EVALUATION OF FRUIT TREE MANAGEMENT PRACTICES IN HAOR HOMESTEADS OF BANGLADESH

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CERTIFICATE

This is to certify that the thesis entitled **'Evaluation of Fruit Tree Management Practices in Haor Homesteads of Bangladesh'** submitted to the Department of Horticulture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE** in **HORTICULTURE**, embodies the result of a piece of *bona fide* research work carried out by **Bhuiyan A. T. M. Obaidullah**, Registration No. **1205236** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this investigation has been duly acknowledged.

Dated: December, 2013
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ABSTRACT

A study was conducted in Haor area of Ajmiriganj upazila of Habigonj district. There are five unions in Ajmiriganj upazila. The 45 homesteads were surveyed to understand their knowledge regarding homestead fruit cultivation and also identify the present fruit production system. A well structured interview schedule was developed based on objectives of the study. The majority (42.22%) of the fruit growers in low knowledge category, while only (20.00%) in high knowledge. Considering the magnitude of different problems in homestead fruit cultivation in Haor areas, the respondents fruit growers faced severe problem in terms of lack of technical knowledge about materials and the second highest in high rate of interest and the third in inadequate loan than demand. In consideration of fertilizer application, for orange cultivation the highest (100%) fruit growers applied fertilizers. In context of irrigation, the highest (84.44%) fruit growers applied irrigation in papaya cultivation. For hormone application, the highest (55.56%) fruit growers applied hormone for mango cultivation. For mulching, the highest (64.44%) fruit growers used mulched materials for banana cultivation. For pruning in homestead fruit cultivation, the highest (100%) fruit growers practiced pruning in jujube. For thinning, the highest (40.00%) fruit growers practiced thinning in papaya cultivation. For training, the highest (42.22%) fruit growers practiced training in jujube plant. Level of education, annual income and size of homestead fruit trees area showed significant positive relationship with knowledge of homestead fruit management, whereas age showed significantly negative relationship with knowledge. The findings revealed that the people of Haor areas

in Bangladesh have lower knowledge on management of homestead fruit production and practices.

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CHAPTER I

INTRODUCTION

Homestead refers to home and adjoining land occupied by a family to cultivate some crops for their own consumption and marketing. Generally, the purpose of homestead is small-scale agricultural production, home upkeep, sanitation, health and nutrition (Ninez, 1984). It is land occupied by the dwelling unit of the household and the immediate area surrounding it, including courtyard, pond, road space around homesteads, space used for cultivation of trees and vegetables and unutilized space (Abdullah, 1986). There are 32.07 million homesteads in Bangladesh and over 74% of the population lives in the rural areas. Approximately 7% area (0.53 million hectare) of the total 8.4 million hectare of cultivable land in Bangladesh is occupied by homesteads which is extremely productive (BBS, 2011).

Homesteads play a vital role in providing timber, fuel wood, fodder, and fruits. Record of 70% of timber, 90% of fuel wood, 48% sawn and veneer logs and almost 90% of bamboo requirement is available from homegardens of Bangladesh (Uddin *et al*., 2002). But state forest of Bangladesh covers 2.52 million hectare of lands, representing 17% of the countries land area and supplying only 12% wood (Poffenberger, 2000). It is difficult to meet the country's huge demand for timber, fuel, fruit and fodder from the state forests. Villages of Bangladesh have a long heritage of growing fruit trees along with other perennial shrubs and herbs (Rahman *et al*., 2009). The homegardens of Bangladesh is a source of livelihood for many farmers and serve as safety net during the time of hardship and natural disaster. Most of the homesteads of landlord houses contained improved cultivars of different fruits and other aesthetic plants, which are very much important from horticultural and breeding point of view. Homesteads represent a land use system involving deliberate management of multipurpose trees and shrubs in limited association with seasonal vegetables (Fernandes and Nair, 1986).

In Bangladesh, homestead gardens represent a well-established traditional land use system where natural forest covers less than 10%; homestead gardens, which are maintained by at least 20 million households, represent one possible strategy for biodiversity conservation (Zashimuddin 2004; Kabir and Webb, 2008). The conservation of cultivated plants in homestead gardens of Bangladesh not only preserves a vital resource for humankind but plays an important role in household food security, as it is a sustainable source of food, fruits and vegetables (Uddin and Mukul, 2007). In Bangladesh context, the increase of homestead at present is not able to keep pace with the growing population. Most of the homestead areas are not utilized properly at present. So, a vast area remains unproductive even through theses land can able to meet the nutrient requirements. Several studies showed that species diversity in a homestead garden can range from less than five (Abdoellah, *et al*., 2006) to more than 100 (Vogl and Vogl-Lukasser, 2003). In Bangladesh, various studies explore the floristic composition in the homestead gardens, agroforestry system, homestead plantation and traditional uses, quantitative structure and silvicultural management; production and services (Islam, 1998; Ahmad, 1997; Millat-E-Mustafa, 2002 and Motiur, *et al*., 2005).

Bangladesh abounds with a large variety of tropical and sub-tropical fruits (Abdoellah, *et al*., 2006; Akhter *et al*., 2010). The term 'fruit' is more conveniently used to refer to the part of the seed suitable for human consumption, eaten fresh, either ripe or young (Uddin and Mukul, 2007). The most widely cultivated fruits are Mango, Jackfruit, Black berry, Pineapple, Banana, Litchi, Lemon, Guava, Hog plum, Custard apple, Wood apple, Elephant apple, Golden apple, Indian berry, Papaya, Coconut, Tamarind, Melon, Watermelon, Cashew nut, Pomegranate, Palmyra, Plum, Rose apple, Indian olive, and Indian jujube. There are many minor edible fruits that are locally available in the wild and are also cultivated, such as latkan, monkey jack, uriam, rattan, river ebony, garcinia, wild date palm, etc. Different fruits grow in Bangladesh round the year because of favorable climatic conditions. Homestead fruit production is quite prevalence in Bangladesh (Alam and Masum, 2005; Motiur *et al*., 2006).

In Bangladesh, there is no specific management plan for the homestead fruit trees which are being traditionally managed by the household owners (FAO, 2010). The management of the traditional homestead garden has evolved as a response to many factors such as cultural, economic and, environmental as well as personal preferences (Motiur *et al*., 2006; Southern, 1994). Millat-E-Mustafa *et al*. (1996) recorded eight major uses of the homestead forest plants: fruit/food, timber, firewood, spice, fodder, medicine, fencing, and miscellaneous. The miscellaneous uses include brooms, handicrafts, shade, ornamental, ceremonial, environmental, and aesthetic. Again, the ecological merits of homestead garden are related to conservation of soil, water, nutrients, and biodiversity (Masum, *et al*., 2008).

The natural forest of Bangladesh is shrinking at an alarming rate due to unprecedented anthropogenic pressure, researchers from across the world have demonstrated homestead gardens' dynamic role in the conservation of biodiversity and provision of necessary daily needs to rural people by turn for urban people (Motiur, *et al*., 2005). Although Haor homestead is different from the main land but it has enough space for fruit production and some other household intervention. Considering the importance of Haor areas homestead fruit production both from economic and nutritional point of view the study was conducted on of fruit tree management practices in Haor homesteads of Bangladesh with the following objectives:

- Survey and identification of management practices on different fruit trees of Haor homestead of Ajmirigonj upazila under Habiganj district;
- Evaluation of homestead fruit production practices in Haor areas and
- To expose the cause of poor production in the Haor homesteads.

