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Research Article

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Homestead tree species diversity and its impact on the livelihood of the farmers in Bangladesh

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Abstract

The study was conducted in twelve villages of four unions under Gopalpur upazila in Tangail district of Bangladesh to explore the diversity of multipurpose tree species in the homesteads and its impact on the livelihood of the farmers in 2016. Study sites were selected purposively as the location. A total of 3334 farmers of the 12 villages constituted the population of study. A sample of 12% farm families was selected based on stratified random sampling procedure. Thus 400 farmers were selected. However, 80 farmers were selected from 400 sampled farmers by using Yamane formula. Therefore, these 80 farmers constitute the sample for this study. Five percent (0.05) level of probability was used as the basis for rejection of any null hypothesis throughout the study. Data for the study were collected through personal interview by the researcher himself during 15 May to 25 December, 2016 using the interview schedule. Farmer's opinion regarding multipurpose tree species in the homesteads and its impact on socio-economic development was the dependent variables of the study. Ten characteristics are age, education, occupation, family member, farm size, homestead area, annual income, socio-economic aspects, knowledge on Multipurpose Tree Species (MPTs) in homestead agroforestry and problem confrontation constituted the independent variables of this study. Species diversity of MPTs in the homesteads agroforestry was measured by Shannon-wiener index (H). In case of all species, highest index (H) value found in Jhaoail union (H=3.017) and lowest index (H) value found in Dhopakandi union (H=2.967). Among these 75 different plant species, Akashmoni (12.53 %), Jackfruit (18.28 %), Neem (1.45%), Bamboo (3.72%), Mander (2.03%) were found as dominant trees for timber, fruit, medicinal, fodder and fuel wood species respectively. MPTs had direct impact on income of the farmers. Small farmers had average income 13.21 thousand taka, Medium farmers had average income 29.33 thousand taka and large farmers had average income 45.79 thousand taka from MPTs in homesteads.

Keywords: Diversity, Farmer, Homestead, Livelihood, Tree Species diversity

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Introduction

Bangladesh is one of the most densely populated countries in the world with a population of 152.5 million and with an annual growth rate of 1.37 (BBS, 2011). There are 32.07 million homesteads in Bangladesh and over 74% of the population lives in the rural areas. Approximately 7% area (0.53 million ha) of the total 8.4 million ha of cultivable land in Bangladesh is occupied by homesteads which is extremely productive (BBS, 2005). The forest land area of Bangladesh was reported at 11.08% in 2010(World Bank, 2011). However, the actual tree coverage area of Bangladesh is estimated only at 9.10% of the country. Most of the forests are distributed to the southeastern and southwestern region of the country. Out of 64 districts of Bangladesh, 35 have no natural forest (Bhuiyan, 1994). The situation of northern Bangladesh is even worse. Forest productivity in Bangladesh is also extremely low (0.5-2.5m3/ha/yr) for both plantation and natural forests (ADB, 1993). The FAO estimates that forest industries contribute more than US$ 450 billion to national incomes, contributing nearly 1 percent of the global GDP in 2008 and providing formal employment to 0.4% of the global labor force (FAO 2012). But alarming for us that forests are decreasing day by day. Therefore, The forests cannot meet the demand of woods of the country and observed that 90% of the fuel wood and bamboo, and 70% of timber requirement of the country were met from the 690 km^2 of homestead Agroforestry (Byron, 1984). The yield of this plantation is 7-9km^3/ha /yr (Douglas, 1982). Homestead Agroforestry is the the integration of tree, crop and vegetable on the same area of land is a promising production system for maximizing yield (Nair, 1990). Homestead represents a land use system involving purposeful management of multipurpose trees and shrubs in intimate association with seasonal vegetables (Fernandes and Nair, 1990). From the conservation point of view, homesteads are the in situ conservation sites of wide range of plant biodiversity (Mannan, 2000). The highly diversity of Multipurpose Tree Species in home garden have a wide socioeconomic and agro-ecological roles including production of food and a wide range of products such as firewood, fodders, spices, medicinal plants and avoidance of climate related hazards commonly associated with monoculture production systems. Multipurpose Tree Species in homestead forests supply 70% of timber and 90% of fuelwood and bamboo (Singh, 2000).

