FARMER'S VIEWS AND PERCEPTIONS ABOUT CROPLAND AGROFORESTRY PROMOTION IN RANGPUR DISTRICT OF BANGLADESH

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CERTIFICATE

This is to certify that the thesis entitled, "Farmer's Views and Perceptions about Cropland Agroforestry Promotion in Rangpur District of Bangladesh." Submitted to the DEPARTMENT OF AGROFORESTRY AND ENVIRONMENTAL SCIENCE, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka in partial fulfilment of the requirements for the degree of MASTER OF SCIENCE in AGROFORESTRY AND ENVIRONMENTAL SCIENCE embodies the result of a piece of bona-fide research work carried out by R. A. MEHEDI, Registration No. 09-03662 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed of during the course of this investigation has been duly acknowledged by him.

Dated:
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Dedicated to
My
Beloved Parents

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The Author

Farmer's Views and Perceptions about Cropland Agroforestry Promotion in Rangpur District of Bangladesh

ABSTRACT

The study was conducted at nine villages of three upazilas of Rangpur district to observe the farmer's views and perceptions about cropland agroforestry promotion in Rangpur district of Bangladesh. The selected characteristics were age, education, population size, farm size, homestead size and annual income. Alamnagar, Kursha and Mirzapur from the upazilas of Rangpur Sadar, Kaunia and Mithapukurupazila respectively under Rangpur district were the locales of the study. A sample of 50 farmers was drawn to collect data for the study. Data were collected on 26 March to 9 April, 2015 using a pre-tested interview schedule. The collected data were then summarized into following to meet the objectives of the study. Perception on future tree plantation on farmland and attitude towards agroforestry on farmland were considered for the present study. Only 14 percent respondents showed low attitude towards cropland agroforestry promotion where 48 percent respondents showed medium attitude and 38 percent respondents showed high attitude towards cropland agroforestry promotion.

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ACRONYMS, SYMBOLS AND ABBREVIATIONS

AESA : Agro Eco-System Analysis

BAU : Bangladesh Agricultural University

BBS : Bangladesh Bureau of Statistics

BRAC : Building Resources across Communities (formerly Bangladesh Rural Advancement Committee)

BINA : Bangladesh Institute of Nuclear Agriculture

DAE : Depart of Agricultural Extension

FFS : Farmers Field School

FAO : Food and Agricultural Organization

GDP : Gross Domestic Product

GOs : Government Organizations

ICM : Integrated Crop Management

ICP : Inter Country Program

IPM : Integrated Pest Management

ITK : Indigenous Technical Knowledge

MOA : Ministry of Agriculture

MS : Master of Science

NGOs : Non-Government Organizations

PROSHIKA : Proshikkhon Shikkha Kaz

RDRS : Rangpur Dinajpur Rural Service

SAAO : Sub Assistant Agriculture Officer

SAU : Sher-E-Bangla Agricultural University

SPPS : Strengthening Plant Protection Services

CHAPTER I

INTRODUCTION

Bangladesh is one of the most densely populated agriculture-based countries in the world. Its population growth rate is very high and thus the area of Bangladesh is very small in comparison to its population. Rapid population growth has created new pressure on limited resources such as forest and land resources. Bangladesh with a population of over 150 million within a territory of 144 thousand sq km is one of the densely populated countries of the world. About 80 percent of the total population lives in the rural areas whose livelihood are centered on agriculture and related activities (BBS, 2011). More than 30 percent of the rural families are landless or functionally landless having land only less than 0.202 hectares although per capita availability of arable land is 0.045 hectares (Ericksen *et al*., 1997). Bangladesh has 2.46 million hectare of forestland covering about 17% of the country's area. Wood is being used as the major source of energy in Bangladesh. Majority of researchers in Bangladesh have showed the large scale consumption of wood fuel is related to poverty. Poor are forced to cut trees when they don't have any alternatives to fulfill their minimum needs. Excessive population creates pressure on available land resources and limited availability of agricultural support services.

Agroforestry is the only and quick solution of all these problems that bridge up the gap between demand and supply of wood and non-wood products. Agroforestry is a dynamic, ecological based natural resource management system that intergrade trees, forests and livestocks. Our agriculture system provides production only. But when we practice agroforestry it gives us both protection and production. This is very beneficial for farmers to fulfill their demands. Most of the farmers of our country don't know about the term agroforestry but they use it following traditional production system. No agriculture development is possible without

farmer's participation in agro-based development activities. Farmers can play a vital role if they increase their perception about agroforestry and its application in their cropland. Bangladesh has a long tradition of agroforestry practices. There are different types of practices like Homestead agroforestry, Cropland agroforestry, Roadside agroforestry, Mixed agroforestry etc.

Cropland Agroforestry (CAF) is a traditional land use system in Bangladesh where tree species like date palm (*Phoenix sylvestris*), palmyra palm (*Borassus flabellifer*), babla (*Acacia nilotica*), mango (*Mangifera indica*), khoer (*A. catechu*), mahogany (*Swietenia mahogany*), jackfruit (*Artocarpus heterophyllus*), eucalyptus (*Eucaliptus camaldulensis*) and sissoo (*Dalbergia sissoo*) grow naturally or planted on agricultural lands and are purposely retained and maintained by the farmers for different household utilities, products and also for cash income (FAO, 2004). Various patterns of cropland agroforestry systems are practiced in different agro-ecological regions of Bangladesh which reflects biophysical and social variations (Miah *et al*., 2002). Trees are planted on the borders or within the field, systemically or at irregular intervals, usually with crops such as rice, wheat, pulse, jute, oilseed, sugarcane, vegetables and others; and farmers also grow shade-tolerant crops such as turmeric, ginger and aroid when trees have high canopy coverage (Shams, 2013).

It is observed that on an average about 2 percent family income come from the Cropland Agroforestry (FAO, 2013). In a study on cropland agroforestry in Bangladesh it is found that about 46 percent of farmers generated cash income from selling trees and met expenses for purchase of land, bullocks and inputs for crops, supplemented expenses of marriage, household expenditure, and loan repayment (Chowdhury and Mahat, 1993). In addition, a comprehensive survey on Jessore district reveals that about 43 percent of the household fuel needs are met by tree products and about half of this comes from the Cropland Agroforestry (Abedin and Quddus,1988). Besides fuel wood supply for household cooking,

Cropland Agroforestry also provides environmental, economic and social benefits to the community (Chundawat and Gautam, 1993) which ultimately boasts the sustainable livelihood strategies of the local people.

Agriculture is very important for the economy of Bangladesh. It contributes about 20.92 percent to the gross domestic products (GDP) and about 66 percent of employment of labor forces. This sector will continue to play a vital role in achieving self-sufficiency in food production which reduces rural poverty and fastening sustainable development. Farmer's perception in promotion of agroforestry is very important in the economy of Bangladesh.

Several NGOs are involved in forestry activities to develop farmer's agroforestry perception which include planting trees along the marginal land, private land and even in the forest department lands. Notable NGOs are Proshika, Manobik Unnayan Kendra, Bangladesh Rural Advancement Committee (BRAC), CARE, RDRS, etc. (Ahmed, 2001). This study dealt with the structural composition and economic benefit of cropland agroforestry practices introduced in Rangpur district. Very few empirical researches were conducted on this issue.

So, on the above consideration the researcher of this study felt necessity to conduct the research on "Farmer's views and perceptions about agroforestry promotion in Rangpur District of Bangladesh" with the following objectives:

1. To determine the farmer's views and perceptions towards agroforestry promotion in Rangpur district of Bangladesh;
2. To assess selected characteristics of farmer's towards agroforestry promotion in Rangpur district of Bangladesh; and
3. To explore the relationship between the selected factors of farmers and their perception towards promotion of agroforestry in Bangladesh.

CHAPTER II

REVIEW OF LITERATURE

This study is concerned with diversity of cropland agroforestry under different level of the farmers of a particular region of Bangladesh. The study was conducted in the homestead and cropland area. The information on cropland agroforestry present in the literature is voluminous. Thus only the most relevant information to this study was presented in this chapter. The research made an elaborate search of available literature for this research. Available literature was extensively reviewed to find out work in Bangladesh as well as abroad. The reviews are conveniently present based on the major objectives of the study.

2.1 Traditional Agroforestry

Agroforestry has been promoted as a sustainable and ecologically sound alternative approach to managing upland landscapes. It involves the integration of annual and perennial food crops as well as livestock, which renders social, economic and environmental benefits (Leakey, 1996). However, the question is whether it is financially attractive for farmers to adopt.

A number of studies have been undertaken to determine the financial viability of agroforestry systems. Many of these studies have sought to examine the financial costs of establishing, managing and producing various combinations of agricultural and timber crops as well as the potential gross revenues and profitability (Grado and Husak, 2004). The adoption of agroforestry systems has proven a financially viable and an attractive land use alternative in various settings throughout the world (Garrett 1997, as cited in Grado and Husak 2004). The increased financial benefits from practicing agroforestry may stem from increased biophysical productivity or reduction in input costs (Franzel, 2004).

Franzel (2004) observed that analyzing the economics of agroforestry practices is more complicated than of annual crops because of the complexity of agroforestry

systems and the time lag between tree establishment and harvest. Also, the analysis should include the valuation of all components of the ecological systems, including the agriculture, forestry, wildlife, livestock and other activities to determine the contribution of each component to the overall system (Grado and Husak, 2004).

Agroforestry is being practiced from the time immemorial in different countries in different forms. John Bene of Canada gave first widely accepted definition. According to Bene *et al.,* (1977) 'Agroforestry is a sustainable management system for land that increases overall production, combines agricultural crops, tree crops and forest plants and/or animal simultaneously or sequentially and applies management practices that are compatible with the cultural patterns of a local population'.

Agroforestry is an idea of combining forestry and agriculture on the same piece of land. The basic concept of intercropping has been extended to agroforestry systems. Many authors have defined agroforcstry in different ways. A widely used definition given by the International Council for Research in Agroforestry (ICRAF) is that "Agroforestry is a collective name for all land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc) are deliberately used on the same land management units as agricultural crops and/or animals in some form of spatial arrangement or temporal sequence".

2.2 Cropland Agroforestry

CAF system provides enough food, timber, fodder, fruit, fuel wood, construction materials, raw materials and other products for forest-based small-scale enterprises and other cottage industries (Rahman, 2011). The best product having commercial value from cropland trees might be poles and pulpwood as these trees are mostly short-rotation species (Ghosh *et al.*, 2011). Trees in crop fields work as insurance in case of sudden crop failure or to support crops against environmental hazards

and also to provide extra income from trees. Moreover, if there is a failure in one crop, the other crops would supplement the deficit. So, CAF is largely evolved with sustainability concerns - resiliency, diversity, and avoiding negative side effects in mind (Brooks *et al.*, 1995).

Chakraborty *et al.* (2015) conducted a study to explore the socio-economic impact of cropland agroforestry in Bangladesh. They surveyed 84 farmers of two sub-districts named Manirampur and Baghe *et al.* rpara under Jessore district in the south-west region of Bangladesh through using a questionnaire. It follows a multistage random sampling procedure for selecting respondents. The main objective of the study is to assess the socio-economic impact of Cropland Agroforestry (CAF) on farmers' livelihood. The survey results reveal that CAF farmers' socio-economic status is better than that of Non-Cropland Agroforestry (NCAF) or monoculture farmers. This study finds that housing pattern, level of education, land and other physical assets are significantly different between CAF and NCAF farmers. The mean annual household income of the surveyed CAF farmers is Tk. 0.19 million which is significantly higher ($p<0.05$) than that of the surveyed NCAF farmers. Household income also varies widely according to farm size and number of members in a household. The Weighted Mean Index (WMI) of five major indicators of farmer's household livelihood situation reveals that CAF farmer's household energy and food situation, affordability of education, medical and clothing expenditure is better than NCAF farmers. This study finds a statistically significant difference ($p<0.05$) between CAF and NCAF farmers in case of these five major indicators. Therefore, this study suggests for planned expansion of cropland agroforestry for overall socio-economic development of the farmers.