CHAPTER II

REVIEW OF LITERTURE

This chapter deals with the review of past research works that related to this investigation directly or indirectly. Review of literatures expediently to the major objectives of this study is presented in this chapter. Despite frantic search, the research found only a few studies are available all of them are indirectly related. The researcher came across with some expert opinions about the concept of knowledge and has tried his best to collect needful information through searching relevant studies, journals, periodicals, bulletins, leaflets, internet etc. These enhanced the researcher's knowledge for better and clear understanding of the present study.

2.1 Concept, components, formation and measurement of knowledge

Haque (1986) conducted a study on a quasi-experiment design, tested rice farming knowledge of field extension agents employed in two provinces Leyte and Sodium Leyte of the Philippines. There farming knowledge was measured before the intervention (treatment) was initiated. Result showed that 75 percent possessed low knowledge and 25 percent possessed high knowledge by the Leyte agents. The percentage of the knowledge in that level was 70 and 30, respectively. The t-statistics show that there were no statistical differences in rice farming knowledge between the agents in two locations.

Hussain *et al.* (1988) in their study revealed that family member, specially wife, husband and children participate in varying percentage in the pre-and post-harvest activities of forests, fruit and vegetable production in the homestead. The involvement of wife was the highest followed by husband and children in seed/seedling collection, seed storage, water management and fruit processing when husband was more involved than wife and children in plant propagation, tree plantation, propagation, fertility management, pest management, weeding, harvesting and selling the fruit and vegetables irrespective of farm category.

Rahman *et al*. (1988) conducted a study on health cover practices of poultry and found that 26 percent of the farm women possessed low level of knowledge while 74 percent possessed medium level and none possessed high level of knowledge.

Vidya *et al*. (1991) in a case study at Naldung, Nepal reported that participation of women in vegetable production was much higher than men. The women labour constituted 73% of total labour employed in the vegetable garden. These activities however were not as time bound as the activities in cereal production. Also year round production of vegetables was not common in the area. The farmers also participate in homestead fruit production.

Rosemary and Zahir (1991) reported that women do not traditionally become tailor, but many RDRS group members are doing so successfully, albeit on a very small scale potential women are selected and get orders from their villages prior to training. They then receive training from a local tailor master. When they have sufficient skill, they fulfill their orders during the training period and are in a position to make a down payment on the lease purchase of their swing machine. These women can then provide a useful service in their villages by making cloths at a price that poor people can afford. They also reported that women with experiences can run home based businesses and can participate in marketing for selling out their product like handicrafts and bamboo made materials. They can also setup small grocery shops or tea shop in local market if they are provided a basic training in record keeping, micro enterprise management and market bargaining etc. They should also be supplied with credit for building materials and for purchase of stock.

Parveen (1995) in her study found that 58 percent of the farm women had moderate knowledge while 35 percent had high and 7 percent had poor knowledge on the use of fertilizers, pesticides and irrigation water for the homestead production of different species.

Khan (1996) conducted a research on the effectiveness of “A Farmer Primer on Growing Rice” in knowledge change of the farmers in Shakhipur Thana and found that 67 percent farmers had good knowledge at initial stage, where 21 percent had excellent knowledge and 12 percent had poor knowledge regarding rice cultivation.

Nurzaman (2000) also in his study on knowledge, attitude and practice of FFS and non-FFS farmers in respect of IPM found that 46.67 percent of the FFS farmers had medium, 31.67 percent had high and 21.67 percent had low IPM knowledge while among the non-FFS farmers, 98.33 percent had low and only 1.67 percent had medium IPM knowledge. In the same study he found that 60 percent of the FFS farmers had medium knowledge, 25 percent low and 15 percent had high agricultural knowledge. The majority (55%) of the non-FFS farmers had low agricultural knowledge and rest (45%) of the non-FFS farmers had medium agricultural knowledge.

Hossain (2000) also in his study on farmers’ knowledge and perception of Binadhan-6 in the Boro season found that highest proportion (65%) of the farmers possessed medium knowledge, 21 percent low knowledge and lowest proportion (14%) possessed high knowledge.

Hossain (2001) in his study found that 84 percent of the farmers had medium, 13 percent had high knowledge and the lowest proportion (3%) possessed low knowledge on modern sugarcane cultivation practices.

Mannan (2001) conducted a study on knowledge about food and nutrition of the farmers under PROSHIKA mung and found that highest proportion (75%) respondents fell in the medium knowledge level, while 9 percent of the respondents fell in the low knowledge level and 16 percent in the high knowledge category.

Saha (2001) made an attempt on farmers knowledge in improved practices of pineapple cultivation and found that the majority (62%) of the farmers possessed

good knowledge, 33 percent poor knowledge and only 5 percent possessed excellent knowledge.

Sarker (2002) studied on farmers' knowledge of and attitude towards BRRI Dhan 29 variety of rice and show that 60 percent of the farmers held medium knowledge 33 percent high knowledge and 7 percent possessed low knowledge.

Sarker (2002) studied on farmers' knowledge on improved banana cultivation practices and showed that majority of the banana growers (83.7%) had moderate, 6.1 percent had poor and the rest 10.2 percent had good knowledge.

Khan (2005) studied on farmers' knowledge of maize cultivation and found that majority (68%) of the farmers had relatively low level of knowledge and 32 percent of the farmers had possessed relatively high level of knowledge.

Hossain (2010) found the highest 64.76 percent farmers belongs to the group of medium level involvement group followed by 31.43 percent in low level involvement group and 3.81 percent in high involvement group in homestead Fruit production activities.

Mamun (2011) studied the homestead farming knowledge of *Garo* women farmers from a study and reported that about half (49.52%) of the respondents fell in low knowledge category followed by very low knowledge (27.62%) and medium knowledge (22.86%) category in homestead farming knowledge.

2.2 Relationship between respondents' characteristics and knowledge

2.2.1 Age and knowledge

Chandargi (1980) found that there was significant association between age and knowledge gain as a result of training.

Hansara and Chopra (1986) found that there was a significant negative correlation between gain in knowledge about cattle disease and age of the respondents i.e., the more was the age of the respondents, less was their gain in knowledge.

Kashem (1987) in his study on the small farmers' constraints to the adoption modern rice technology found that age of the farmers had significant negative correlation with their agricultural knowledge.

The report of Rayspreddy and Jayarmaiah (1989) revealed that age of the VEOs showed negative relationship with their knowledge level on rice production technologies.

Islam (1993) in his study concluded that age of the Block Supervisors (BSs) had no significant relationship with their knowledge on modern agricultural technology.

Khan (1996) conducted a research on the effectiveness of "A Farmers primer on Growing Rice" in knowledge change of the farmers in Shakhipur thana and found that age of the respondent had no role with the three dependent variables namely initial rice knowledge, final rice knowledge and knowledge gain in the socio-economic condition of Shakhipur thana.