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In the context of the prevailing shortage of fuel wood and excessive deforestation in Bangladesh, this homestead agroforestry system needs to be strengthened (Leuschner and Khaleque, 1987). The diversity of MPTs in the homegarden associated with other organisms contribute to the formation and maintenance of soil structure, retention of moisture and nutrient levels and promotes the recycling of nutrients; which reduces ecosystem vulnerability to climate change. MPTs in homegardens of Bangladesh is a source of livelihood for many farmers. It increases income of the farmers and serve as safety net during the time of hardship and natural disaster. Farmers want to be used his farm area for maximum production. They can increase production by practicing intercropping, mixed cropping; relay cropping system under suitable MPTs. But farmers have no sufficient knowledge about effect of different MPTs on their production. Even they have no cleared idea about beneficial function of different MPTs. Majority of the farmers cultivate their homesteads by different MPTs in unplanned way. So it is necessary to give them suggestions how to make for plantation of MPTs and how to increase income. Overall it improves socio-economic condition of the farmers. There are few researches are done in this case. It is necessary to make sound plans and procedure for planting more prevalent MPTs in scientific way considering climatic condition. So the study was conducted to explore the diversity of multipurpose tree species in the homesteads and its impact on the livelihood of the farmers of Gopalpur upazila in Tangail district.

Materials and Methods

The study was conducted in twelve villages under four unions of Gopalpur upazila in Tangail district. According to population census (BBS, 2011), the total number of households of Tangail district is 202 thousand which is 1.1 percent of total households of the country and the population is 1120 thousand which is 0.93 % of the total population of the country. The density of the population is 650 per sq. km. The percentage of the male and female population is 51.16 % and 48.84 %, respectively. The average literacy rate as of the census (BBS, 2011) was 46.8%; male 50%, female 43.8% among 12 upazila of Tangail district. The study was conducted in Tangail district that consists of 12 upazilas. Among them, Gopalpur upazila was purposively selected. It consists of 10 unions. Among them, 4 unions were randomly selected. They are Hadira, Dhopakandi, Jhaoail and Hemnagar unions. 3 villages name Vadurirchor, Gonipur and Koriata from Hadira union, 3 villages name Shahapur, Ramnagar and Boroma from Dhopakandi union, 3 villages name Jawail, Moail and Patalia from Jhaoail union, and 3 villages name Natuarpara, Sonamukhi and Chaltapur from Hemnagar union were randomly selected. There are total of 3334 different homesteads in this selected area. Out of 3334 homesteads, a sample of 12%, i.e., 400 homesteads were selected by stratified random sampling method. Then finally 80 representative homesteads were selected for questionnaire survey, to find out the effect of multipurpose tree species on the livelihood of the farmers and tree diversity measurement. Final selection of homesteads had been done by using Yamane formula: $n=N/\{1+N(e^2)\}$ Where, n=Sampling size, N=Population, e=Error of precision. After selection of sampled farmers, Farmers were classified into the following groups on the basis of farm size in terms of hectare according to Abedin and Quddus (1990). In social research, the selection and measurement of variables constitute a significant task. The independent variables were: age, level of education, occupation, family size, farm size, homestead area, annual income, organizational participation, knowledge on MPTs in homestead agroforestry, and problem confrontation of the farmers. The farmer's opinion regarding the impact of MPTs in homestead agroforestry on socio-economic aspects was the dependent variable. Ultimately ten independent and one dependent variable were selected for this study. The independent variables were Age, Education, Occupation, Family member, Farm size, Homestead size, Annual income, Organizational participation and Knowledge on MPTs in homestead agroforestry. Education of a respondent was measured in terms of classes passed by him. Occupation of a respondent was measured in terms of working by him and respondent to the time of interview. It was operationally measured in terms of actual occupation. Family member of a respondent was determined in terms of the total number of members of each respondent. The family member included respondent himself, spouse, sons, daughters and other dependents. Land is the most important capital to a farmers and size influences on personal characteristic of farmer. Farm size was expressed as hectare and was computed by using the formula: Farm size = Homestead area + Own land under cultivation + Cultivated area taken under lease + ½ (Cultivated area given to others as borga + cultivated area taken from others as borga). Annual income was measured by the sum of all income sources of a farmer in a year (agricultural income like framing, cropping etc. and non-agricultural income like business, service, saving, labour, other etc.).