Mujibar Rahman and Alam (2007) surveyed for cropland agroforestry practices practiced by the farmers to observe the extent of coverage with particular emphasis on its composition and economic benefit derived in Charghat, Putia and

Paba upazilas in the Rajshahi district. It was observed that the farmers practicing the cropland agroforestry plantation with trees were broadly of four types viz. (i) boundary plantation in and around the crop field, (ii) scattered plantation within the crop field, (iii) strip plantation within the crop field and (iv) composite plantation having timber trees in the boundary and fruit trees within the crop field. The composition of each of these practices has been elaborately described with supporting photographs. Economic evaluation of these different cropland agroforestry practices revealed that the farmers are getting significantly higher income from this simultaneous production system. From the findings, it is concluded that cropland agroforestry practices in Rajshahi district were economically profitable and fulfilling the demand of fuel wood and small timbers as well as increasing the tree coverage in comparatively drier part of the country.

Cropland agroforestry is an important production system of Bangladesh. Hasanuzzaman *et al.* (2014) conducted this study to focus the diversity, composition, people's preferences, spatial variations and purpose of cultivation of agricultural crops in the cropland agroforestry practices of southwestern Bangladesh. A total of 313 cropland agroforests were randomly surveyed from Khulna, Jessore and Satkhira districts of this region. The highest (0.84 to 0.87) crop diversity index (CDI) was found for climber vegetables, followed by tuber vegetables (CDI - 0.78 to 0.81), spices (CDI - 0.75 to 0.81) and the lowest (CDI - 0.20 to 0.40) was found for cereal crops. Among these three districts maximum crop diversity was found in Jessore as the soil is more suitable as well as marketing and transportation facility is higher than the other two districts. Among the cereal crops maximum (95%) preferred paddy (*Oryzae sativa*). Among the cash crops maximum (68%) preferred jute (*Corchorus capsularis*). Among the tuber vegetables maximum (44%) preferred potato (*Solanum tuberosum*). Among the fruity vegetables maximum (42%) preferred brinjal (*Solanum melongena*). Among the leafy vegetables maximum (39%) preferred basil (*Basella alba*).

Among the climber vegetables maximum (36%) preferred bean (*Lablab niger*). Among the pulses maximum (52%) preferred lentil (*Lens culinaris*). Among the spices maximum (42%) preferred green peeper (*Capsicum frutescens*). Among the flowers maximum (70%) preferred rose (*Rosa centifolia*). Among the annuals/perennials maximum (66%) preferred banana (*Musa* spp.). Overall diversity and preference of agricultural crops in southwestern Bangladesh were determined by the local demand and end product.

In cropland agroforestry system, various fast growing trees that demand less water and blocked minimum sunlight are planted alongside crops or some cases along the plot boundaries. In addition to cereal crops different vegetables, pulses, beans, spices and nontraditional cash crops are grown under the trees or using trees as trellis in the croplands (Chowdhury, 1997). Crop diversification enhances nitrogen in the soil to replenish the soil fertility as well as more pest-resistant thus, increases the sustainability of arable land (Chakraborty, 2012). It generates more employment opportunities and has tremendous potential to alleviate rural poverty particularly in the lean period when smallholders await for maturing and harvesting of main crops, the short durational complimentary non-cereal crops act as a safety net (Gunasena, 2003). Therefore, agroforestry practice is gaining popularity is many parts of Bangladesh (Aktar *et al*., 1992).

Sharmin and Rabbi (2016) conducted a survey in Jhenaidah District of Bangladesh. The main objective of this study was to investigate and analyze the farmers' attitude towards agroforestry, the reasons for adoption of agroforestry by farmers and the problems being faced by them. It was found that the middle aged farmers (42.7%) were mostly interested in adopting agroforestry with traditional practice whereas young aged farmers (23.95%) appeared to practice it in a wide range. On the other hand, farmers (23.53%) who generally take lease for cultivation do not practice agroforestry. In the study area all farmers practice homestead agroforestry and 61% of the farmers practice cropland agroforestry.

Above 80% respondents have taken positively agroforestry practice, but did not receive formal training skills or facility but just inherited ideas from their superiors. Most of the farmer's (94.12%) have positive attitude towards Agroforestry in Jhenaidah district.

Tolunay *et al.* (2007) observed traditional cropland agroforestry practices in West Mediterranean Region of Turkey. Each agroforestry practice was determined and classified in the agroforestry systems. Many of the agroforestry production patterns are being seen as a traditionally in the entire region. Results showed that, agroforestry application in the region studied can be put in major cropland agroforestry practices like, agricultural systems, alley cropping, multi layer tree gardens, multipurpose trees on croplands, home gardens, trees in soil conservation and reclamation, shelter belts and windbreaks, silvopastoral systems; home garden involving animals, multipurpose woody hedgerows apiculture with trees, aquaforestry, multipurpose woodlots. As an agroforestry practice, shifting cultivation and Taungya are determined in the region; however, both practices are not applicable, because of causing forest degradation.

Roy *et al.* (2005) reported that significant gap between traditional cultivation methods and improved cropland agroforestry systems in socio-economic terms. Improved agroforestry systems provide approximately double income per capita in comparison to traditional methods. More intensified cash crop cultivation in the highlands of the East Usambara also results in double income compared to that in the low lands. However, people are sensitive to risks of changing farming practices. Encouraging farmers to apply better land management and practice sustainable cultivation of cashcrops in combination with multipurpose trees would be relevant in improving their economic situation in the relatively short term. The markets of most cash crops are already available. Improved agroforestry methods could ameliorate the living conditions of the local population and protect the natural reserves from human disturbance.

Tangang *et al.* (2004) stated that agroforestry systems have been maintained as a part of rural survival over generations, with the multi-storey vegetation structure and diverse type of plant composition. In the present study, plant species composition and diversity of traditional agroforestry systems practiced by three different ethnic groups in Arunachal Pradesh, India were evaluated. The total number of trees, shrubs and herbs species recorded is 41, 22 and 35 respectively. The Nyishis practice jhum and terrace cultivation, silvi-horticultural and agro-silvi-horticultural systems. The Apatanis and Kalitas practice paddy-cum-fish culture and bamboo-cum-pine forests, and agro-horti-pisci-silviculture and animal husbandry systems, respectively. Overall, the plants have been distributed contagiously (83.19%). Shannon's diversity index varied between 0.73 and 1.22 for tree species and between 0.98 and 1.08 for the herbaceous species. The cost-benefit ratio was lowest in the systems practiced by Nyishis, whereas it was highest in the paddy cum-fish culture systems of the Apatanis, Nonetheless, the variation in species composition, diversity and the economic returns are linked to the traditional beliefs and the day-to-day requirements of the people.

Palace *et al.* (2003) explores the relationship between agro forestry-based soil fertility replacement (SFR) systems (improved fallows and biomass transfer) and poverty reduction in rural western Kenya. It further examines the role that different dissemination approaches play in conditioning which segments of society gain access to information on the technologies and then use them. The study made use of different qualitative and quantitative data collection methods, and samples from both pilot areas where farmers learned of the technologies through other channels. The findings showed that poverty is rampant among households and appeared to worsen during the study period. The poor were reached by many different information providers and liked certain aspects of almost all types of organizations, from government extension to community group-based methods. Access to information is mediated by social relationships of wealth, gender and

status; nevertheless, poor farmers acquired a significant amount of knowledge about soil fertility management. Adoption rates are not outstanding but they are encouraging with about 20% of all farmers using the technologies on a regular basis, and a sizable percentage of farmers newly testing them. Unlike some agricultural technologies, SFR was not found to bias toward people controlling and managing resources above a certain threshold. The study also found that the poor were using the agroforestry technologies to a greater extent than they were using fertilizer (about 33% of farmers not using any other soil fertility practice were trying the new systems). The technologies were almost always at least doubling the yields of maize. Despite these promising signs, the systems were not found to be linked to improved household-level food security or poverty indicators, primarily because the size of the fields under the agroforestry systems was, on average, quite small.

Scherr *et al.* (2000) studied on successful diffusion and adoption of new agro forestry practices depends not only upon the technical performance of those practices and their fit with farming systems, but also on the broader policy environment. Key policy factors relate to: tree germplasm supply, agricultural input supply, markets for agro forestry products, land and foresee tenure systems and strategies and institutional arrangements for extension and research support. On-farm research during the technology development process provides a strategic opportunity to begin evaluating policy constraints and ways to address them. It is observed that practices that minimize the rate of soil degradation, increase crop yields and raise farm income are keys to sustaining agricultural productivity in the hills of Nepal. They also stated that agro forestry has great potential for enhancing food production and farmers' economic conditions in a sustainable manner through its positive contributions to household income.

Nagarajan and Sundaramoonhy (2000) stated that the distribution of available nutrients (CNP) were in traditional agro forestry system with cultivated as well as

uncultivated fields. *P. cineraria* enhanced the C, N and P in both conditions. They also started that the enrichment of available nutrients was significantly higher in uncultivated fields as compared to the cultivated fields.

Manel *et al.* (2000) stated that piecemeal changes in land use might have cumulative effects on regional biodiversity. Land use in the region was 33% terraced agriculture, with associated vegetation of scrub or rough pasture, broadleaved or mixed forests, conifers forests, sal *(Shorea robusta)* forest, and alpine vegetation. They also suggested that large-scale surveys, although providing one of the few pragmatic methods of assessing large anthropogenic effects on ecosystems, will need careful design to factor out potential confounds if they are to be supported where possible with process studies, intervention studies and model applications to independent data.

Korianthimath *et al.* (2000) observed that panniyu-1 pepper and C1.37 cardamons were grown with silver oaks *(Grevillea robusta)* as shade trees in Kodagu district. Karnataka. Cultural practices and irrigation followed local recommended practice. Costs and returns were analyzed using a 14 % discount rate. This indicated that this agro forestry system was economically viable.

Riha *et al.* (1999) stated that the influence of hedgerow agro forestry systems in water movement and water use by plants was compared with a more conventional agricultural system. The hedgerow components combined with climate, soil and landscape factors affecting water movement and use process arc demonstrated. Biophysical factors and cultural practices affect surface runoff, infiltration and soil evaporation, influencing water movement and plant water process in an agro forestry systems.

Francisco (1999) reported the profitability analyses of the dominant farming systems: Agro forestry system 1 (agricultural crops with forest/fruit trees), agro forestry system 2 (mixed fruit/forest trees) and mono-perennial cropping systems)

in Makiling Forest Reserve (MFR), in Philippines. He suggested that an average size of approximately two hectares can be an adequate farm size for farm households.

Mendoza-Vega (1995) observed that soil fertility aspects (physical and chemical soil properties) and the effects of current land use practices on this properties. They reported that plots with the same soil type (Mollic Gleysols, Rendzic Leptosols. Calcic Phaeozems and Stagnic Lixisols) and different land use did not differ too much in physical and chemical properties. They suggested that due to the natural fertility the Indians agricultural practices allowed the sites to regenerate. Relevant types of agricultural use or land utilization were defined and crop suitability for 22 species was given.