Nandiwal *et al*. (1999) conducted in a study on knowledge and adoption level of the farmers about production technology at Kheda district of Gujarat state, India. They found that age of the farmers had non significant correlation with their knowledge about production technology.

Hossain (2000) in his study found that age of the farmers had no significant relationship with their knowledge on cultivation practices or different modern production technology.

Saha (2001) made an attempt on farmers' knowledge on improved practices of pineapple cultivation and found that the age of the farmers had no significant relationship with their knowledge on improved practices of pineapple cultivation.

Rahman (2001) conducted a study to determine the knowledge, attitude and adoption of the farmers regarding Alok 6201 hybrid rice. He found that age of the farmers was not related to farmers' knowledge on Alok 6201 hybrid rice.

Sarker (2002) found in his study that age of the farmers had a significant and negative relationship with their knowledge on improved banana cultivation.

Akhter (2003) found in his study that the age of the farmers had no significant relationship with their knowledge on agricultural activities. Saha (2003) found no relationship between poultry farmers' age and their knowledge on poultry production.

Rahman (2004) found in his study that age of the farmers had no significant relationship with their knowledge on boro rice cultivation.

Khan (2005) found in his study that age of the farmers was not related to their knowledge of maize cultivation practices.

Hossain (2010) conducted in a study on involvement of farmers in homestead fruit production activities at Pangsha Upazila under Rajbari district and found that age of the farmers' had non significant correlation with involvement in homestead fruit production activities.

Mamun (2011) studied the homestead farming knowledge of *Garo* women farmers and reported that age had significant negative correlation with homestead farming knowledge.

2.2.2 Level of education and knowledge

Hansara and Chopra (1986) found that education and knowledge gain in cattle disease through telecasts have highly significantly positive relationship.

Kashem (1987) in his study revealed that there was no significant relationship between education of the farmers and their agricultural knowledge.

Kumari (1988) from a study on communication effectiveness of selected mass media concluded that there was a significant association between education of the respondents (women) and attitude towards the message and knowledge level.

Rathore and Shaktawat (1990) reported in their study that farmers' education was significantly related with their knowledge.

Islam (1993) found that the general education of the BSs had no significant relationship with their knowledge on modern agricultural technologies. However, the trend of relationship between general education and knowledge on modern agricultural technologies was negative.

Khan (1996) in his study found the formal education was related to both their initial rice knowledge (r=0.42) and their final rice knowledge (r=0.33) but also found that concerned variable was not related to their knowledge gain (r=0.02).

Hazarika *et al*. (1999) conducted a study on relative influence of socio-personal psychological and communicational traits of the farmers on gain in knowledge in plain and hilly areas of Kamrup district of Assam and found that both in hilly and plain areas education of the respondents positively and significantly related to their knowledge gain.

Hossain (2000) found that the education of the respondents had significant positive relationship with their knowledge on Binadhan-6.

Saha (2001) found that the education of the farmers had a positive significant relationship with their knowledge on improved practices of pineapple cultivation.

Saha (2003) found, among the six independent variables, only education was positively and significant related at 0.01 level of probability with poultry farming knowledge.

Sarker (2002) found that education level of the farmers had significant and positive relationship with their knowledge on improved banana cultivation.

Rahman (2004) revealed that level of education of the farmers had a significant and positive relationship with their knowledge on boro rice cultivation.

Hossain (2010) conducted in an investigation on involvement of farmers in homestead fruit production activities at Pangsha Upazila under Rajbari district and found that level of education had non significant correlation with involvement in homestead fruit production activities.

Mamun (2011) studied the homestead farming knowledge of *Garo* women farmers and reported that education level had significant positive correlation with homestead farming knowledge.

2.2.3 Family size

Parveen (1993) found that there was a significant positive relationship between family size of the farm women and their awareness and knowledge on environmental degradation.

Akanda (1994) mentioned that family size of the rural women had significant positive relationship with their participation in the cultivation of fruit trees. The relationship with homestead vegetable cultivation and non-farm household activities was positive but not significant.

Rao (1994) reported that rural women's participation in agriculture was positive correlated with the size of their family.

Chowdhury (2000) in his study found that family size of the rural women had no significant relationship with their opinion for participation in development activities.

Alam (2001) in his study observed that family size had non-significant relationship with their participation in agriculture, fisheries and poultry programs of BAUEC.

Aurangozeb (2002) found that family size of the rural women had non-significant relationship with their adoption of integrated homestead farming technologies.

Islam (2002) in his study found that family size of the women had non significant relationship with their involvement in income generating activities.

Hossain (2010) conducted an investigation on involvement of farmers in homestead fruit production activities at Pangsha Upazila under Rajbari district and found that family size had non significant negative correlation with involvement in homestead fruit production activities.

Mamun (2011) studied the homestead farming knowledge of *Garo* women farmers from a study and reported that family size had non significant positive correlation with homestead farming knowledge.

2.2.4 Annual income and knowledge

Ali (1984) also found that income of the contact and non-contact farmers' differed significant positive contribution to both of their agricultural knowledge and adoption of innovations.

Nurzaman (2000) found that incomes of the rural women farmers had no relationship with their knowledge of the farmers.

Islam (2002) in his study found that family income of the women had significant positive relationship with their involvement in income generating activities and decision making in household and health care.

Hossain (2003) found that income of the rural women farmers had negative relationship with their knowledge of modern Boro rice cultivation.

Hossain (2010) conducted a study on involvement of farmers in homestead fruit production activities at Pangsha Upazila under Rajbari district and found that annual family income had non significant correlation with involvement in homestead fruit production activities.

Mamun (2011) studied the homestead farming knowledge of *Garo* women farmers from a study and reported that annual income had significant positive correlation with homestead farming knowledge.

2.2.5 Age of homestead and knowledge

Manjunatha (1980) revealed that the more c exposure to mass media farmers had higher knowledge level and adoption behavior compared to lower exposure to mass media.

Rayapareddy and Jayaramaiah (1989) working on village extension officers (VEOs) knowledge of rice production technology and found that exposure to mass media had significant positive relationship with the knowledge level of VEOs.

Karim and Hossain (1995) observed that the farmers differed significantly in their knowledge in sugarcane cultivation based on their exposure to mass media.

Hossain (2001) found that the exposure to mass media of the respondents had positive relationship with their knowledge of crop cultivation.

Mannan (2001) in his study found that the exposure to mass media of the farmers had a positive significant relationship with their knowledge on food and nutrition.

2.2.6 Farm size and knowledge

Sharma and Sonoria (1983) found that both the contact and non-contact farmers were different in their size of operational holding. However, they found no

significant differences in knowledge of both the contact and non-contact farmers with the size of their operational holdings.

Ali (1984) found that farm size of the contact and non-contact farmers had significant positive contribution to their agricultural knowledge.

Khan (1996) in his study indicated that farm size of the respondent was not significantly related to their initial rice knowledge, final rice knowledge and knowledge gain.

Hossain (2000) found that farm size of the farmers had no relationship with their knowledge of Binadhan-6.

Hossain (2001) in his study found that farm size of the farmers was related to farmers' knowledge of crop cultivation.

Sarker (2002) also found that there was a positive relationship between farm size of the farmers and their knowledge of BRI Dhan29.