A score of 1 (one) was given for each thousand Taka. Organizational participation of respondents was measured on the basis of the nature of his involvement and duration of participation in different local formal and informal groups or organizations in the study area. For computing organizational participation score, the formula is Organization participation score = $\sum (A \times D)$ Where, A = Activity score, D = Duration score. Participation score was assigned in the following manner for activities of a farmer in each group or organization. Organizational participation score of respondent is obtained by adding the score according to the above mentioned formula for his activities in the respective group or organization. The farmers were asked 15 questions on different aspects of homestead agroforestry. The total assigned score on the entire question was 75. A respondent answering a question correctly obtained the full score of 5 while for partial answer he obtained partial score and for wrong answer he obtained zero score. The total score obtained by a respondent was taken as his knowledge on homestead agroforestry score. Problem was measured one way such as using of closed form of questions as shown in item number 17 of the interview schedule. The respondents were asked to give their opinion of the questionnaires along with their extent of confrontation in use of homestead agroforestry practices. As four-point scale was used for computing the problem confrontation score of a respondent. The weights were assigned 3 (three) for 'high', 2 (two) for 'medium', 1 (one) for 'low' and 0 (zero) for 'not at all'. The problem confrontation score of the respondents could range from 0 to 51. Zero indicating no problem and 51 indicating high problem confrontations. The farmers were asked to give their opinion regarding the

improvement of their livelihood due to the direct or indirect contribution of MPTs in homestead argoforestry. It was measured on the basis of opinion obtained from the respondents on 18 statement containing information on the improvement of socio-economic aspect of their livelihood. A-4 point modified Liked type scale such as strongly agree, agree, disagree and strongly disagree was used to measure to extent of agreement of farmers with the statement. The score assigned to each of the scale for measuring the extent of agreement was 3, 2, 1 and 0, respectively for each of the 18 statements. Cell of the scale of individual consequence with its considering score such as 3 for 'strongly agree', 2 for 'agree', 1 for 'disagree' and 0 for 'strongly disagree'. Finally adding all the frequency count of each of the cell of the scale, the value was calculated. Species diversity is measured the total number of species within a given area under study. Species diversity can be expressed by species diversity index (both in richness and abundance of the species). The most commonly used method of species diversity is the Shanon-Wiener index: $H = -\sum PiInPi$, Where, Pi is the proportional abundance of the ith species such that $Pi = n/N$ (n is the number of individuals in the ith species and N is the total number of individuals of all species in the community). The statistical analysis is done by using SPSS program.

Results and Discussion

Demographic and socio-economic characteristics of the respondents of the study area

The age of the respondents ranged from 18 to 70 years. The respondents were grouped into three categories- young (up to 35 years), middle (36 to 50 years) and old (above 50 years) on the basis of their age. Number and percentage distribution of farmers according to their age group has been shown in the Table 1.

Table 1. Distribution of respondents according to their age

Category	Respondent (Number)	Percent	Average	Standard deviation
Young age (up to35 years)	14	17	47.36	12.16
Middle age (36 to 50 years)	35	44		
Old age (above 50 years)	31	39		
Total	80	100		

Data presented in Table 1 revealed that the majority (44 %) of the respondents were in the middle aged category, 39 % of the respondents were in the old aged and only 17 % were young aged category in the study area. The education level of the farmers ranged from 00-14 with an average of 4.5 and standard deviation of 2.96 of schooling. In this study 61.25% of the farmers had primary level education, whereas 16.25 % of them were illiterate, 20 % were of secondary level and 2.5 % were of higher level education (Table 2).

Table 2. Categorization of respondents according to their education

Category	Respondent (Number)	Percent	Average	Standard deviation
Illiterate (0)	13	16.25	4.50	2.96
Primary level (class 1 to 5)	49	61.25		
Secondary level (class 6 to 10)	16	20.00		
Higher level (above 10)	2	2.50		
Total	80	100		

Member of sampled farm households were categorized into three groups (Table 3). The categories and distribution of the respondents with their number, percent, mean and standard deviation are furnished below.