Abedin and Quddus (1990) found that jackfruit was the farmers' most preferred tree species for planting in at an increasing rate in the Madhupur Sal forest and other agro ecological regions of Bangladesh. Jackfruit is a perfect multipurpose tree. The fruit is delicious and enjoys a good price in the market. The seeds are used as vegetables, and the remaining parts are used as supplementary feed for livestock.

Casely (1987) observed that the establishment of a village woodlot of *Eucalyptus* and the planting of a unknown indigenous tree (*Acacia albida)* interplant with the locally unknown species *Leucaena leucocephala* along the contours of farm fields, at wide enough spacing to allow cultivation by ox-drawn equipment.

CHAPTER III

MATERIALS AND METHODS

This Chapter included the detailed procedures that were used in conducting the study. This Chapter also included brief description of the study area and characteristics of the sample farmers. The geographical location, agro-ecological region, topography, climate, land use and socio-economic characteristics of the sample farmers are described in the following sections:

3.1 Selection of the study area

The study was conducted in three upazillas of Rangpur district. From each upazilla, one union was randomly selected and from each union, three villages were randomly selected for the study area. Total of 985 household families from nine villages, 84 sample populations was preselected. Among the 84 sample population, 50 families were selected (60% of the preselected sample) for data collection. One active working person of each selecting household was interviewed for taking data and the data was analyzed using software programme. The information's were taken according to the prepared questionnaire from 50 sample population and distribution of population as sample size for data collection are presented in Table 1.

Table 1. Distribution of population and sample size in study area

District	Upazilas	Unions	Villages	Total House-holds	Preselected Sample Population	Selected sample population for data collection
Rangpur	Rangpur Sadar	Alamnagar	Babupara	105	9	5
			Senpapa	120	11	6
			Bananipara	95	8	5
	Kaunia	Kursha	Bahagili	113	7	4
			Mirbag	123	13	8
			Baghmari	87	7	4
	Mithapukur	Mirzapur	ImadpurMadrashapara	116	9	6
			Ismailpur	98	7	4
			Rajaram	128	13	8
Total				985	84	50

These upazilas were selected purposively for data collection on farmer's views and perceptions about agroforestry promotion in Rangpur District of Bangladesh.

Among other things, the following considerations were kept in mind during selection of the study area:

i) Concentration of cropland agroforestry
ii) No systematic study on this aspect had yet been conducted
iii) Easy accessibility to collect required information and
iv) Good co-operations from the respondents in view of getting reliable and valuable information

3.2 Geographical location and area

The study was conducted in three upazilas of Rangpur district named as Rangpur Sadar, Kaunia and Mithapukur. The Latitude and Longitude of Rangpur Bangladesh is 25.7504 and 89.2559 respectively. Map of Rangpur district and three upazilas under the study area are presented in Figure 1– 4.

3.3 Agro-ecological region

The study area belonged to the different Agro-ecological Zone (AEZ). The study area under Rangpur district is under the AEZ-2: Active Tista Floodplain, AEZ-3: Tista Meander Floodplain and AEZ-27: North Eastern Barind Tract (BBS, 2010).

3.4 Crops and cropping pattern

In upland soils (i.e. Chala) brinjal, turmeric, ginger, chili, sponge gourd, snake gourd, country bean, kakrol, ladys finger, bitter gourd, bottle gourd, cucumber, amaranth, jackfruit, mango, banana, olive, lemon, papaya, guava etc. are mainly cultivated. In medium high land and medium low land and low land, local and high yielding variety of transplanted Aman and Boro rice, are grown under irrigated condition.

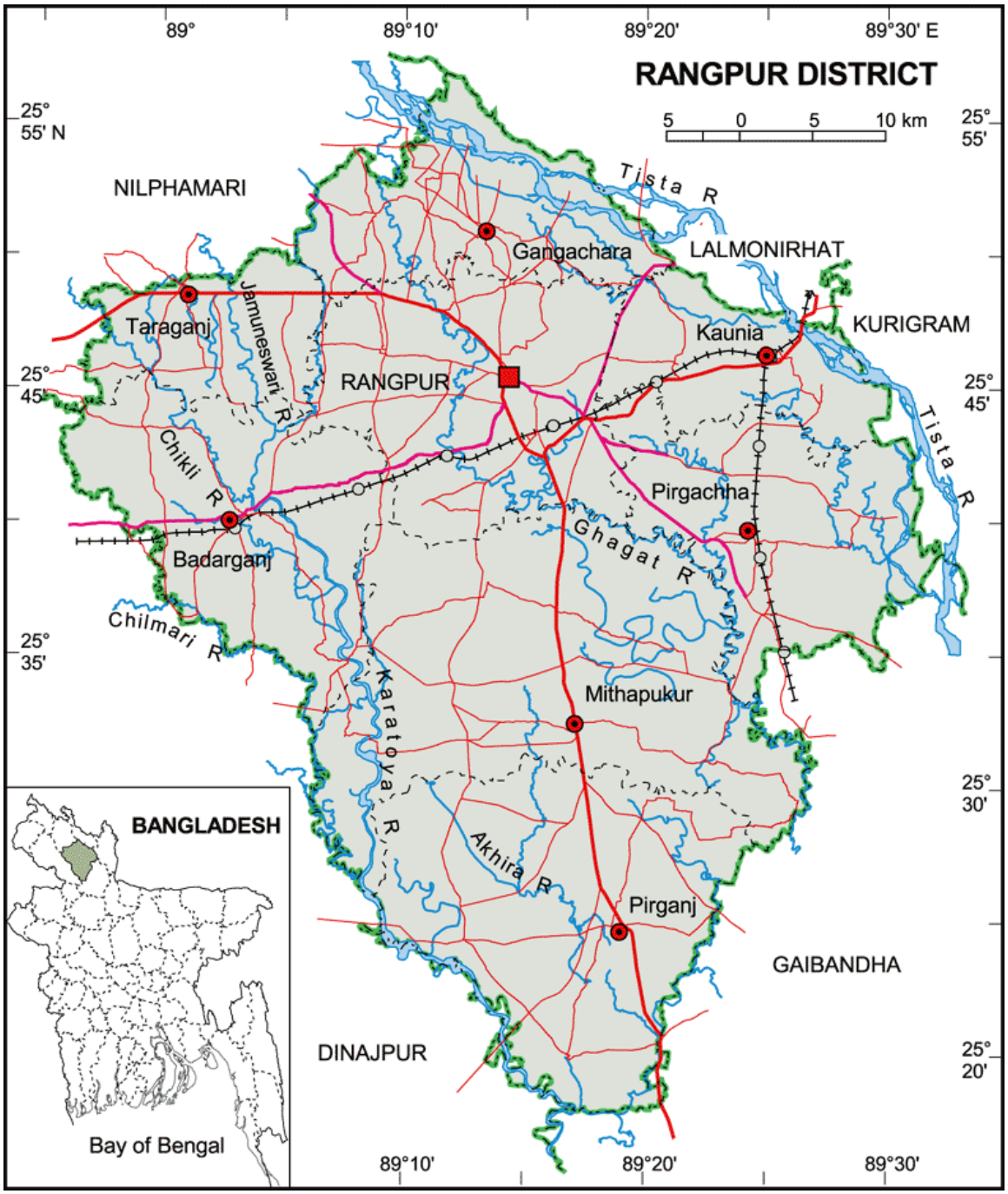

Fig. 1. Map showing locale of the study area in Rangpur district

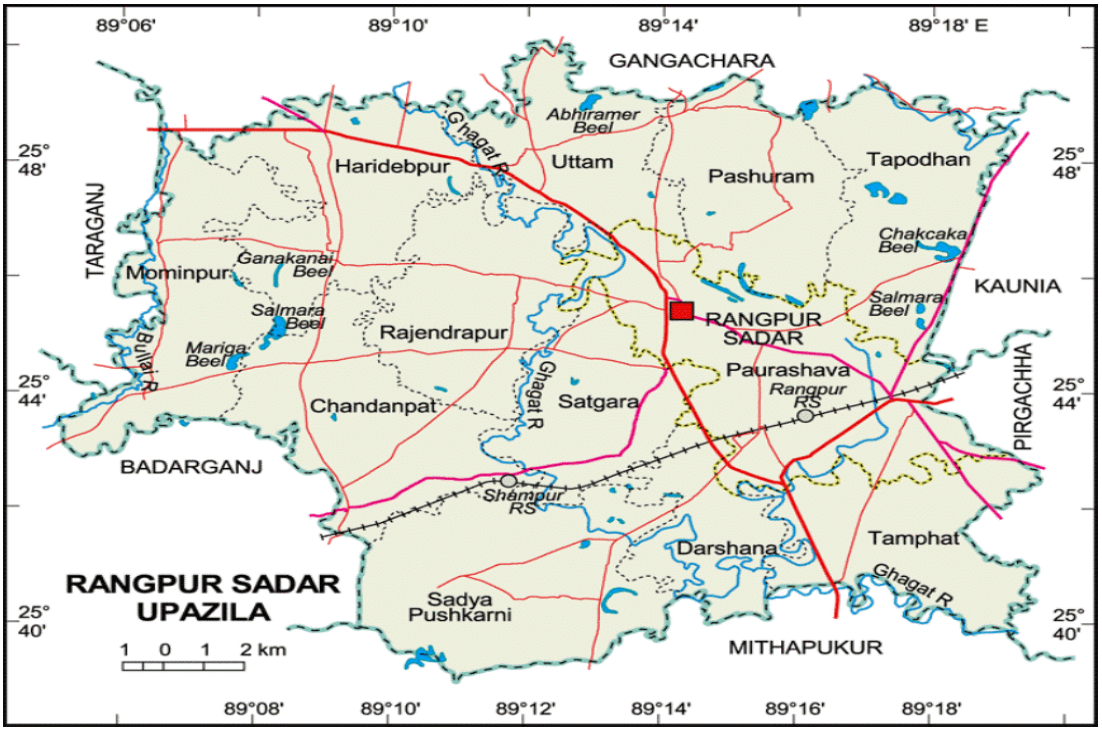

Fig. 2. Map showing locale of the study area in Rangpur Sadar Upazila

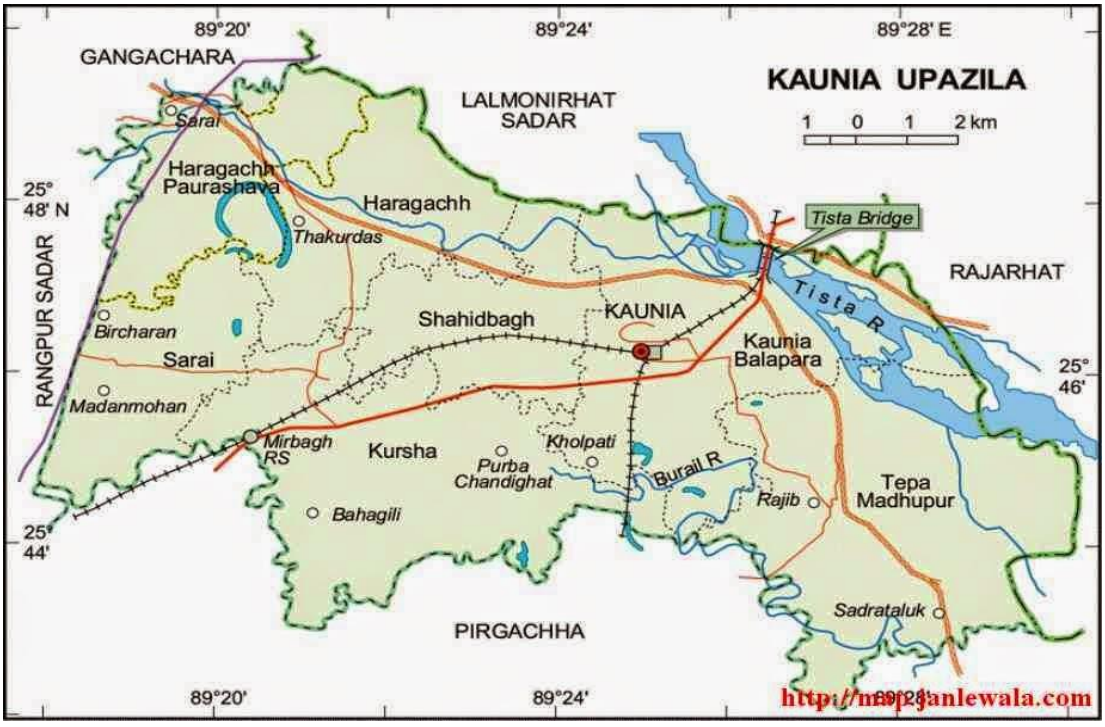

Fig. 3. Map showing locale of the study area in Kaunia Upazila

Fig. 4. Map showing locale of the study area in Mithapukur Upazila

3.5 Period of the study

The study was conducted during the period from November 2014 to March 2015 through field testing of interview schedule, direct interviewing of the respondents, field visit and observations, and discussion with the concerned experienced farmers.