Akter (2003) found in his study that farm size of the farmers had a significant and positive relationship with their knowledge on agricultural activities.

Rahman (2004) reported that farm size of the farmers had a significant and positive relationship with their knowledge on boro rice cultivation practices.

Khan (2005) found in his study that farm size of the respondent had no relationship with their knowledge of maize cultivation.

Hossain (2010) conducted a study at Pangsha Upazila under Rajbari district and found that farm size had non significant negative correlation with involvement in homestead fruit production activities.

Mamun (2011) studied the homestead farming knowledge of *Garo* women farmers and reported that homestead farm size had significant positive correlation with homestead farming knowledge.

2.3 Conceptual Framework

In scientific research, selection and measurement of variables constitute an important task. The hypothesis of a research while constructed properly consist at least two important elements i.e.: a dependent variable and an independent variable. A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes 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. Variables together are the causes and the phenomenon is effect and thus, there is cause effect relationship everywhere in the universe for a dependent variable and an independent variable.

The conceptual framework of Rosenberg and Hovland (1960) was kept in mind while making structural arrangements for the dependent and independent variables. This study is concerned with the knowledge on management of homestead fruit production and practices which includes fertilizer, irrigation, hormone, mulching, pruning, thinning and Training. Thus, the knowledge on management of homestead fruit production and practices was the dependent variable and 7 selected characteristics of the fruit growers' households were considered as the independent variables. Knowledge on management of homestead fruit production and practices of an individual may be affected through interacting forces of many independent variables. It is not possible to deal with all independent variables in a single study. It was therefore, necessary to limit the independent variables, which include age, level of education, family size, annual income, age of homestead, size of homestead and size of homestead fruit trees area for this study.

Considering the above mentioned discussion, a conceptual framework has been developed for this study, which is diagrammatically presented in the following Figure 2.1.

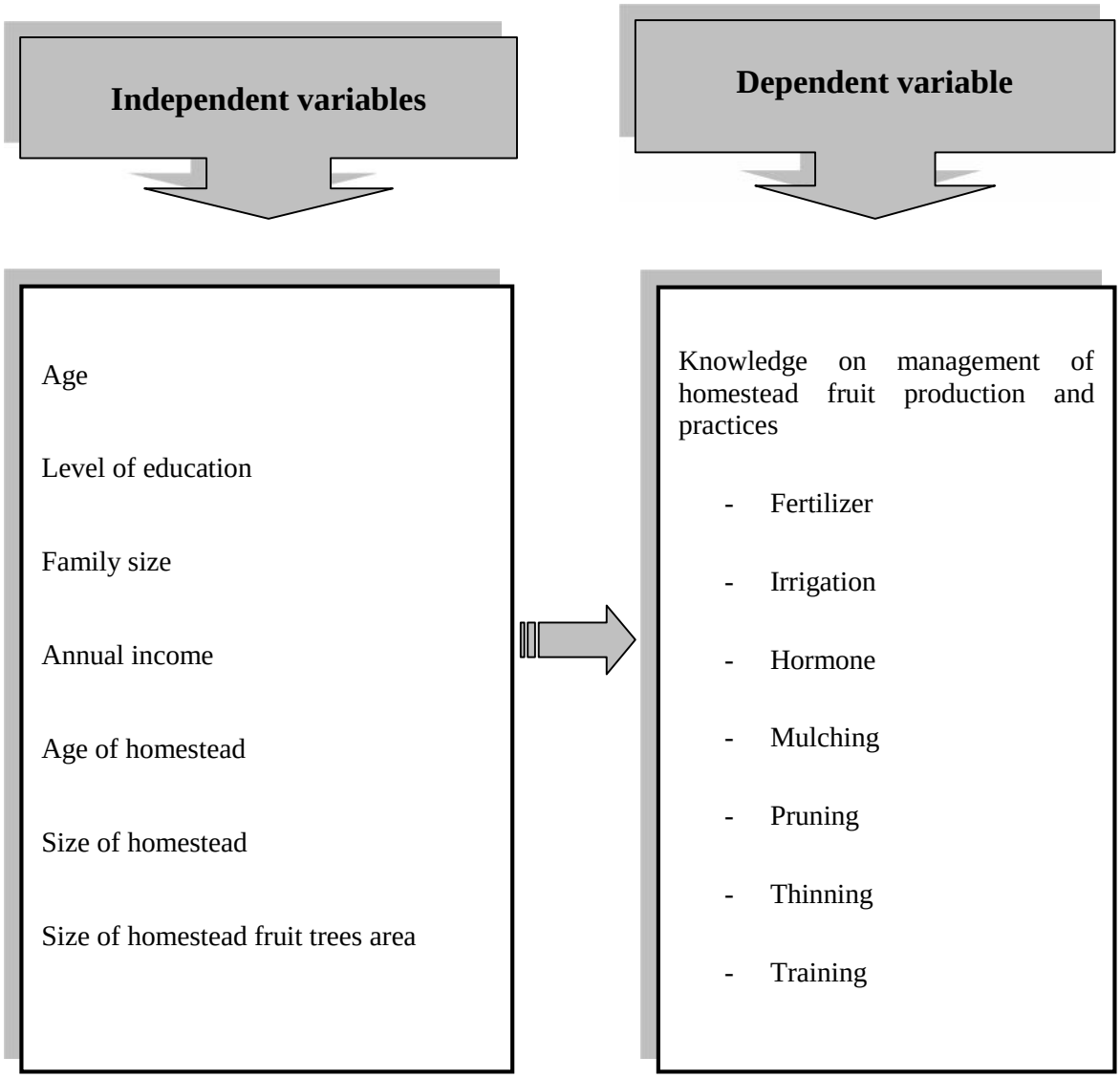

Figure 2.1 The conceptual framework of the study

2.4 Literature related to the concept of different management practices of homestead fruit trees

2.4.1 Fertilizer

Poor cropping is considered to be a serious and major problem that faces by fruit growers. This problem is attributed mainly to poor fruit retention and/or extensive dropping of flowers and fruits. Unfavourable environmental conditions, malnutrition, application of higher amounts of mineral N and undesirable physiological conditions around the trees are considered important reasons for such problem (Miller *et al*., 1990). Therefore, it is necessary for avoiding the excessive use of nutrients partially by using some bio-stimulants namely seaweed extract, yeast and vitamins (Tung *et al*., 2003).

Plants contain more than 90 elements, but only 16 elements are recognized as essential. These elements are carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, zinc, copper, molybdenum, boron and chlorine. Besides these, another four elements viz. silicon, sodium, cobalt and vanadium might be beneficial for a group of plants. Except carbon, hydrogen and oxygen, all the 13 elements are taken up by plants from soils and they are called mineral nutrients. Plants obtain carbon, hydrogen and oxygen from air and water. The nutrients can be divided into two groups on the basis of the quantity required by the plants: macronutrients and micronutrients. Macronutrients are required relatively in larger quantities (usually above 0.1 % on dry weight basis) while micronutrients are required in smaller quantities (usually below 100 ppm). Carbon, H and O constitute 90-95% of plant dry matter weight. Nitrogen, P and K are called primary nutrients because of their large requirement and Ca, Mg & S are called secondary nutrients (FRG, 2005).

