (diversified products) and intangible (environmental services) benefits. They perceived that trees had more important roles in terms of production and agroforestry served a great contribution for space utilization and recreational purposes. Most of the respondents (72%) realized the importance of agroforestry practices in the study area due to its multi-faced benefits. The study results show that 61% respondents received cash followed by 56% timber, 94% fruits/foods, 87% fuel woods, 58% fodder, 47% construction materials and 68% got environmental benefits from agroforestry (Fig. 3). They gave multi-response on importance of agroforestry. Moreover, about 72% farmers showed positive attitudes towards agroforestry practice followed by 20% negative attitudes and not interested on agroforestry as they had not sufficient own land or if had those were small land to practice agroforestry. The respondents who had negative perception on agroforestry thought this practice declined the annual crop production due to the competition between tree crops and agricultural crops. They stated that trees occupied much more space above and below ground and dominated in the competition for space and light than the other crops. The rest (8%) were confused about agroforestry practice in terms of benefit or loss. One of the respondents opined: *"trees on agricultural croplands may decline crop production for sometimes but in future the trees will give more and more outputs"*. They thought that it could be a reserve bank of resources for their next generations as food security and economic solvency. In Jhenaidah and Jessore districts of Bangladesh, farmers' perception and attitude towards agroforestry were reported nearly similar (Islam *et al*., 2012; Sharmin and Rabbi, 2016).

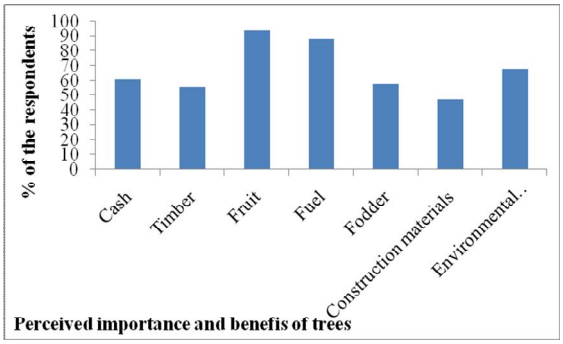

Fig. 3. Farmers' perceptions on agroforestry practices.

Prospects to develop land use system through agroforestry practices

The farmers also received economic and environmental benefits from agroforestry. This practice was done for their own satisfaction and household consumption. It was getting popular and profitable land use system among the respondents in the study area. They perceived that trees protected their agricultural crops from natural calamities as well as provided shade and water stability in the soil. They received diversified forest products such as timber, fruits, fuel, fodder, construction materials and relative stability of early return from crop-tree combinations. Therefore, agroforestry can be a major source of their cash income and food security. This practice can be a very effective method for involving the farmers and more land can be converted to forestry activities. Transportation and market opportunities denoted the overall market condition, facilities and demands of certain forest and agricultural products (Heinemann *et al*., 2011). The study revealed that 72% respondents perceived the transportation and market facilities were so good for selling forest and agricultural products in the study area. The climate, soil quality, topography, socio-economic condition of the respondents was positive for agroforestry practices in the study area. As a result, agroforestry could be an extensive programme for the entire study area to meet increased demand of forest products and tree-based services. Therefore, it was a great opportunity for the farmers to adopt and expand agroforestry practices as an integrated land use practice.

Conclusions

The study results reflected that most of the respondents were involved in practicing of agriculture directly or indirectly. They depended mostly on agricultural and homestead lands for the fulfillment of their daily needs. The present study indicated clearly that maximum respondents practiced agroforestry in their homestead lands and two-thirds of them introduced in their croplands. Almost two-third of the total lands was used only for agricultural cultivation and a very small amount of land was used as agroforestry and homestead. They were practicing mainly three types of agroforestry practices in their farmlands by planting different types of timber, fruit and annual crops with seasonal vegetables. They perceived agroforestry as a profitable land use system, which provided them in diversified products such as timber, fruit, fuel, fodder, construction materials, as well as income generating and environmental benefits. Their attitude and perception on agroforestry was very much positive and supportive to promote and ameliorate agroforestry in the study area. Some farmers were not interested to expand agroforestry practices willingly because of their insufficient land, lack of technical and scientific knowledge of agroforestry and long-term profit earning of forest products. It can be concluded that agroforestry may be expanded to other lands

through co-operative systems among the farmers and may use same piece of land for multi-production addressing resource constraints. This study results may be effective in identifying better land use technologies based on financial and biophysical aspects of the study area. In addition, the farmers should be aware of and trained-up with improved and scientific management of agroforestry practices. Therefore, agroforestry may be a potential opportunity for increasing forest resources and farmers' socio-economic development.

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