3.6 Sampling procedure

At the first phase of the study, it is not possible to make survey covering all the respondents. For the convenience of time and money, a simple random sampling technique was followed. All sample farmers of nine (9) unions of different upazila under Rangpur district constitute the population of the study. From about total of 985 farmers in these 9 unions, only 84 framers were randomly selected as the sample of the study by using random number table. From these 84 farmers, 50 respondents (60%) were selected randomly from the selected areas. A structured questionnaire was used to collect information on cropland based agroforestry practiced from the selected respondents.

3.7 Preparation of interview schedule

Based on the field observation and objectives of the study, an interview schedule was prepared. The draft interview schedule was validated in the field and then necessary modifications were done incorporating the information recorded during the testing of the interview schedule. After pretesting and necessary adjustment, a final schedule was prepared to collect data from the selected respondents. The interview schedule of the present study is presented in Appendix 1.

3.8 Methods of data collection

Before going to make an actual interview, a brief introduction of the aims and objectives of the study were explained to each respondent. When they were assured that the study was purely academic and had no other purpose, they provided their cooperation to the researcher. The necessary information was collected by the researcher himself during the period of the study. After completion of each interview, the schedule was checked and verified to be sure that the answers were correct. In order to minimize errors, data were collected in the local units. The local units were later converted into standard units.

3.9 Selection of variable of the study

In scientific research, selection and measurement of variable constitute an important element viz. an independent variable and a dependent variable. Independent variable is that factor manipulated by experimenter in her attempt to ascertain its relationship to an observed phenomenon. On the other hand, a dependent variable is that factor which appears, disappears, or varies as the experiment introduces, removes, or varies the independent variables.

a) Independent variables of study area:
    1. Age
    2. Education
    3. Family size
    4. Farm size
    5. Homestead area
    6. Annual income
    7. Organizational participation
    8. Problem faced for tree growing in cropland

9. Information needed for cropland agroforestry
10. Suggestions needed for cropland agroforestry

b. Dependent variables of study area:
    1. Perceptions about Cropland Agroforestry Promotion

3.10 Measurement of independent variables

3.10.1 Age

Age of farmers refers to the period of time from his birth to the time of interview. A score of (1) was assigned for each year of his age. It was measured in complete years as reported by a farmer.

3.10.2 Education

Education is defined as the ability of an individual to read and write, or formal education received up to ascertain standard. Education of a respondent was measured on the basis of classes he had passed in formal educational institution. For example, if a respondent passed class five, his education score was 5. If a respondent not knowing reading and writing was given a score of zero (0), and a score of 0.5 was assigned to these respondents who can sign only.

3.10.3 Family size

The family size was measured by the total number of members in the family of a farmer. Die family members included the farmer himself, spouse, children and other dependents. The information was obtained by a farmer's to item number 3 of the interview schedule. The total number of family members was considered as the family size score of a farmer.

3.10.4 Farm size

Farm size of a respondent was measured in terms of hectares by using the followings formula:

Farm size = $A_1 + A_2 + {}^1/_2 (A3+A_4) + A_5$

Where.

A_1 = Homestead area

A_2 = Own land under own cultivation

A_3 = Land taken from and/or given to other on borga

A_4 = Land taken from and/or given to other on lease

A_5 = Others (pond, fruit garden etc).

3.10.5 Homestead area

It was measured by the area of the raised land in which the household has its entire living room, livestock and poultry shed, yard under vegetables, fruit and timber trees, backyard, bushes, bamboo bunches, pond etc. It was express in hectare.

3.10.6 Annual income

This refers to the total earnings of all family members of a farmer from farming, livestock and fisheries and other sources as contained in item number 5 of the interview schedule. A score of one (1) was assigned for each one thousand taka.

3.10.7 Organizational participation

It was measured by the farmers involved with Government and Non-Government organization reported by them. Scoring was used for measuring organizational participation of a respondent and involved with one or two or three organization is scored by 1 or 2 or 3 respectively.

3.10.8 Problem faced for tree growing in cropland

Problem faced for tree growing in cropland was measured by questioning and answering process among the selected farmers and scoring system was applied according to the question and the questions sources as contained in item number 9 of the interview schedule. A score of one (1) was assigned for each question.

3.11 Data analysis

Collected data of the present study were summarized and scrutinized carefully for statistical analysis using SPSS 16.0 computer software for analyzing Social Science data. In order to achieve meaningful conclusions, tabular technique of analysis was intensively used because its simplicity. Finally, relevant Tables were prepared according to the requirements of data presentation to meet objectives of the study.

After completion of field survey data form all the interview schedules were coded, complied, tabulated and analyzed in accordance with the objectives of the study. In this process, all the responses in the interview schedule were given numerical coded values. Local units after checking were converted into standard international units. Qualitative data were converted into quantitative ones by means of suitable scoring whenever necessary. The responses to the questions in the interview schedules were transferred to a master sheet to facilitate tabulation.

For describing the different characteristics and their constraint facing, the respondents were classified into several categories. These categories were developed by considering the nature of distribution of data, general understanding prevailing in the social system and possible score system.

3.12 Statement of Hypothesis

As defined by Goode and Hatt (1952) 'A hypothesis is a proposition, which can be put to a test to determine its validity.' It may prove valid or invalid of a proposition. In any event, however, it leads to a practical test. In studying relationship between variables, research hypotheses are formulated which state anticipated relationships between variables. However, for statistical test it becomes necessary to formulate null hypothesis. A null hypothesis states that there is no relationship among the variables. If a null hypothesis is rejected on the basis of a statistical test, it is assumed that there is a relationship between the concerned variables.

The following null hypotheses were formulated for this study:

"*There is no relationship between each of the selected independent characteristics of the farmers and their attitude towards cropland Agroforestry"*.

3.13 The Conceptual Framework of the Study

In scientific research, selection and measurement of variables constitute an important task. Properly constructed hypothesis of any research contain at least two variables namely, dependent variable and independent variable. Selection and measurement of those variables is also crucial. A dependent variable is that which appears, disappears or varies as the researcher introduces, remove or varies the independent variables (Townsend, 1953).

An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon. Based on these above discussion and the review of literature, the conceptual framework of this study has been formulated and shown in figure 5.

Conceptual Framework of the Study

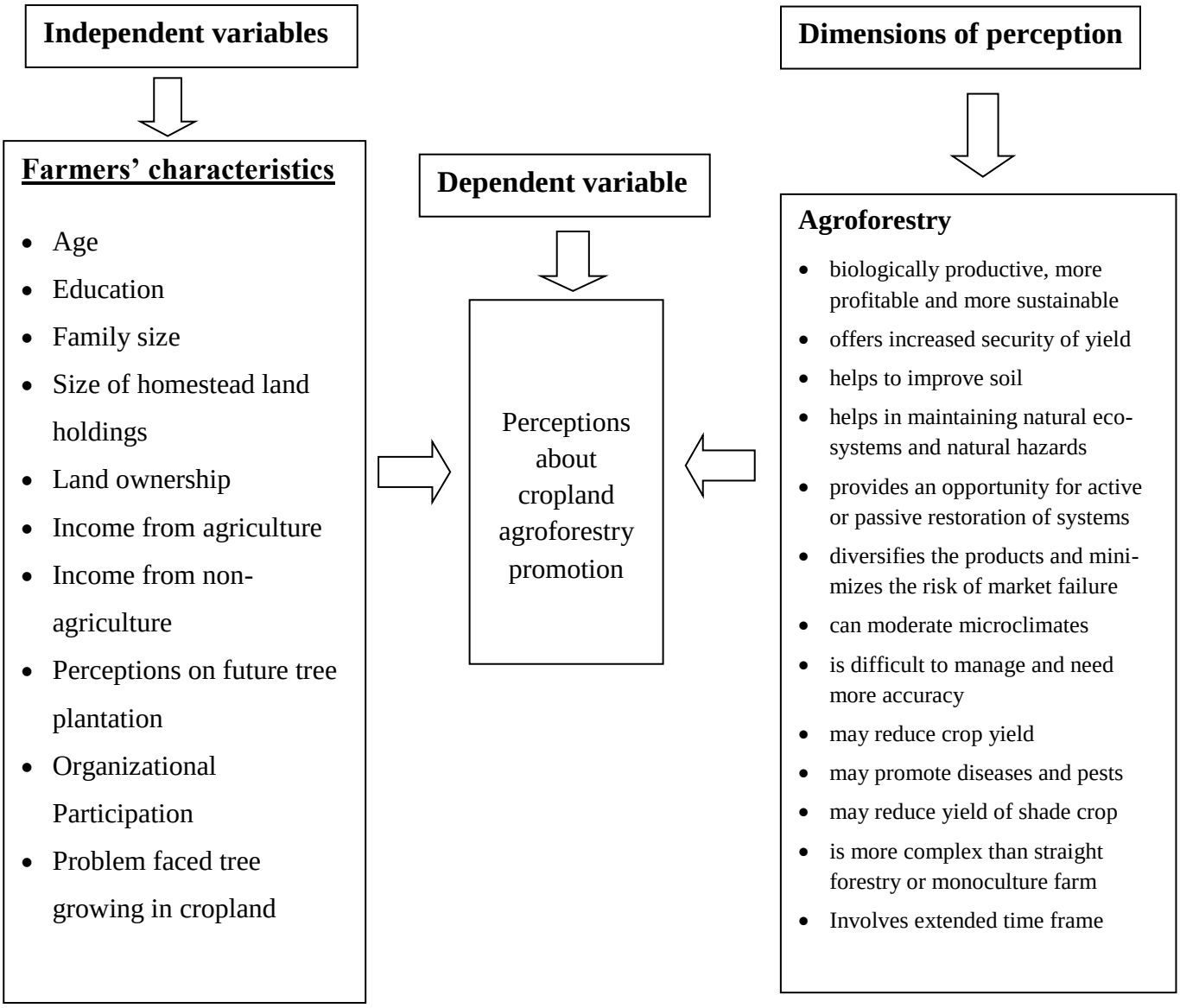

Figure 5. Conceptual framework of the study

CHAPTER IV

RESULTS AND DISCUSSION

The finding of this study is presented in two parts of this chapter. The first part deals with the description of the variables of the study and the second part deals with the perceptions about cropland agroforestry promotion among the respondents.