2.4.2 Irrigation

Irrigation is a vital management practice in fruit production regions of the world, particularly in arid and semi-arid climates. Better understanding and utilization of tree physiological parameters is needed for management of irrigation water in fruit crops and this will ultimately lead to achieving optimum yield and fruit

quality while conserving water resources (Al-Yahyai, 2012). Despite the variations in the available water resources among fruit producing countries, the question of frequency of irrigation and amount of water applied to fruit crops is a common concern. Insufficient water supply may result in reduced tree growth, yield and fruit quality due to water stress. Excessive irrigation, on the other hand, may increase nutrient leaching, water logging problems, incidence of pests and diseases, and the associated cost of frequent operation and maintenance of the irrigation system. In addition, unmanaged irrigation may lead to adverse environmental effects such as agrochemical leaching into groundwater aquifers, reduced water reservoir, and water and soil salinity. Optimizing water applications by scheduling irrigation to fruit orchards may increase water conservation, reduce production costs, and increase tree growth and yield. Irrigation scheduling is especially important in horticultural crops because net returns are normally higher than those of other crops (Fereres, 1997).

According to Hillel (1998), the main issue with irrigation management is to determine the frequency, quantity, and timing of irrigation to optimize crop growth and productivity. However, irrigation scheduling and management of fruit crops where rain falls in sufficient quantities in temperate, tropical and subtropical regions is not well established. For example, irrigation was not a common practice in fruit orchards in the humid-temperate regions such as New York, USA. However, in recent decades, irrigation has become more common since it was proven to increase growth and promote early production of high-density apple orchards (Robinson and Stiles, 1995). Availability of weather data allows the use of evapotranspiration (ET) predictions as a basis for irrigation scheduling (Hutmacher, *et al*., 1994). Similar irrigation scheduling approaches were reported by Ebel *et al*. (1995). Irrigation based on climatic data, is the method commonly used to schedule irrigation of apple orchards in North-Eastern United States.

South Florida is the main region in the continental United States where subtropical and tropical fruit crops are grown. In this region, trees are commonly irrigated at rates and frequencies based mainly on grower’s experience and

observations of crop growth and yield rather than on quantitative scientific information (Schaffer, 1998; Al-Yahyai, *et al*., 2005). According to a survey by Munoz-Carpena *et al*., 2003, 64.3% of fruit growers irrigate trees based on rainfall frequency and quantity. Problems concerning variability in irrigation duration and frequency were rated high among the fruit growers (Li *et al*., 2000), which highlight the need for a better understanding of irrigation requirements of these crops.

Measurement of soil water content and soil matric potential provide an index of the rate at which water is taken up by the plant or lost from the root zone. Soil water content and potential is therefore most useful in con-junction with information about the soil-plant-atmosphere system (Campbell and Campbell, 1982). Water extraction from the soil is de-pendent on plant properties that determine the plant water potential (Ψ) at which a particular plant species can continue to grow and extract water from the soil (Jones, 1990).

Although climate and soil-based methods provide a means for estimating irrigation amount and timing, they do not take into account the variability between fruit tree species and cultivars, growth stage, or the response of trees to soil moisture deficit. The water refill point, which is the lowest possible soil water content with no decrease in yield or fruit quality, varies among different tree varieties, rootstocks, soils and seasons (Jones, 2004). Several physiological variables are used as indicators of tree water status. Among the most frequently used is tree water potential (Al-Yahyai, *et al*., 2005).

It is often beneficial to use both soil and plant factors for irrigation scheduling. An integrated approach utilizing soil and plant factors suggested by Buss (1989) included soil surveying to determine soil properties and available soil moisture content and crop factors that included crop type, canopy size, rooting width and depth, and crop density. Irrigation scheduling was then planned from a combination of available water data, crop water extraction rates, and the irrigation system layout. Physiological processes in fruit trees such as water potential and

gas exchange are sensitive to changes in soil water content (Naor and Cohen, 2003; Al-Yahyai *et al*., 2005). These physiological variables, growth, and fruit production should be correlated with soil water content prior to determining the appropriate amount of water to apply to an orchard. Little is known about the response of temperate fruit crop, such as apple, and tropical fruit crop, like star-fruit, to changes in soil water content under field conditions in humid-temperate and subtropical climates. This paper discusses the relationship between soil water content and water potential of apple and star-fruit trees grown in irrigated orchards using climate-based (ET) and soil-based (capacitance probes) irrigation scheduling methods.

2.4.3 Hormone

Hormone or plant growth regulators (PGR's) are organic compounds, which in small amounts, somehow modify a given physiological plant process. It plays an essential role in many aspects of plant growth and development, stem elongation and flower development (Chaudhary *et al.,* 2006; Ouzounidou *et al.,* 2008). Plant growth regulators can be used to modify growth and development in various ways. Some growth regulators affect primarily on vegetative growth; others influence the fruit; still others may induce modifications in vegetative and fruiting parts (Tanimoto, 1987; Leclerc *et al*., 2006). The responses to a particular growth regulator depend upon factors such as the plant, the chemical, and the environment. Fruit per plant, fruit size and weight per fruits was the yield components which may vary on the application of different PGR’s.

2.4.4 Mulching

Mulches prevent weeds from germinating, reduce evaporative loss from soil surfaces, add organic matter to soils thereby increasing their mineral content and increase soil-borne disease suppression. The benefit most desired from mulch applications is for more growth or better growth of trees. Increased growth of trees has been associated with organic mulches in several studies (Downer and Faber, 2005; Greenly and Rakow, 1995; Foshee *et al*., 1996). Mulch effects on growth depend on the age of the tree, whether newly planted or an established

specimen, tree species and site factors such as water applications, soil types and their mineral nutrient content as well as the presence or absence of pathogenic fungi in soil.

Mulching with organic materials derived from trees increases the mineral content of underlying soils, and many positively charged nutrients contained in plants (including toxic ions) tend to accumulate in fine textured soils under organic mulches (Downer, 1998).

2.4.5 Training and Pruning

Historically, fruit tree form and structure have been maintained by pruning. Tree training, however, is a much more efficient and desirable way to develop form and structure. Pruning is the removal of a portion of a tree and is used to correct or maintain tree structure.

Training is a practice that allows tree growth to be directed into a desired shape and form. Training young fruit trees is essential for proper tree development. It is more efficient to direct tree growth with training than to correct it with pruning.

Pruning is most often accomplished during the winter, commonly referred to as dormant pruning. Training includes summer training and summer pruning as well as dormant pruning. The goal of tree training is to direct tree growth and to minimize pruning and removing a portion of the tree, although dormant pruning is always going to be needed (Michael, 2004).

The best ways for homeowners to control the height of a fruit tree are to plant a dwarfing rootstock, prune well, or use a trellis system. Keeping the tree's height low allows for easier harvesting and pest management. A post-and-wire trellis system is a popular way to keep fruit trees at a manageable height. Untrained fruit trees can become infestation sites for serious insect and disease pests. Untrained trees can make it difficult for commercial growers in the region to control key pests (Olsen, 2011).