Table 3. Family member of sampled farmers

Family member (Number)	Respondent (Number)	Percent	Average	Standard deviation
Small (2-4)	25	31.25	5.4	1.93
Medium (5-6)	35	43.75		
Large (above 7)	20	25.00		
Total	80	100		

Data presented in Table 3 showed that majority of the farmers (43.75 %) belonged to medium size family, 31.25 % of the respondents had small size family and 25.00 % of them belonged to large family. The homesteads size of the farmer ranged from 0.01 - 0.27 hectare with an average of 0.069 hectare and standard deviation of 0.064. Among the farmers 22.5 % were landless and marginal, 22.5 % were small, 38.75 % were medium and 16.25 % were large. Homesteads size are given below (Table 4).

Table 4. Categorization of respondents according to their homestead size

Category	Respondent (Number)	Percent	Average	Standard deviation
Landless and marginal (up to 0.02 ha)	18	22.50	0.069	0.064
Small (0.03 to 0.05 ha)	18	22.50		
Medium (0.06 to 0.09 ha)	31	38.75		
Large (above 0.09 ha)	13	16.25		
Total	80	100		

Annual income of the farm families from MPTs ranged from Tk. 33 thousand to Tk. 550 thousand with an average 114.62 thousand having standard deviation of 82.34. The respondents are classified three categories basis on their income e.g.; low income (Tk. 33-102 thousand) category, medium income (Tk. 103-250 thousand) and high income (above Tk. 250 thousands) categories.

Table 5. Distribution of respondents according to their annual income

Category	Respondent (Number)	Percent	Average	Standard deviation
Low income	19	24	114.62	82.34
Medium income	36	45		
High income	25	31		
Total	80	100		

Data presented in Table 5 indicated that majority (45 %) of the respondents had medium income category, 31 % of the respondents had high income category and 24 % of the respondents in low income category.

Table 6. Distribution of the farmers according to their knowledge

Category	Respondent (Number)	Percent	Average	Standard deviation
Low (up to 15)	20	25.00	16.92	5.45
Medium (16-22)	38	47.50		
High (above 22)	22	27.50		
Total	80	100		

Table 6 indicated that major portion of the respondents (47.50 %) belonged to have medium knowledge while slight more than a quarter (27.50 %) had high knowledge and 25 % being under low knowledge category.

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Problem confrontation scores of the respondent farmers varied from 10-30 with mean and standard deviation were 13.45 and 3.23 respectively. In case of percent, there are 29.34% timber trees, 32% fruit trees, 17.34% medicinal trees, 10.66% fodder trees and 10.66% fuel wood trees in study area (Figure 1).

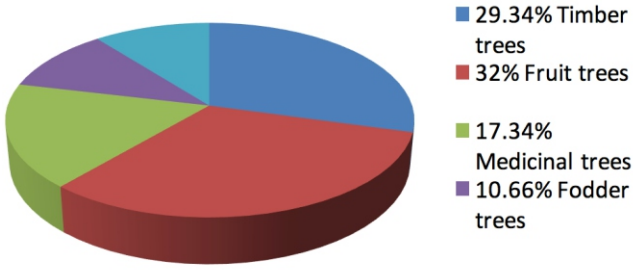

Figure 1. Percentage of fruit, timber and medicinal trees in the study area

Among 22 different timber trees, Akashmoni (12.53 %), Mahogany (8.43 %) and Eucalyptus (7.29 %) were found as dominant trees. Among 24 different fruit trees, Jackfruit (18.28 %) and Mango (14.89 %) were dominant trees. Among 13 medicinal trees, Neem (1.45%), and Bel (1.35%) were dominant trees. Among 8 fodder trees, Bamboo (3.72%)and Ipil-ipil (2.86%) were dominant trees. Among 8 fuel trees, Mander (2.03%) and Sissoo (0.48%) were dominant trees. Out of 22 timber species Mahogoni, Akashmoni and Euclyptus were found as commonly in almost 80% respondent houses area. The diversity of timber species in the study area was rich compare to medicinal, fruits. Similar type of timber species diversity was observed by Sadat (2007) in Gaibandha and he observed total 21 timber species in his study area.