4.1 Basic characteristics of the respondents as independent variables

4.1.1 Age

Age of the respondents ranged from 31 to 55 years with an average of 40.08 years and standard deviation of 13.18 where the observed range among the respondents in respect of age was 33 to 55 (Table 2). On the basis of their age, the respondents were classified into three categories. Data presented that the highest proportion of 74 percent of the farmers was in the middle age range, where the lowest proportion of 6% of the farmers was in the old age range followed by 20% young age range of respondents.

Table 2. Age of the respondents regarding farmer's views and perceptions about cropland agroforestry promotion in Rangpur district

Age category	Age ranges	Observed range	Number of respondents		Mean	SD
			Number	Percent (%)		
Young age	Up to 35	33-55	10	20	40.08	13.18
Middle age	36 – 50		37	74		
Old age	Above 50		3	6		
Total			50	100		

4.1.2 Education

The education level of the farmers ranged from 0 – 16 with an average of 2.80 and standard deviation of 2.42 of schooling where the observed range among the respondents in respect of education was also 0 – 16 (Table 3). There was no respondent in 'Can't read and write' category. In this study 52 percent of the farmers

was in 'Can read and write' category where only 12% of the total respondents was in the category of 'Secondary education and above'. The category of 'Primary education – Class X' also put up with 12% of the total respondents. A major portion of respondents (24%) was in the category of 'Can sign only'.

Table 3. Education level of the respondents regarding farmer's views and perceptions about cropland agroforestry promotion in Rangpur district

Education level	Score	Number of respondents		Mean	SD
		Number	Percent (%)		
Can't read and write	0	0	0	2.80	2.42
Can sign only	0.50	12	24		
Can read and write	1.00	26	52		
Primary education – Class X	1 – 10	6	12		
Secondary education and above	10 – 16	6	12		
Total	0 – 16	50	100		

4.1.3 Family size

The family size scores of the farmers ranged from 2 – 8 with an average of 5.94 and standard deviation 3.27 where the observed range among the respondents in respect of family size was also 2 – 8 (Table 4). Most of the farmers (60 Percent) had medium family size compared to 10 percent small and 30 percent large family. Among the 50 farm families, there were total of 297 family members where male was 162 and female was 135.

Table 4. Family size of the respondents regarding farmer's views and perceptions about cropland agroforestry promotion in Rangpur district

Family size (Members)	Number of respondents	Percent (%)	Family members			Mean	SD
			Male	Female	Total		
Small (2 – 4)	5	10	12	8	20	5.94	3.27
Medium (5 – 6)	30	60	89	78	167		
Large (6 – 8)	15	30	61	49	110		
Total (2 – 8)	50	100	162	135	297		

4.1.4 Farm size

In the study area the farm size of the farmer ranged from 0 – > 750 decimal of land with an average of 285.38 decimal with the standard deviation of 11.26 where the observed range among the respondents in respect of farm size was 16 – 880 decimal (Table 5). Among the farmers, 10 Percent was land less and large, 22 percent was marginal and medium and 36 Percent was small farm holder. It was observed that maximum farmers were small land holder (36%) where minimum number of farmers was large land holder (10%) and also land less farmer (10%).

Table 5. Farm size or land ownership of the respondents regarding farmer's views and perceptions about cropland agroforestry promotion in Rangpur district

Categories of the farmers	No. of respondents	Percent	Total land (dec)	Percent of total land	Average farm size (decimal)	SD
Landless (0-49 decimal)	5	10.00	130.00	0.91	285.38	11.26
Marginal (50-149 decimal)	11	22.00	1177.00	8.25		
Small (150-249 decimal)	18	36.00	3456.00	24.22		
Medium (250-749 decimal)	11	22.00	5346.00	37.47		
Large (above 750 decimal)	5	10.00	4160.00	29.15		
Total	50	100.00	14269.00	100.00		

4.1.5 Homestead size

The homestead size of the farmer ranged from <0.02 – >0.20 hectare with an average of 43.78 decimal of land and standard deviation of 8.67 where the observed range among the respondents in respect of homestead size was 0.05 – 0.35 ha (Table 6). Among the farmers, 22 percent had marginal, 28 percent had small, 34 percent had medium and only 16 percent had large homestead size. Here, there was no landless homestead farmer among the respondents. It was observed that the highest number of farmers (34%) had medium homestead size (<0.14 – 0.20) where the lowest number of farmers (16%) had large homestead size (>0.2).

Table 6. Homestead land holdings of the respondents regarding farmer's views and perceptions about cropland agroforestry promotion in Rangpur district

Category of homestead (Hectare)	Number of respondents	Percent (%)	Amount (Decimal)	Percent (%)	Mean (Decimal)	SD
Marginal homestead (<0.02 – 0.08)	11	22	130	5.94	43.78	8.67
Small homestead (<0.08 – 0.14)	14	28	431	19.69		
Medium homestead (<0.14 – 0.20)	17	34	749	34.22		
Large homestead (>0.2)	8	16	879	40.16		
Total	50	100	2189	100		

4.1.6 Annual income

4.1.6.1 Income from agriculture

The annual income of the farmers from agriculture ranged from Tk. <30000 – >60000 with an average of Tk. 18730 and standard deviation of 12034 where the observed range among the respondents in respect of annual income from agriculture was 6000 – 68000 (Table 7). Among the farmers, 78 percent had low, 14 percent had medium and only 8 percent had high annual income. Here, it was observed that maximum number of farmers (78%) had low annual income where the lowest number of farmers (8%) had high annual income.

Table 7. Annual income of the respondents from agriculture regarding farmer's views and perceptions about cropland agroforestry promotion in Rangpur district

Category of income	Income range	Number of respondents		Total annual income	% Annual income	Mean	SD
		Number	%				
Low	<30000	39	78	370500	39.56	18730	12034
Medium	30000 - 60000	7	14	294000	31.39		
High	>60000)	4	8	272000	29.04		
Total	30000 – >60000	50	100	936500	100		

4.1.6.2 Income from non-agriculture

The annual income of the farmers from non-agriculture ranged from Tk. <30000 – >60000 with an average of Tk. 19806 and standard deviation of 14218 where the observed range among the respondents in respect of annual income from non-agriculture was 11000 – 75000 (Table 8). Among the total of 50 farmers, only 18 percent farmers were involved in non-agricultural activities. Taking into account of total farmers, only 6% farmers had low, 8% had medium and 4% had high non-agricultural annual income.

Table 8. Annual income of the respondents from non-agriculture regarding farmer's views and perceptions about cropland agroforestry promotion in Rangpur district

Category of income	Income range (Tk.)	Number of respondents		Total annual income	% Annual income	Mean	SD
		Number	%				
Low	<30000	3	6	34500	9.68	19806	14218
Medium	30000 - 60000	4	8	176000	49.37		
High	>60000)	2	4	146000	40.95		
Total	<30000 – >60000	9	18	356500	100.00		

4.1.7 Opinions on economic benefits

Opinions on economic benefits among the respondents were positive in the study area. Results indicated that most of the farmers (62 percent) were opined to homestead agroforestry where 19 percent respondents favored to cropland agroforestry. Among the farmers category, all large (<1.5) farmers prioritized to cropland agroforestry where marginal farmers had no opinion on behalf of cropland agroforestry (Table 9). But all the farmers had positive responses on crop land agroforestry (Table 15 and 16). Small (0.05 to 1 ha) and medium (1 to 1.5 ha) farmers had diversified opinion on both homestead and cropland agroforestry (Table 9).

Table 9. Opinions of the respondents on economic benefits of agroforestry regarding farmer's views and perceptions about cropland agroforestry promotion in Rangpur district

Categories of farmer (ha)	Number of respondents	Responses of respondents on economic benefits of cropland agroforestry in respect of annual income					
		Homestead agroforestry		Cropland agroforestry		% of total respondents	
		No.	%	No.	%	No.	%
Marginal (> .05)	14	14	28	0	0	14	28
Small (0.05 to 1)	12	7	14	5	10	12	24
Medium (1 to 1.5)	17	10	20	7	14	17	34
Large (<1.5)	7	0	0	7	14	7	14
Total	50	31	62	19	38	50	100

4.1.8 Organizational participation

Perception on future tree plantation on farmland from the respondents score ranged from 0 – 9 with an average of 1.24 and standard deviation of 1.04 where the observed range among the respondents in respect of organizational participation was also 0 – 9 (Table 10). The score was measured from 3 selected categories with 4 levels of judgment. The selected categories were (i) No participation, (ii) Ordinary member, (iii) Executive member and (iv) Executive officer and 4 levels of judgment with given score was (i) Involved with no organization = 0, (ii) Involved with at least one organization = 1, (iii) Involved with at least two organization = 2 and (iv) Involved with at least three organization = 3. So, minimum score of a respondent was 0 and the highest score was 9 and total score range was 0 – 9. Results showed that low organizational participation was from 80 percent, medium perception from 12 percent and high perception was from 8 percent respondents. Here, it was found that maximum organizational participation (80%) was in low category where the lowest perception (8%) was in low category.

Table 10. Organizational participation of the respondents regarding farmer's views and perceptions about cropland agroforestry promotion in Rangpur district

Category of participation	Score range	Respondents		Total score	Mean	SD
		Number	%			
No or Low	0 – 3	40	80	1	1.24	1.04
Medium	4 – 6	6	12	28		
Strong	7 – 9	4	8	33		
Total	0 – 9	50	100	62		

4.1.9 Problem faced for tree growing in cropland

Problem faced for tree plantation on farmland, from the respondents score ranged from 0 – 27 with an average of 19.74 and standard deviation of 8.74 where the observed range among the respondents in respect of faced problems for cropland agroforestry was 3 – 26 (Table 11). The score was measured from 9 selected questions with 4 levels of judgment. The selected questions were (i) Ploughing problem, (ii) Lack of management, (iii) Fertilizer application, (iv) Lack of technical knowledge, (v) Insect infestation, (vi) Disease infestation, (vii) Lack of skill labor, (viii) Lack of required input and (ix) Irrigation problem and 5 levels of judgment with given score was (i) No Problem = 0, (ii) Low Problem = 1, (iii) Moderate Problem = 2 and (iv) Severe Problem = 3. So, minimum score of a respondent was 0 and the highest score was 27 and total score range was 0 – 27. Results showed that low problem was from 12 percent, medium problem was from 36 percent and high problem was from 54 percent of the total respondents. Here, it was found that maximum problem (54%) was in high category where the lowest problem (12%) was in low category.

Table 11. Problem faced by the respondents for tree growing in cropland regarding farmer's views and perceptions about cropland agroforestry promotion in Rangpur district

Category of problems	Score	Respondents		Total score	Mean	SD
		Number	%			
Low	0 – 9	6	12	85	19.74	8.74
Medium	10 – 18	18	36	276		
High	19 – 27	26	54	626		
Total	0 – 27	50	100	987		

4.1.10 Information needed for cropland agroforestry

Information needed for tree plantation on farmland from the respondents score ranged from 5 – 25 with an average of 17.76 and standard deviation of 7.39 where the observed range in respect of needed information for cropland agroforestry was 8 – 23 (Table 11). The score was measured from 5 selected terms for gathering information with 5 levels of opinion. The selected terms were (i) Just general agroforestry information, (ii) Financial or investment advice, (iii) Markets or marketing, (iv) Land rehabilitations issues and (v) Integrating agroforestry into existing system and 5 levels of opinions with given score was (i) Strongly agreed = 5, (ii) Agreed = 4, (iii) No opinion = 3, (iv) Disagreed = 2 and (v) Strongly disagreed = 1. So, minimum score of a respondent was 5 and the highest score was 25 and total score range was 5 – 25. Results demonstrated that low level of information is needed for cropland agroforestry was from 10 percent, medium level was from 56 percent and high level was from 34 percent of the total respondents. Here, it was found that only 10% respondents needed low information for cropland agroforestry because they are about cropland agroforestry more aware than the others. Similarly, the maximum respondents (56%) have low awareness about cropland agroforestry.