CHAPTER III

METHODOLOGY

Methodology would be enabling the researcher to collect valid information. It is impossible to conduct research work smoothly without proper methodology and it is very difficult to address the objectives with a scientific manner. It requires a very careful consideration on the part of the researcher to collect valid and reliable data and to analyze the same for meaningful conclusion. The study was conducted through 2 step survey. A sequential description of the methodologies followed in conducting this research work has been presented in this chapter.

3.1 Locale of the study

The study was conducted in Ajmiriganj upazila under Habigonj district and it was a Haor area and the overview of Haor homestead presented in Plate 1. There are 05 unions in Ajmiriganj upazila, viz. Ajmiriganj, Kakailseo, Jalsuka, Badalpur, and Shibpasha. BAS-USDA-PALS project has identified 45 homesteads in 5 unions of this upazila which family have Mango, Hog plum, Papaya, Banana, Orange, Lemon, Jujube, Coconut, Guava, Star fruit, Pummelo, Sapota and Wax apple fruit trees in their homestead areas. But most of them are unaware about the benefits of fruit production (both cash and nutrient value of fruits). So, to bring the area in the light of great concern it was selected as the locale of the study. A map of Ajmiriganj upazila that is the study area presented in Appendix I.

3.2 Sample size

Homestead fruit growers of Ajmiriganj upazila under Habigonj district constituted the population of the study. Through a survey under the project BAS-USDA-PALS an update list of 45 family were made who have the fruit trees of Mango, Hog plum, Papaya, Banana, Orange, Lemon, Jujube, Coconut, Guava, Star fruit, Pummelo, Sapota and Wax apple in their homestead areas. Thus, 45 homestead fruit growers constituted the sample of the study. The 45 homesteads were surveyed to understand their knowledge regarding homestead fruit cultivation and also identify the present fruit production system of them.

Plate 1. Overview of the homestead in Haor areas

3.3 The research instrument

A well structured interview schedule was developed based on objectives of the study. Firstly, for collecting information related to the characteristics of homestead fruit growers and knowledge regarding homestead fruits cultivation were used that contained direct and simple questions in open form and close form keeping in view the dependent and independent variables. Secondly, specific management practices of the specific fruit trees were identified through another simple structured interview schedule.

The questionnaire was pre-tested with 5 homestead fruit growers to find out actual situation before making final draft. Necessary corrections, additions, alternations, rearrangements and adjustments were made in the interview schedule based on pretest experience. The questionnaire was then multiplied by printing in its final form. A copy of the interview schedule is presented into Appendix II.

3.4 Measurement of variables

The variable is a characteristic, which can assume varying, or different values in successive individual cases. A research work usually contains at least two important variables viz. independent and dependent variables. An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon. A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variable (Townsend, 1953). In the scientific research, the selection and measurement of variable constitute a significant task. Following this conception, the literature reviewed to widen this understanding about the natures and scopes of the variables relevant to this research. At last he had selected 7 independent variables and one dependent variable. The independent variables were: age, level of education, family size, annual income, age of homestead, size of homestead and size of homestead fruit trees area. The dependent variable of this study was the knowledge on management of homestead fruit production and practices.

3.5 Measurement of independent variables

The 7 characteristics of the homestead fruit growers in Haor areas mentioned above constitute the independent variables of this study. The following procedures were followed for measuring the independent variables.

3.5.1 Age

Age of respondent homestead fruit growers was measured by the period of time from their birth to interview and it was measured in terms of complete years on the basis of their response. A score of one (1) was assigned for each year age.

3.5.2 Level of education

Level of education was measured in terms of class passed by respondent homestead fruit growers. Their education was assessed in terms of year of schooling, i.e. one (1) score was given for one year of schooling. For example, if the fruit grower passed the final examination of class V, their education score was taken as 5. If the fruit growers had education out side school and the level of education was equivalent to that of class V of the school than his education score was taken as 5. Each illiterate person was given a score of zero (0). The fruit growers who did not know how to read or write but able to can sign only was given a score of '0.5'.

3.5.3 Family size

The family size of a respondent fruit growers was measured in terms of actual number of members in his/her family including himself/herself, spouse, children, brothers, sisters, parents and other person who jointly live and ate together during the period of interviewing.

3.5.4 Annual family income

The term annual income refers to the annual gross income of a respondent fruit growers and the members of his/her family from different sources and expressed in taka. In measuring this variable, total earning in taka of an individual fruit

growers was converted into score. A score of one (1) was given for every one thousand (Tk. 1000) taka.

3.5.5 Age of homestead

Age of homestead of respondent fruit growers was measured by the period of time from their household construction in this area to interview and it was measured in terms of complete years on the basis of their response. A score of one (1) was assigned for each year age of homestead.

3.5.6 Size of homestead

Homestead farm size of respondent fruit growers referred to the area of land on which his/her family used for homestead and received full benefits for his/her family. It was measured in hectares for each respondent fruit growers. The size of homestead of fruit growers was computed in terms of hectares by using the following formula:

Size of homestead, HS = A + B + C + D + E + F + G

Where,

A = Residential areas/House areas

B = Homestead premises

C = Pond area

D = Cow/livestock shade

E = Areas of homesteads garden

F = Trees plantation areas/forest

G = Others (if any)

The total size of homestead thus obtained was considered as the homestead size score of the fruit growers in Haor areas.

3.5.7 Size of homestead fruit trees areas

Size of homestead fruit trees areas of respondent fruit growers referred to the area of land on which his/her family used for homestead fruit trees cultivation and received full benefits for his/her family. It was measured in hectares for each respondent fruit growers.

3.6 Knowledge on management of homestead fruit production and practices

Knowledge on management of homestead fruit production and practices referred to the knowledge gained by the respondent fruit growers in homestead fruit cultivation. Fifty one questions on different aspect of homestead fruit management were asked to the respondent fruit growers to ascertain their knowledge score. The score was assigned as 2 for full correct answer and zero (0) for incorrect or no answer for each question. Partial score 1 was assigned for partial answers. Thus knowledge on management of homestead fruit production and practices scores of the respondents fruit grower could range from '0' to 70 where zero (0) indicated very no knowledge and 70 indicated very high knowledge on homestead fruit cultivation in Haor areas of Bangladesh.

3.7 Hypothesis of the study

In the present study the following null hypotheses were formulated:

"There are no relationships between each of 7 selected characteristics of the homestead fruit growers and their knowledge on management of homestead fruit production and practices".

3.8 Estimation of correlation

Simple correlation was estimated for different traits with the following formula (Singh and Chaudhary, 1985):

$$r = \frac{\sum xy - \frac{\sum x . \sum y}{N}}{\left[\left\{\sum x^2 - \frac{(\sum x)^2}{N}\right\}\left\{\sum y^2 - \frac{(\sum y)^2}{N}\right\}\right]^{1/2}}$$

Where,

$\sum$ = Summation

x and y are the two variables

N = Number of observations

3.9 Data collection procedure

The researcher himself collected the data from the sample respondents fruit grower through personal contact with the help a pre-tested interview schedule. Whenever any respondent fruit growers faced difficulty in understanding questions, more attention was taken to explain the same with a view to enabling the respondents fruit grower to answer properly. No serious problem was faced by the investigator during data collection but obtained cooperation from the respondent fruit growers. Data collection was started in October, 2013 and completed in November, 2013.