Table 7. Multipurpose tree species diversity of homestead agroforestry

Sl. No.	Common Name	Scientific Name	Relative prevalence
Timber trees			
1	Akashmoni	*Acacia auriculiformis*	12.53
2	Acacia hybrid	*Acacia sp.*	0.43
3	Mahogany	Swietenia macrophylla	8.43
4	Nilotica	*Acacia nilotica*	0.58
5	Jarul	*Leagerstromia specieosa*	0.35
6	Bilati babul	*Acacia farnesiana*	0.38
7	Kalokori	*Albizia lebbeck*	0.43
8	Raintree	*Albizia saman*	0.18
9	Hijal	*Baringtonia acutangula*	0.19
10	Teak	*Tecktona grandis*	0.54
11	Debdaru	*Polyalthia longifolia*	1.43
12	Gab(Deshi)	*Diospyros peregrine*	0.30
13	Eucalyptus	*Eucalyptus camaldulensis.*	7.29
14	Pitraj	*Aphanomixis polystachya*	0.35
15	Katbadam	*Terminalia catappa*	1.36
16	Kadam	*anthocephalus chinensis*	3.66
17	Choto mahogoni	*Swietenia mahogoni*	1.09
18	Dewa	*Artocarpus lacucha*	0.21
19	Chapalish	*Artocuarpus chaplasha*	0.86
20	Bakul	*Mimosops elengi*	0.6
21	Albida	*Acacia albida*	0.4
22	Rajkoroi	*Albizia richardiana*	0.5
Fruit trees			
23	Mango	*Mangifera indica*	14.89
24	Jamrul	*Syzygium samarengense*	0.04
25	Golapsam	*Syzygium Jambos*	0.10
26	Jam	*Syzygium cumini*	0.07
27	Jackfruit	*Artocarpus heterophyllus*	18.28
28	Khejur	*Phoenix sylvestris*	0.20
29	Coconut	*Cocos nucifera*	0.03
30	Litchi	*Litchi chinensis*	0.10
31	Sofeda	*Achras sapota*	0.16
32	Dalim	*Punica granatum*	0.06
33	Tal	*Borassus flabellifer*	0.04
34	Amloki	*Phyllanthus embelica*	0.60
35	Arboroi	*Phyllanthus acidus*	1.30
36	Papaya	*Carica papaya*	0.67
37	Ata	Annona reticulate	0.37
38	Sharifa	*Annona squamosa*	0.60
39	Leamon	*Citrus limon*	0.12
40	Guava	*Psidium guajava*	0.08
41	Boroi	Zizypus mauritania	0.10
Sl. No.	**Common Name**	**Scientific Name**	**Relative prevalence**
42	Jambura	*Citrus grandis*	0.04
43	Bilatiamra	*Spondias dulce*	0.30
44	Deshiamra	*Spondias pinnata*	0.25
45	Jalpai	*Elaeocarpus floribundus*	0.38
46	Amloki	*Phyllanthus embelica*	0.10
Medicinal trees			
47	Bohera	*Terminalia bellirica*	0.01
48	Neem	*Azadirachta indica*	1.45
49	Kadbel	*Feronia* limonia	0.02
50	Khoir	*Acacia catechu*	0.41
51	Horitoki	*Terminalia chubela*	0.01
52	Sonalu	*Cassia fistula*	0.03
53	Bel	*Aegle marmelos*	1.35
54	Tejpata	*Cinnamomum tamala*	0.45
55	Kaju badam	*Anacardium occidentale*	0.15
56	Arjun	*Terminalia arjuna*	0.90
57	Basak	*Adhatoda vasica*	0.39
58	Agar	*Apuilara agallocha*	0.03
59	Supari	*Areca catechu*	0.04
Fodder trees			
60	Ipil-Ipil	*Leucaena leucocephala*	2.86
61	Sesrakoroi	*Albizia chinensis*	0.61
62	Arhar	*Cajanus cajan*	1.43
63	Bot	*Ficus bengalensis*	0.75
64	Sajna	*Moringa oleifera*	0.43
65	Bamboo	*Bambusa spp*	3.72
66	Sil Koroi	*Albizia procera*	0.15
67	Dumur	*Ficus racemosa*	0.1
Fuel trees			
68	Mander	*Erythrina orientalis*	2.03
69	Chalta	*Dillenia indica*	0.12
70	Sissoo	*Dalbergia sissoo*	0.48
71	Tentul	*Tamarindus indica*	0.29
72	Shimul	*Bombax ceiba*	0.05
73	Jiga	*Garuga pinnata*	0.23
74	Gamar	*Gmelina arborea*	0.16
75	Khoksha	*Ficus hispida*	0.07