Table 12. Information needed by farmers to adopt agroforestry regarding farmer's views and perceptions about cropland agroforestry promotion in Rangpur district

Category	Score range	Respondents		Total score	Mean	SD
		Number	%			
Low	5 – 12	5	10	47	17.76	7.39
Medium	13 – 18	28	56	452		
High	19 – 25	17	34	394		
Total	5 – 25	50	100	738		

4.1.11 Suggestions needed for cropland agroforestry

Suggestion needed for agroforestry on farmland from the respondents score ranged from 5 – 30 with an average of 19.16 and standard deviation of 9.68 where the observed range among the respondents in respect of suggestions needed for cropland agroforestry was 10 – 28 (Table 13). The score was measured from 6 selected terms for gathering information with 5 levels of opinions. The selected terms were (i) Increase extension education activities, (ii) Frequent visits of forest department staff, (iii) Training of farmers to plant trees on farmlands, (iv) Provision of credit on easy terms to promote agroforestry, (v) Better marketing facilities and (vi) Easily accessible nurseries and 5 levels of opinions with given score was (i) Strongly agreed = 5, (ii) Agreed = 4, (iii) No opinion = 3, (iv) Disagreed = 2 and (v) Strongly disagreed = 1. So, minimum score of a respondent was 5 and the highest score was 30 and total score range was 5 – 30. Results demonstrated that low level of suggestions is needed for cropland agroforestry was from 16 percent, medium level was from 60 percent and high level was from 24 percent of the total respondents. Here, it was found that only 8% respondents needed low suggestions for promotion of cropland agroforestry because they are much more up to date knowledge than the others. Similarly, the maximum

respondents (60%) need medium level of suggestions for the promotion of cropland agroforestry. Again, only 24% respondents need high level of suggestions.

Table 13. Suggestions needed by farmers for speedy adoption of cropland agroforestry promotion regarding farmer's views and perceptions in Rangpur district

Category	Score range	Respondents		Total score	Mean	SD
		Number	%			
Low	5 – 13	8	16	85	19.16	9.68
Medium	14 – 21	30	60	545		
High	22 – 30	12	24	328		
Total	5 – 30	50	100	1024		

4.2 Agroforestry perception as dependent variable

4.2.1 Perception on future tree plantation

Perception on future tree plantation on farmland from the respondents score ranged from 5 – 25 with an average of 14.84 and standard deviation of 6.39 where the observed range in respect of awareness of future tree plantation was 9 – 24 (Table 14). The score was measured from 5 selected questions with 5 levels of judgment. The selected questions were (i) Do you know about agroforestry, (ii) Do you like to have more trees on your farmland, (iii) Future trees on farmlands is increasing, (iv) Trees should be planted for fruit timber, fuel wood and fodder requirements and (v) You like to get some help to grow trees and 5 levels of judgment with given score was (i) Strongly Agreed = 5, (ii) Agreed = 4, (iii) No Opinion = 3, (iv) Disagreed = 2 and (v) Strongly Disagreed = 1. So, minimum score of a respondent was 5 and the highest score was 25 and total score range was 5 – 25. Results showed that low perception was from 20 percent, medium perception from 54 percent and high perception was from 26 percent respondents. Here, it was found that maximum perception (54%) was in medium category where the lowest perception (20%) was in low category.

Table 14. Distribution of the respondents' category to their perceptions on future tree plantation of farmlands

Category of perception	Score range	Respondents		Total score	Mean	SD
		Number	%			
Low	5 – 12	10	20	72	14.84	6.39
Medium	13 – 18	27	54	410		
High	19 – 25	13	26	274		
Total	5 – 25	50	100	634		

4.2.2 Attitude of farmers towards cropland agroforestry

Attitude towards agroforestry on farmland, responses from the respondents score ranged from 13 – 65 with an average of 42.38 and standard deviation of 14.52 where the observed range in respect of attitude of farmers towards cropland agroforestry was 19 – 64 (Table 15). The score was measured from 13 selected terms with 5 levels of judgment (Table 16). The selected 13 terms were divided into two categories viz. positive and negative point of view. There were 8 terms considered as positive responses and 5 terms considered as negative responses. The selected 8 positive terms for positive attitude was (i) Agroforestry is biologically productive, more profitable and more sustainable, (ii) Agroforestry offers increased security of yield, (iii) Agroforestry increases the fertility of soil and prevents soil erosion, (iv) Agroforestry helps in maintaining natural ecosystems and help buffer against natural hazards, (v) Agroforestry provides an opportunity for active or passive restoration of systems where they have been degraded or lost, (vi) Agroforestry diversifies the products and minimizes the risk of market failure, (vii) Agroforestry can moderate microclimates and (viii) Agroforestry system is difficult to manage and need more accuracy and selected 5 negative terms for negative attitude was (i) Field crop yield may reduce due to competition of trees with food crops for space, sunlight, and moisture and nutrient, (ii) A combination of trees and crops may promote diseases and pests, (iii) Yield

of shade crop may reduce under agroforestry, (iv) Farming issues are far more complex than in a straight forestry operation or monoculture farm and (v) Extended time frame is Involved in agroforestry system (Table 16). Five (5) levels of judgment for positive attitude with given score was (i) Strongly Agreed = 5, (ii) Agreed = 4, (iii) No Opinion = 3, (iv) Disagreed = 2 and (v) Strongly Disagreed = 1 where for negative attitude with given score was (i) Strongly Agreed = 1, (ii) Agreed = 2, (iii) No Opinion = 3, (iv) Disagreed = 4 and (v) Strongly Disagreed = 5 (Table 16). So, score range of respondents for 13 statement with 5 judgment (positive and negative), the minimum score was 13 and the highest score was 65 and total score range was 13 – 65. Score ranges were divided into three categories as low medium and high. Results indicated on the basis of score range that only 14 percent respondents showed low attitude towards cropland agroforestry promotion where 48 percent respondents showed medium attitude and 38 percent respondents showed high attitude towards cropland agroforestry promotion.

Table 15. Attitude of the farmers towards cropland agroforestry promotion regarding farmer's views and perceptions in Rangpur district

Agreement to statement	Score range	Respondents		Total score	Mean	SD
		Number	%			
Low	13 – 25	7	14	140	42.38	14.52
Medium	26 – 45	24	48	844		
High	46 – 65	19	38	1135		
Total	13 – 65	50	100	2119		

Table 16. Degree of agreement with some vital statements by farmers for cropland agroforestry promotion regarding farmer's views and perceptions in Rangpur district

Sl. No.	Statements	Number of respondents on responses of statements										Total number of respondents	
		Strongly Agreed		Agreed		No Opinion		Disagreed		Strongly Disagreed			
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1. (+)	Agroforestry is biologically productive, more profitable and more sustainable	1	2	40	80	8	16	1	2	0	0	50	100
2. (+)	Agroforestry offers incr-eased security of yield	0	0	32	64	14	28	3	6	1	2	50	100
3. (+)	Agroforestry increases the fertility of soil and prevents soil erosion	0	0	32	64	14	28	3	6	1	2	50	100
4. (+)	Agroforestry helps in maintaining natural eco-systems and help buffer Against natural hazards	0	0	34	68	11	22	5	10	0	0	50	100
5. (+)	Agroforestry provides an opportunity for active or passive restoration of systems where they have been degraded or lost	1	2	32	64	14	28	3	6	0	0	50	100
6. (+)	Agroforestry diversifies the products and mini-mizes the risk of market failure	0	0	30	60	17	34	3	6	0	0	50	100
7. (+)	Agroforestry can mode-rate microclimates	2	4	35	70	11	22	2	4	0	0	50	100
8. (+)	Agroforestry system is difficult to manage and need more accuracy	0	0	35	70	14	28	1	2	0	0	50	100
9. (-)	Field crop yield may reduce due to compete-tion of trees with food crops for space, sunlight, and moisture and nutrient	1	2	34	68	8	16	7	14	0	0	50	100
10. (-)	A combination of trees and Crops may promote diseases and pests	0	0	33	66	11	22	6	12	0	0	50	100
11. (-)	Yield of shade crop may Reduce under agroforestry	1	2	20	40	11	22	15	30	3	6	50	100
12. (-)	Farming issues are far more complex than in a straight forestry operation or monoculture farm	0	0	29	58	15	30	6	12	0	0	50	100
13. (-)	Extended time frame is Involved in agroforestry system	0	0	30	60	16	32	4	8	0	0	50	100

4.3 Relationship between selected factors and perceptions

4.3.1. Relationship between the selected factors of the farmers and their perceptions towards promotion of agroforestry

The purpose of this section is to examine the relationship of 10 selected characteristics of the farmers with their perceptions about cropland agroforestry promotion. The 10 characteristics of the farmers included: age, education, family size, size of homestead land holdings, land ownership, income from agriculture, income from non-agriculture, perceptions on future tree plantation, organizational participation and problem faced tree growing in cropland.

Each of the characteristics constituted the causal variables, while perception about cropland agroforestry promotion was the predicted variable. To explore the relationships between each of the selected individual characteristics of the farmers and their perceptions about cropland agroforestry promotion, Pearson's product moment co-efficient of correlation (r) has been used.

Five percent level of probability was used as the basis for rejection of a null hypothesis. The computed values of 'r' were compared with relevant tabulated values for 48 degrees of freedom at the designated level of probability in order to determine whether the relationships between the concerned variables were significant or not.

The summary of the results of the correlation analysis has been presented in Table 17 showing the relationship between each of 10 selected characteristics of the farmers and their perceptions about cropland agroforestry promotion. For understanding about the inter-correlations among all the variables Appendix-B may be seen.

Table 17. Relationship between the selected factors of farmers and their perceptions about cropland agroforestry promotion in Rangpur, Bangladesh

Dependent variable	Independent variable	Computed value 'r'	Tabulated value 'r'	
			At 0.05 level	At 0.01 level
Perceptions about cropland agroforestry promotion	Age	0.114^{NS}	0.279	0.361
	Education	0.489**		
	Family size	0.127^{NS}		
	Size of homestead land holdings	0.175^{NS}		
	Land ownership	0.296*		
	Income from agriculture	0.327*		
	Income from non-agriculture	0.093^{NS}		
	Perceptions on future tree plantation	0.542**		
	Organizational participation	0.312*		
	Problem faced tree growing in cropland	-0.465**		

^{NS} Not significant

* Significant at 0.05 level of probability

** Significant at 0.01 level of probability

4.3.2 Relationship between age of the farmers and their perceptions about cropland agroforestry promotion

Relationship between age of the farmers and their perceptions about cropland agroforestry promotion was determined by testing the following null hypothesis: "There is no relationship between age of the farmers and their perceptions about cropland agroforestry promotion".

The calculated value of the co-efficient of correlation between the concerned variables was found to be 0.114 as shown in Table 17. The following observations were made regarding the relationship between the two variables under consideration.

a) The computed value of 'r' (r = 0.114) was found to be smaller than the tabulated value (r = 0.279) with 48 degrees of freedom at 0.05 level of probability.

b) The null hypothesis could not be rejected.
c) The relationship between the concerned variables was not significant.
d) The relationship showed a positive trend between the concerned variables.