3.10 Data processing

Qualitative data were converted into quantitative data by means of suitable scoring wherever necessary. After collection of data, data processing and analysis was done the following the steps as mentioned below:

3.10.1 Compilation of data

After completion of field survey all the interview schedule were coded, compiled, tabulated and analyzed according to the objectives of the study. In this process all the responses in the interview schedule were given numerical coded values. The responses to the question in the interview schedule were transferred to a master sheet to facilitate tabulation. Tabulation was done on the basis of categories developed for the investigation.

3.10.2 Categorization of respondent fruit growers

For describing the various independent and dependent variables the respondents were classified into various categories based on the assigned score. In developing categories the researcher was guided by the nature of data and general consideration prevailing on the social system. The procedures have been discussed while describing the variable in the sub-sequent sections of next chapter.

3.11 Data analysis

Data collected from the respondent fruit growers were complied, coded, tabulated and analyzed in accordance with the objectives of the study. Various statistical measures such as frequency counts, percentage distribution, average, and standard deviation were used in describing data. SPSS (version 11.5) computer program were used for analyzing the data. The categories and tables were used in describing data. The categories and tables were also used in presenting data for better understanding. The used statistical measurement in describing the selected dependent and independent variables were frequency and percent distribution, range, mean and standard deviation.

For determining the association of the selected characteristics of the respondent fruit growers with the knowledge in management of homestead fruit cultivation and practices Pearson Product Moment Correlation was used. Five percent (0.05) level of probability was used as the basis for rejecting any null hypothesis. If the computed ‘r’ value was equal or large than the table value at 0.05 level of probability with (n-2) degree of freedom, the null hypothesis was rejected and it was concluded that there was a significant relationship between the variables concerned. If the computed ‘r’ values were found to be smaller than the table value at 0.05 level of probability, the concerned null hypothesis could not be rejected and led to the conclusion that there was no significant relationship between the concerned variables.

CHAPTER IV

RESULTS AND DISCUSSION

In this chapter the findings of the study were presented in accordance with the objectives of the study and possible interpretation of the recorded information also presented. The chapter has five sections. The first section deals with the characteristics of the homestead fruit growers in Haor homestead of Bangladesh. The second section deals with the knowledge on management of homestead fruit cultivation and practices. The third section deals with the relationship between individual characteristics of the homestead fruit growers with their knowledge on management of homestead fruit cultivation and practices. The 4th section deals with different aspects and magnitude of different problems in homestead fruit cultivation and the 5th sections deals the status of different management practices of homestead fruit trees.

4.1 Characteristics of the fruit growers

There are different interrelated characteristics of the fruit growers that influence their knowledge on the management practices for homestead fruit cultivation in Haor homestead of Bangladesh. It was therefore, hypothesized that the characteristics of the fruit growers under the study would have an effect on the homestead farming knowledge of fruit growers. However, the most important features of seven selected characteristics of the homestead fruit growers in Haor homestead of Bangladesh such as age, level of education, family size, annual income, age of homestead, size of homestead and size of homestead fruit trees area. Character wise summary of descriptive statistics of homestead fruit growers in *Haor* area of Bangladesh are presented in Table 1 and Summary distribution of the respondents according to their selected characteristics are presented in Table 2. Subsequently the details are presented and discussed for specific characters of homestead fruit growers in *Haor* area of Bangladesh.

Table 1. Descriptive statistics of homestead fruit growers in *Haor* area of Bangladesh

(N=45)

Characteristics	Measuring unit	Observed range	Mean	Standard deviation
Age	Years	26-60	47.22	8.93
Level of education	Schooling year	0.0-14	4.26	4.68
Family size	Numbers	2.0-6.0	4.18	1.11
Annual income	Amount	56-260	123.5	46.67
Age of homestead	Years	8-40	26.40	9.84
Size of homestead area	Hectare	0.08-0.56	0.248	0.134
Size of homestead fruit trees area	Hectare	0.03-0.38	0.115	0.08
Number of livestock in homestead	Number	3-21	10.24	4.11
Knowledge on management of homestead fruit cultivation	Score	10-64	28.36	15.98

Table 2. Distribution of the respondents according to their selected characteristics

Characteristics	Categories	Respondents	
		Number	Percentage
Age (years)	Young (up to 30 years)	3	6.67
	Middle (31-50 years)	22	48.89
	Old (above 50 years)	20	44.44
	Total	45	100
Education (Schooling years)	Illiterate (0 to can sign only-0.05)	24	53.34
	Primary (1-5)	2	4.44
	Secondary (6-10)	14	31.11
	Above secondary (above 10)	5	11.11
	Total	45	100
Family size (Number)	Small (up to 4)	26	57.78
	Medium (5-6)	17	37.78
	Large (above 6)	2	4.44
	Total	45	100
Annual income	Low income group (up to 70,000)	4	8.89
	Medium income group (70,001-140,000)	28	62.22
	High income group (above 140,00)	13	28.89
	Total	45	100
Age of homestead	Low aged homestead (up to 15 years)	10	22.22
	Medium aged homestead (16-30 years)	16	35.56
	High aged homestead (above 30 years)	19	42.22
	Total	45	100
Size of homestead	Small (up to 0.15 ha)	12	26.67
	Medium (.0.16-0.30 ha)	20	44.44
	Large (above 0.30 hectare)	13	28.89
	Total	45	100
Size of homestead fruit trees areas	Small (up to 0.10 ha)	24	53.33
	Medium (.0.11-0.20 ha)	14	31.11
	Large (above 0.20 hectare)	7	15.56
	Total	45	100
Livestock in homestead	Lowest number of livestock (up to 6)	9	20.00
	Medium number of livestock (7-12)	22	48.89
	Highest number of livestock (above 12)	14	31.11
	Total	45	100

4.1.1 Age

The score of age of the homestead fruit growers in Haor areas who have involvement in homestead fruit production range from 26 to 60 with a mean and standard deviation of 47.22 and 8.93, respectively. Considering the observed age score of the farmers they were classified into three categories namely 'young (upto 30 years)', 'middle aged (31-50 years)' and 'old aged (above 50 years' aged). The distribution and percentage of fruit growers homestead fruit growers according to their age are presented in Table 3.

Table 3. Distribution of the fruit growers according to their age

Categories (Years)	Fruit growers'		Mean	Standard deviation
	Number	Percent		
Young aged (upto 30 years)	3	6.67	47.22	8.93
Middle aged (31-50 years)	22	48.89		
Old aged (above 50 years)	20	44.44		
Total	45	100		

Table 3 indicates that the middle aged homestead fruit growers in Haor areas comprise the major proportion (48.89%) followed by old aged category (44.44%) and the young aged constitute the lowest (6.67%) proportion. Data also indicates that a total 93.33% fruit growers belonged to the middle and old aged group. The middle and young aged homestead fruit growers in Haor areas were generally tended to involve in homestead fruit growing activities than the younger. Probably middle and old aged fruit growers were more sincere regarding the planting of different variety of fruit trees in their homestead areas. During data collection only the fruit growers were selected who have the fruit trees of Mango, Hog plum, Papaya, Banana, Orange, Lemon, Jujube, Coconut, Guava, Star fruit, Pummelo, Sapota and Wax apple in their homestead areas. Probably, the young community was more involvement in another income generating activities or specific fruits cultivation. Mamun (2011) reported that age is an important factor regarding knowledge because age had significant negative correlation with homestead farming knowledge.