Total 24 fruit tree species were found in the study area. Among the fruit species Mango and Jackfruit were dominant and found up to 99% respondent houses. The diversity of fruit species in the study area was rich compare all other species. Similar type of fruit species diversity was observed by Belali (2011) in Narayangonj and he observed total 28 fruit species in Narayangonj area. And species diversity was observed by Hossain and Bari (1996) stated that the homesteads in rural Bangladesh are clustered with nearly 25 species of fruit trees and 30 species of timber, fuelwood and industrial wood trees.

Species diversity index for the Multipurpose Tree Species in the homesteads agroforestry was measured by Shannon-wiener index (H). Shannon-wiener index (H) value ranged from (2.417-3.017). Incase of timber species, highest index (H) value found in Hemnagar union (H=2.937) and lowest index (H) value found in Jhaoail union (H=2.892). Incase of fruits species, highest index (H) value found in Jhaoail union (H=2.937) and lowest index (H) value found in Dhopakandi union (H=2.918). Incase of medicinal tree species, highest index (H) value found in Jhaoail union (H=2.881) and lowest index (H) value found in Dhopakandi union (H=2.731). Incase of fodder tree species, highest index (H) value found in Hadira union (H=2.553) and lowest index (H) value found in Dhopakandi union (H=2.417). Incase of fuel tree species, highest index (H) value found in Jhaoail union (H=2.635) and lowest index (H) value found in Hadira union (H=2.421). Incase of all species, highest index

value found in Jhaoail union (H=2.892). Incase of fruits species, highest index (H) value found in Jhaoail union (H=2.937) and lowest index (H) value found in Dhopakandi union (H=2.918). Incase of medicinal tree species, highest index (H) value found in Jhaoail union (H=2.881) and lowest index (H) value found in Dhopakandi union (H=2.731). Incase of fodder tree species, highest index (H) value found in Hadira union (H=2.553) and lowest index (H) value found in Dhopakandi union (H=2.417). Incase of fuel tree species, highest index (H) value found in Jhaoail union (H=2.635) and lowest index (H) value found in Hadira union (H=2.421). Incase of all species, highest index (H) value found in Jhaoail union (H=3.017) and lowest index (H) value found in Dhopakandi union (H=2.967), (Table 8).

Table 8. Species diversity index of different species

Species	Shannon-wiener index (H)			
	Hadira	Dhopakandi	Jhaoail	Hemnagar
Timber Species	2.913	2.921	2.892	2.937
Fruit Species	2.936	2.918	2.937	2.924
Medicinal Species	2.876	2.731	2.881	2.752
Fodder Species	2.553	2.417	2.432	2.475
Fuel Species	2.421	2.532	2.635	2.573
All Species	2.987	2.967	3.017	2.975

Similar type of species diversity was observed by Roy *et. al.,* (2013), The result of Shannon-Winner diversity index value was calculated highest for tree (3.39), herb (2.56) and shrub (2.48) in rural homestead garden.

Distribution of respondents according to their income from MPTs

In homestead agroforestry, Multipurpose Tree Species (MPTs) have direct impact on income of the farmers. Farmers are classified into three categories on the basis of MPTs number with standard deviation 19.42. Small farmers with MPTs number (15 – 30) have average low income 13.21 thousand. Medium farmers with MPTs number (31 – 50) have average medium income 29.33 thousand. And large farmers with average MPTs number more than 51 have average highest income 45.79 thousand (Table 9).

Table 9. Categorization of respondents according to their income from MPTs

Category	Respondent (Number)	Percent	Average income (Thousand)	Standard deviation
Small (15-30)	21	26.25	13.21	19.42
Medium (31-50)	35	43.75	29.33	
Large (above 51)	24	30	45.79	

Scores of farmers opinion regarding changes in socio-economic aspects due to homestead agroforestry ranged from 0 to 54.0 indicated no opinion and 54.0 indicated high opinion. 16.25% respondents think that MPTs in homestead agroforestry have low impact in improving socio-economic aspects. 53.75% respondents think that MPTs in homestead agroforestry have medium impact in improving socio-economic aspects. 30% respondents think that MPTs in homestead agroforestry have high impact in improving socio-economic aspects (Table 10).