Based on the above findings, the researcher can be concluded that age of the farmers had no significant relationship with their perceptions about cropland agroforestry promotion.

4.3.3 Relationship between education of the farmers and their perceptions about cropland agroforestry promotion

Relationship between education of the farmers and their perceptions about cropland agroforestry promotion was determined by testing the following null hypothesis: "There is no relationship between education of the farmers and their perceptions about cropland agroforestry promotion".

The calculated value of the co-efficient of correlation between the concerned variables was found to be 0.489 as shown in Table 17. The following observations were made regarding the relationship between the two variables under consideration.

a) The computed value of 'r' (r = 0.489) was found to be larger than the tabulated value (r = 0.361) with 48 degrees of freedom at 0.01 level of probability.
b) The null hypothesis could be rejected.
c) The relationship between the concerned variables was highly significant.
d) The relationship showed a positive trend between the concerned variables

Based on the above findings, the researcher can be said that education of the farmers had a significant and positive relationship with their perceptions about cropland agroforestry promotion. This indicates that education of the farmers was an important factor for their perceptions about cropland agroforestry promotion.

4.3.4 Relationship between family size of the farmers and their perceptions about cropland agroforestry promotion

Relationship between family size of the farmers and their perceptions about cropland agroforestry promotion was determined by testing the following null hypothesis: “There is no relationship between family size of the farmers and their perceptions about cropland agroforestry promotion”.

The calculated value of the co-efficient of correlation between the concerned variable was found to be 0.127 as shown in Table 17. The following observations were made regarding the relationship between the two variables under consideration.

a) The computed value of ‘r’ (r = 0.127) was found to be smaller than the tabulated value (r = 0.279) with 48 degrees of freedom at 0.05 level of probability.
b) The null hypothesis could not be rejected.
c) The relationship between the concerned variables was not significant.
d) The relationship showed a positive trend between the concerned variables

The findings indicated that family size of the farmers had no significant relationship with their perceptions about cropland agroforestry promotion. This indicated that family size of the farmers was not an important factor for their perceptions about cropland agroforestry promotion.

4.3.5 Relationship between homestead land and their perceptions about cropland agroforestry promotion

Relationship between homestead land of the farmers and their perceptions about cropland agroforestry promotion was determined by testing the following null hypothesis: “There is no relationship between homestead land of the farmers and their perceptions about cropland agroforestry promotion”.

The calculated value of the co-efficient of correlation between the concerned variable was found to be 0.175 as shown in Table 17. The following observations were made regarding the relationship between the two variables under consideration.

a) The computed value of 'r' (r = 0.175) was found to be smaller than the tabulated value (r = 0.279) with 48 degrees of freedom at 0.05 level of probability.
b) The null hypothesis could not be rejected.
c) The relationship between the concerned variables was not significant.
d) The relationship showed a positive trend between the concerned variables.

The findings indicated that homestead land of the farmers had no significant relationship with their perceptions about cropland agroforestry promotion. This indicated that homestead land of the farmers was not an important factor for their perceptions about cropland agroforestry promotion.

4.3.6 Relationship between land ownership and their perceptions about cropland agroforestry promotion

Relationship between land ownership of the farmers and their perceptions about cropland agroforestry promotion was determined by testing the following null hypothesis: "There is no relationship between land ownership of the farmers and their perceptions about cropland agroforestry promotion".

The calculated value of the co-efficient of correlation between the concerned variable was found to be 0.296 as shown in Table 17. The following observations were made regarding the relationship between the two variables under consideration.

a) The computed value of 'r' (r = 0.296) was found to be larger than the tabulated value (r = 0.279) with 48 degrees of freedom at 0.05 level of probability.

b) The null hypothesis could be rejected.
c) The relationship between the concerned variables was significant.
d) The relationship showed a positive trend between the concerned variables.

The findings indicated that homestead land of the farmers had significant relationship with their perceptions about cropland agroforestry promotion. This indicated that land ownership of the farmers was an important factor for their perceptions about cropland agroforestry promotion.

4.3.7 Relationship between income from agriculture of the respondents and their perceptions about cropland agroforestry promotion

Relationship between income from agriculture of the farmers and their perceptions about cropland agroforestry promotion was determined by testing the following null hypothesis: "There is no relationship between income from agriculture of the farmer and their perceptions about cropland agroforestry promotion".

The calculated value of the co-efficient of correlation between the concerned variables was found to be 0.327 as shown in Table 17. The following observations were made regarding the relationship between the two variables under consideration.

a) The computed value of 'r' (r = 0.327) was found to be larger than the tabulated value (r = 0.279) with 48 degrees of freedom at 0.05 level of probability.
b) The null hypothesis could be rejected.
c) The relationship between the concerned variables was significant.
d) The relationship showed a positive trend between the concerned variables

Based on the above findings, the researcher concluded that income from agriculture had significant relationship with their perceptions about cropland agroforestry promotion. This indicated that income from agriculture of the farmers

was an important factor for their perceptions about cropland agroforestry promotion.

4.3.8 Relationship between income from non-agriculture and their perceptions about cropland agroforestry promotion

Relationship between income from non-agriculture of the farmers and their perceptions about cropland agroforestry promotion was determined by testing the following null hypothesis: "There is no relationship between income from non-agriculture of the farmers and their perceptions about cropland agroforestry promotion".

The calculated value of the co-efficient of correlation between the concerned variable was found to be 0.093 as shown in Table 17. The following observations were made regarding the relationship between the two variables under consideration.

a) The computed value of 'r' (r = 0.093) was found to be smaller than the tabulated value (r = 0.279) with 48 degrees of freedom at 0.05 level of probability.
b) The null hypothesis could not be rejected.
c) The relationship between the concerned variables was not significant.
d) The relationship showed a positive trend between the concerned variables.

The findings indicated that income from non-agriculture of the farmers had no significant relationship with their perceptions about cropland agroforestry promotion. This indicated that income from non-agriculture of the farmers was not an important factor for their perceptions about cropland agroforestry promotion.

4.3.9 Relationship between perceptions on future tree plantation of the farmers and their perceptions about cropland agroforestry promotion

Relationship between perceptions on future tree plantation of the farmers and their adoption of perceptions about cropland agroforestry promotion was determined by

testing the following null hypothesis: “There is no relationship between perceptions on future tree plantation of the farmers and their perceptions about cropland agroforestry promotion”.

The calculated value of the co-efficient of correlation between the concerned variables was found to be 0.542 as shown in Table 17. The following observations were made regarding the relationship between the two variables under consideration.

a) The computed value of ‘r’ (r = 0.542) was found to be larger than the tabulated value (r = 0.361) with 48 degrees of freedom at 0.01 level of probability.
b) The null hypothesis could be rejected.
c) The relationship between the concerned variables was highly significant.
d) The relationship showed a positive trend between the concerned variables

Based on the above findings, the researcher can be said that perceptions on future tree plantation of the farmers had a significant and positive relationship with their perceptions about cropland agroforestry promotion. This indicates that a perception on future tree plantation of the farmers was an important factor for their perceptions about cropland agroforestry promotion.

4.3.10 Relationship between organizational participation of the farmers and their perceptions about cropland agroforestry promotion

Relationship between organizational participation of the farmers and their perceptions about cropland agroforestry promotion was determined by testing the following null hypothesis: “There is no relationship between organizational participation of the farmers and their perceptions about cropland agroforestry promotion”.

The calculated value of the co-efficient of correlation between the concerned variable was found to be 0.312 as shown in Table 17. The following observations

were made regarding the relationship between the two variables under consideration.

a) The computed value of 'r' (r = 0.312) was found to be larger than the tabulated value (r = 0.279) with 48 degrees of freedom at 0.05 level of probability.
b) The null hypothesis could be rejected.
c) The relationship between the concerned variables was significant.
d) The relationship showed a positive trend between the concerned variables

The findings indicated that organizational participation of the farmers had significant relationship with their perceptions about cropland agroforestry promotion. This indicated that organizational participation of the farmers was an important factor for their perceptions about cropland agroforestry promotion.

4.3.11 Relationship between problems faced tree growing in cropland of the farmers and their adoption in IPM practices

Relationship between problem faced tree growing in cropland of the farmers and their perceptions about cropland agroforestry promotion was determined by testing the following null hypothesis: "There is no relationship between problem faced tree growing in cropland of the farmers and their perceptions about cropland agroforestry promotion".

The calculated value of the co-efficient of correlation between the concerned variables was found to be -0.465 as shown in Table 17. The following observations were made regarding the relationship between the two variables under consideration.

a) The computed value of 'r' (r = 0.465) was found to be larger than the tabulated value (r = 0.361) with 48 degrees of freedom at 0.01 level of probability.
b) The null hypothesis could be rejected.
c) The relationship between the concerned variables was highly significant.

d) The relationship showed a negative trend between the concerned variables.

Based on the above findings, the researcher can be concluded that problem faced tree growing in cropland of the farmers had a highly significant negative relationship with their perceptions about cropland agroforestry promotion. This is meant that problem faced tree growing in cropland of the farmers was an important factor for the perceptions about cropland agroforestry promotion.

CHAPTER V

SUMMARY, CONCLUSION AND RECOMENDATION

5.1 Summary

This study was conducted at nine villages of three upazilas of Rangpur district to observe the Farmer's views and perceptions about Cropland Agroforestry promotion in Rangpur district of Bangladesh. The selected characteristics were age, education, population size, farm size, homestead size and annual income. Alamnagar, Kursha and Mirzapur from the upazilas of Rangpur Sadar, Kaunia and Mithapukur upazila respectively under Rangpur district were the locales of the study.

A sample of 50 farmers was drawn to collect data for the study. Data were collected on 26 March to 9 April, 2015 using a pre-tested interview schedule. The collected data were then summarized into following to meet the objectives of the study.

Average age of the respondents was 40.08 years where the observed range among the respondents was 33 to 55. The highest proportion (38 %) of the farmers was in the age range of 36 – 40 years, where the lowest proportion (12%) of the farmers was in the age range of 46 – 55 years followed by 20% and 30 % from 31 – 35 and 41 – 45 years age range respectively.

Farmers educational status score ranged from 0 – 16 with an average of 2.80 of schooling. In this study 52 percent of the farmers was in 'Can read and write' category where only 12% of the total respondents was in the category of 'Secondary education and above'. The category of 'Primary education – Class X' also put up with 12% of the total respondents. A major portion of respondents (24%) was in the category of 'Can sign only'.

Average family size of the respondents was 5.94 with the score ranged from 2 – 8. Most of the farmers (60 percent) were medium sized family compared to 10 percent small and 30 percent large families.

The observed range of farm size was 16 – 880 decimal with an average of 285.38 decimal of land. The maximum farmers were small land holder (36%) where minimum number of farmers was large (10%) and also the lowest land holder (10%).

Average homestead size of the respondents was 43.78 decimal with the observed range of 5 – 350 decimal. It was found that the highest number of farmers (34%) had medium homestead (<0.14 – 0.20 ha) where the lowest number of farmers (16%) had large homestead size (>0.2 ha).

Average annual income of the selected respondents was Tk. 18730 with the observed range of 6000 – 68000 Tk. from agriculture. Maximum number of farmers (78%) had low annual income and minimum number of respondents (8%) had large annual income from agriculture. Among the total of 50 farmers, only 18 percent farmers were involved in non-agricultural income. Taking into account of total farmers, only 6% farmers had low, 8% had medium and 4% had high non-agricultural annual income.

Opinions on economic benefits among the respondents were positive and it was found that most of the farmers (62 percent) were opined to homestead agroforestry where 19 percent respondents favored to cropland agroforestry. All the Large (<1.5) farmers prioritized to cropland agroforestry where all marginal farmers had no opinion on behalf of cropland agroforestry.

The observed score range in respect of organizational participation was 0 – 9 with an average of 1.24. Results indicated that no and/or low organizational participation was from 80 percent, medium perception from 12 percent and high perception was from 8 percent respondents.

Problems faced for tree plantation on farmland, the observed score range was 3 – 26 with an average of 19.74. Results showed that low problem was from 12 percent, medium problem was from 36 percent and high problem was from 54 percent of the total respondents.

Information needed for tree plantation on farmland, the observed score range was 8 – 23 with an average of 17.76. It was found that only 10% respondents needed low information for cropland agroforestry because they are more aware than the others. Similarly, the maximum respondents (56%) have low awareness about cropland agroforestry.

Perception on future tree plantation on farmland, the observed score range was 10 – 28 with an average of 19.16. It was found that only 8% respondents needed low suggestions for promotion of cropland agroforestry because they are much more up to date knowledge than the others. Similarly, the maximum respondents (60%) need medium level of suggestions and only 24% respondents' need high level of suggestions.

Attitude towards agroforestry on farmland, the observed score range was 19 – 64 with an average of 42.38. Results indicated on the basis of score range, only 14 percent respondents' showed low attitude towards cropland agroforestry promotion where 48 percent respondents showed medium attitude and 38 percent respondents showed high attitude towards cropland agroforestry promotion.

5.2 Conclusion

Conclusion drawn on the basis of the findings and their logical interpretation in the light of other relevant facts are furnished below:

1. Given that the urgent need for rising perceptions about cropland agroforestry promotion, it is recommended that the concerned authority may take effective steps for strengthening extension and other services in order to change using percentage of the farmers regarding attitude to cropland agroforestry promotion.

2. Education of the respondent had significant positive relationship with their perceptions about cropland agroforestry promotion. Therefore, it may be recommended that attempts should be taken to establish adult learning centre to increase educational level of the farmers as well as cropland agroforestry promotion.

3. Land ownership had significant positive relationship with their perceptions about cropland agroforestry promotion. Therefore, it may be recommended that, concerned authority should conduct more awareness programs on proper land use on the basis of cropland agroforestry.

4. Income from agriculture existed a positive significant relationship with perceptions about cropland agroforestry promotion. Therefore, it may be recommended that attempts should be taken by encouraging to increase area of cropland agroforestry system.

5. Perceptions on future tree plantation had significant positive relationship with the respondents and perceptions about cropland agroforestry promotion. Therefore, it may be recommended that, concerned authority and other extension agencies may campaign about perceptions on cropland agroforestry promotion to favor the attitude.

6. Organizational participation had significant positive relationship with their perceptions about cropland agroforestry promotion. Therefore, it may be recommended that, concerned authority should conduct more programs in the remote area to acquire the farmers about perceptions on cropland agroforestry promotion.
7. Problem faced tree growing in cropland had significant negative relationship with their perceptions about cropland agroforestry promotion. Therefore, it may be recommended that, concerned authority and related agencies should conduct more programs to the procedures of removing problems in that area.

5.3 Recommendation

On the basis of experience, observation and conclusions drawn from the findings of the study following recommendations are made:

1. The study reveals that an overwhelming majority of the farmers under landless and marginal category possessed low number of diversified tree species in the homestead and cropland agroforestry system. Thus the authority and other concerning organization should take appropriate program for dissemination of diversified tree in cropland in the study area.

2. Though only 8% respondents had high perception for future crop land agroforestry but most of the farmers (86%) had positive attitude for continuing cropland agroforestry in their farmland. So, the people of the study area may be exercised for promotion of cropland agroforestry.

3. Economic benefits from agroforestry (homestead agroforestry and cropland agroforestry) were prioritized to homestead agroforestry than cropland agroforestry observed from the opinion of the selected respondents. All large farmers favored to cropland agroforestry. So, awareness can be developed to marginal, small and medium farmers for cropland agroforestry, because all type of farmers had positive responses on cropland agroforestry.

4. To validate the information about perception of cropland agroforestry promotion in Bangladesh, it is necessary to conduct this type of study in other areas.

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Appendices

Appendix 1. Questionnaire on interview Scheduled

An interview scheduled for a research study on "Farmer's views and perceptions about Cropland Agroforestry promotion in Rangpur district of Bangladesh"

Objectives:

i. To determine the farmers views and perceptions towards agroforestry promotion in Rangpur district,
ii. To assess selected characteristics of farmer's towards agroforestry promotion in Rangpur district and
iii. To explore the relationship between selected factors of farmers and their perception towards promotion of agroforestry.

Serial No –

Name of the respondent –

Village –

Union –

"Please answer the following questions"

1. **Age**
   How old are you? ---------- Years.

2. **Education**
   What is your level of education?
   - Can read and write **( )**
   - Can sign only **( )**
   - I read up to class ……..
   - I passed ……

3. Family Size

Please indicate the numbers of your family members

a) Male	……. Numbers
b) Female	……. Numbers
Total	……. Numbers

4. Farm size

Category	Area	
	Tick Mark	**(Local Unit….)**
Landless (0-49 decimal)		
Marginal (50-149 decimal)		
Small (150-249 decimal)		
Medium (250-749 decimal)		
Large (above 750 decimal)		
Total		

5. Size of land holding

Which Category of homestead size do you have? Put tick mark below:

Category of homestead (hectare)	**Amount**	
	Tick Mark	**(Local Unit….)**
Marginal homestead (>0.02 – 0.08)		
Small homestead (<0.08 – 0.14)		
Medium homestead (<0.14 – 0.20)		
Large homestead (.2>)		

6. Family income

What are the main sources of income (Indicate all the activities that you practice and which contribute to sustain your household average earning)

- **Agricultural Income:**

Sl No	Source of production	Quantity of Annual production(Local Unit)	Value per unit(TK)	Total Price (TK)
1.	Paddy			
2.	Wheat			
3.	Jute			
4.	Potato			
5.	Onion			
6.	Vegetables			
7.	Poultry farm			
8.	Fish cultivation			
9.	Business			
10.	Labors			
11.	Others			

- **Non-Agricultural Income**

Occupation	Annual Income Generated (TK)
Wage Job	
Private Business	
Service	
Boat/Troller	
Others	

7. Distribution of the respondents with regard to their perceptions about future of trees on farmlands

Sl No	Perception	Strongly Agreed	Agreed	No Opinion	Disagreed	Strongly Disagreed
1.	Do you know about agroforestry					
2.	You like to have more trees on your farmland					
3.	Future of trees on farmlands is increasing					
4.	Trees should be planted for fruit timber, fuel wood and fodder requirements					
5.	You like to get some help to grow trees					

8. Training Exposure

Nature of Training	Duration (Days)	Organization

9. Organizational Participation

Please indicate the nature of your participation in past and present in the following organizations

Sl No	Name of Organization	Not Involved	Name of participation			
			Ordinary member	Member of the executive committee	Executive officer (President/Secretary)	No participation
1.						
2.						
3.						

10. Problem faced tree growing in cropland

Sl No	Problems	Extent of problems			
		Severe Problem	**Moderate Problem**	**Low Problem**	**No Problem**
1.	Ploughing problem				
2.	Lack of management				
3.	Fertilizer application				
4.	Lack of technical knowledge				
5.	Insect infestation				
6.	Disease infestation				
7.	Lack of skill labor				
8.	Lack of required input				
9.	Irrigation problem				

11. Information needed by farmers to adopt agroforestry

Sl No	Information	Strongly Agreed	Agreed	No Opinion	Disagreed	Strongly Disagreed
1.	Just general agroforestry information					
2.	Financial or investment advice					
3.	Markets or marketing					
4.	Land rehabilitations issues					
5.	Integrating agroforestry into existing system					

12. Suggestions for speedy adoption of agroforestry promotion

Sl No	Suggestions	Strongly Agreed	Agreed	No Opinion	Disagreed	Strongly Disagreed
1.	Increase extension education activities					
2.	Frequent visits of forest department staff					
3.	Training of farmers to plant trees on farmlands					
4.	Provision of credit on easy terms to promote agroforestry					
5.	Better marketing facilities					
6.	Easily accessible nurseries					

13. Please give your opinion about economic benefits of agroforestry:

Categories of farmer (hectare)	Annual income from		
	Homestead agroforestry	Cropland agroforestry	Others
Marginal (> .05)			
Small (0.05 to 1)			
Medium (1 to 1.5)			
Large (<1.5)			

14. Please give your opinion about environmental benefits of agroforestry:

Impacts of homestead agroforestry		**Extent of villagers opinion**			
	Strongly Agreed	**Agreed**	**No Opinion**	**Disagreed**	**Strongly Disagreed**
More trees in cropland decrease temperature					
More trees in cropland increase rainfall					
More trees in cropland reduce soil moisture loss					
More trees in cropland increase carbon sequestration					
More trees in cropland increase soil fertility					
More trees in cropland create micro climate for soil micro organism					

15. Please mention your degree of agreement with the following statements

Sl no.	Attitudinal statements	Degree of agreement				
		Strongly Agreed	**Agreed**	**No Opinion**	**Disagreed**	**Strongly Disagreed**
1. (+)	Agroforestry is biologically productive, more profitable and more sustainable.					
2. (+)	Agroforestry offers increased security of yield.					
3. (+)	Agroforestry increases the fertility of soil and prevents soil erosion					
4. (+)	Agroforestry helps in maintaining natural ecosystems and help buffer against natural hazards.					
5. (+)	Agroforestry provides an opportunity for active or passive restoration of systems where they have been degraded or lost					
6. (+)	Agroforestry diversifies the products and minimizes the risk of market failure.					
7. (+)	Agroforestry can moderate microclimates.					
8. (+)	Agroforestry system is difficult to manage and need more accuracy.					
9. (-)	Field crop yield may reduce due to competition of trees with food crops for space, sunlight, and moisture and nutrient.					
10. (-)	A combination of trees and crops may promote diseases and pests.					
11. (-)	Yield of shade crop may reduce under agroforestry.					
12. (-)	Farming issues are far more complex than in a straight forestry operation or monoculture farm					
13. (-)	Extended time frame is Involved in agroforestry system.					

Appendix-II: Correlation Matrix

Characters	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	Y
X_1	1										
X_2	0.104	1									
X_3	-0.036	0.067	1								
X_4	0.039	0.058	0.32	1							
X_5	0.042	0.069	0.144*	0.053*	1						
X_6	0.173*	0.126**	0.069	0.072*	0.039**	1					
X_7	0.108**	0.067**	0.058	0.018	0.088	-0.049	1				
X_8	0.142*	0.038**	0.018	0.055*	0.058*	0.054*	-0.049*	1			
X_9	-0.036	0.199**	0.161	0.126	0.097	0.068*	0.083	0.075*	1		
X_{10}	0.044	-0.252**	0.178	-0.028	-0.064	-0.094*	0.081	-0.039**	-0.064**	1	
Y	0.114^{NS}	0.489**	0.127^{NS}	0.175^{NS}	0.296*	0.327*	0.093^{NS}	0.542**	0.312*	-0.465**	1

X_1 = Age
X_2 = Education
X_3 = Family size
X_4 = Size of homestead land holdings
X_5 = Land ownership
X_6 = Income from agriculture
X_7 = Income from non-agriculture
X_8 = Perceptions on future tree plantation
X_9 = Organizational participation
X_{10} = Problem faced tree growing in cropland
Y = Perceptions about cropland agroforestry promotion