Table 10. Distribution of the farmers according to their socio-economic aspect

Category	Respondent (Number)	Percent	Average	Standard deviation
Low (up to 19)	13	16.25	23.340	7.902
Medium (20 to 32)	43	53.75		
Large (above 32)	24	30.00		
Total	80	100		

Relationship

The section deals with relationship between ten selected characteristics of the farmers and the impact of multipurpose tree species in the homestead argoforestry system on the livelihood of the farmers. The variables were age, education, family member, farm size, homestead size, annual income, organnization participation, knowledge on hoemstead and problem confrontation. To explore the relationships Pearson's Product Moment Co-efficient of Correlation (r) has been used (Table 14) with description of the meaning of 'r' (Cohen and Holiday, 1982(. The relationships of the selected characteristics of the respondents and the impact of multipurpose tree species on the livelihood of the farmers have been shown in Table 11.

Table 11. Computed co-efficient of correlation (r) between farmers selected characteristics and Impact of multipurpose tree species on the livelihood of the farmers in homestead agroforestry (N = 80)

Dependent variable	Independent variables	Correlation co-efficient 'r'
Impact of multipurpose tree species on the livelihood	Age	0.322^{NS}
	Education	-0.572**
	Family member	0.193^{NS}
	Farm size	0.570**
	Homested size	0.301**
	Annual income	0.651**
	Organizational participation	0.664**
	Konwledge on MPTs in homestead agroforestry	0.569**
	Problem confrontation	0.813**

**Correlation is significant at the 0.01 level, *Correlation is significant at the 0.05 level, NS = Non-significant

The age of the farmers and the impact of multipurpose tree species on the livelihood of the farmers was examined against the null hypothesis as "there is no relationship between the age of of the farmers and the impact of multipurpose tree species on the livelihood of the farmers." The value of correlation 'r' was found ٠,٣٢٢ which was non-significant. The findings indicated that age of the respondents had no relationship with the impact of multipurpose tree species on the livelihood of the farmers. Aearwal (2001) also observed same relation in northern Bangladesh. The education of the farmers and the impact of multipurpose tree species on the livelihood of the farmers was examined against the null hypothesis as "there is no relationship between the eduaction of the farmers and the impact of multipurpose tree species on the livelihood of the farmers. The value of correlation 'r' in such case was found -٠,٥٧٢ which was significant at ٠,٠١ level of probability. It means that a person having more education was likely to have less impact with multipurpose tree species on his livelihood .Sudmeye *et. al.,* (2004) also observed the same result in Rongpur district. Halim and Hossain (1994) also observed the same result in Tangail district. The homestead size of the farmers and the impact of multipurpose tree species on the livelihood of the farmers was examined by testing the following null hypothesis: "there is no relationship between the homestead size of the farmers and the impact of multipurpose tree species on the livelihood of the farmers". The computed value of 'r' was found 0.301 which was significant at 0.01 level of probability. The relationship between the two concerned variables also showed positive trend. Hence, the concerned null hypothesis could be rejected. The findings indicated that homestead size of the respondents had a positive significant relationship with the impact of multipurpose tree species on the livelihood of the farmers. This implies that farmers with larger homestead size had higher level of the impact of

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multipurpose tree species on the livelihood of the farmers. The relation bwtween annual income of the farmers and the impact of multipurpose tree species on the livelihood of the farmers was examined by testing the null hypothesis: "there is no relationship between annual income of the farmers and their attitude towards homestead agroforestry". The computed value of 'r' was found 0.651 which was significant at 0.01 level of probability.

Conclusion

Total 75 tree species were recorded from the study area of which 22 timber species, 24 fruit species, 13 medicinal species 8 fodder species and 8 fuel wood species. The highest diversity index value (H) for all species was found in Jhaoail union (H=3.017) and lowest index (H) value found in Dhopakandi union (H=2.967). The average size of the homestead was 0.096 ha and almost all the farmers of the study area had positive feeling towards the impact of the MPTs in homestead agroforestry. Education, occupation, farm size, homestead area, annual income, socio-economic aspects, knowledge on MPTs in homestead agroforestry and problem confrontation showed the significant results, age and family size showed the non-significant results.

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