4.1.2 Level of education

The level of educational scores of the homestead fruit growers in Haor areas of Bangladesh ranged from 0 to 14 with the mean and standard deviation of 4.26 and 4.68, respectively. Based on educational scores, fruit growers were classified into four categories such as 'illiterate' (0 to 'can sign only 0.5)', 'primary education' (1 to 5), 'secondary education' (6 to 10) and above secondary (above 10). Table 4 indicates the distribution and percentage of the homestead fruit growers in Haor areas according to their level of education.

Table 4. Distribution of the fruit growers according to their level of education

Categories (Schooling years)	Fruit growers'		Mean	Standard deviation
	Number	Percent		
Illiterate (0 to can sign only-0.05)	24	53.34	4.26	4.68
Primary (1-5)	2	4.44		
Secondary (6-10)	14	31.11		
Above secondary (above 10)	5	11.11		
Total	45	100		

According to the categories of fruit growers presented in Table 4 shows that under 'illiterate' category constitute the highest proportion (53.34%) compared to 31.11% 'secondary level category and 11.11% above secondary level category. On the other hand, the lowest (4.44%) constitute primary level category. Education broadens the horizon of outlook of homestead fruit growers in Haor areas and expands their capability to analyze any situation related to homestead fruit cultivation. An educated Haor fruit grower is likely to be more responsive to the modern facts, ideas, technology and information of homestead fruits cultivation. To adjust with the same, illiterate group would be vulnerable to adopt as well as involve with modern management practices of homestead fruit cultivation. Saha (2001) reported that level of education is an important factor because education of the farmers had a positive significant relationship with their knowledge on improved practices of pineapple cultivation.

4.1.3 Family size

Family size score of the fruit growers homestead fruit growers in Haor areas ranged from 2 to 6 with the mean and standard deviation of 4.18 and 1.11, respectively. According to family size the fruit growers were classified into three categories, viz. 'small family', 'medium family' and 'large family' and the distribution of the fruit growers presented in Table 5.

Table 5. Distribution of the fruit growers according to their family size

Categories (No. of members)	Fruit growers'		Mean	Standard deviation
	Number	Percent		
Small (up to 4)	26	57.78	4.18	1.11
Medium (5-6)	17	37.78		
Large (above 6)	2	4.44		
Total	45	100		

Data revealed that the small family constitute the highest proportion (57.78%) followed by the medium family (37.78%). Only 4.44% fruit growers had large family size. Such finding is quite normal as per the situation of Bangladesh. Table 5 also showed that average family size of the fruit growers was lower than that of national average of 5.4.

4.1.4 Annual income

Annual family income score of the fruit growers homestead fruit growers in Haor areas ranged from 56 to 260 thousands with a mean and standard deviation of 123.5 and 46.67, respectively. On the basis of their annual income, the homestead fruit growers in Haor areas were classified into three categories, viz. low, medium and high annual family income category. The distribution of the homestead fruit growers in Haor areas according to the annual income categories has been presented in Table 6.

Table 6. Distribution of the fruit growers according to their annual income

Categories ('000 Taka)	Fruit growers'		Mean	Standard deviation
	Number	Percent		
Low income group (up to 70)	4	8.89	123.5	46.67
Medium income group (71-140)	28	62.22		
High income group (above 140)	13	28.89		
Total	45	100		

Data presented in Table 6 revealed that the homestead fruit growers in Haor areas having medium income constitute the highest proportion (62.22%) followed by high annual income (28.89%) and the low income group constitute the lowest annual income group (8.89%).

4.1.5 Age of homestead

The age of homestead areas in Haor areas ranged from 8 to 40 years with a mean and standard deviation of 26.40 and 9.84, respectively. Based on age of homestead scores, they were classified into three categories such as 'low aged homestead (up to 15 years), 'medium aged homestead (16-30 years) and high aged homestead (above 30 years). Table 7 represents the distribution of the homestead fruit growers in Haor areas as per the age of homestead.

Table 7. Distribution of the fruit growers according to their age of homestead

Categories (Years)	Fruit growers'		Mean	Standard deviation
	Number	Percent		
Low aged homestead (up to 15 years)	10	22.22	26.40	9.84
Medium aged homestead (16-30 years)	16	35.56		
High aged homestead (above 30 years)	19	42.22		
Total	45	100		

Data presented in Table 7 indicated that age of homestead of fruit growers under high aged category constitutes the highest proportion (42.22%) compared to 35.56% of medium aged homestead and the lowest percentage 22.22% low aged

homestead. Rahman *et al*. (2009) reported that villages of Bangladesh have a long heritage of growing fruit trees along with other perennial shrubs and herbs.

4.1.6 Size of homestead

The score of size of homestead of the fruit growers' homestead fruit growers in Haor areas ranged from 0.08 hectare to 0.56 hectare with a mean and standard deviation of 0.248 and 0.134, respectively. Based on their size of homestead, the fruit growers were classified into three categories. These categories were small size (upto 0.15 ha), medium size (0.16- 0.30 ha) and large size (above 0.30 ha). The distribution of the homestead fruit growers in Haor areas according to their size of homestead has been presented in Table 8.

Table 8. Distribution of the fruit growers according to their size of homestead

Categories (ha)	Fruit growers'		Mean	Standard deviation
	Number	Percent		
Small size (up to 0.15 ha)	12	26.67	0.248	0.134
Medium size (.0.16-0.30 ha)	20	44.44		
Large size(above 0.30 ha)	13	28.89		
Total	45	100		

Table 8 indicates that the medium size of homestead constitutes the highest proportion 44.44% followed by 28.89% with large size homestead and the lowest 26.67% in small size homestead. The findings of the study reveal that majority of the homestead fruit growers in Haor areas were medium sized in their homestead area. Abdullah (1986) reported that homestead land occupied by the dwelling unit of the household and the immediate area surrounding it, including courtyard, pond, road space, space used for cultivation of trees and vegetables.

4.1.7 Size of homestead fruit trees areas

The score of size of homestead fruit trees areas of the fruit growers' homestead fruit growers in Haor areas ranged from 0.03 hectare to 0.38 hectare with a mean and standard deviation of 0.115 and 0.08, respectively. Based on their size of homestead fruit trees areas, the fruit growers were classified into three categories.

These categories were small size (upto 0.10 ha), medium size (0.11- 0.20 ha) and large size (above 0.20 ha). Table 9 represents the distribution of the homestead fruit growers in Haor areas according to their size of homestead fruit trees areas.

Table 9. Distribution of the fruit growers according to their size of homestead fruit trees areas

Categories (ha)	Fruit growers'		Mean	Standard deviation
	Number	Percent		
Small size (up to 0.10 ha)	24	53.33	0.115	0.08
Medium size (.0.11-0.20 ha)	14	31.11		
Large size (above 0.20 ha)	7	15.56		
Total	45	100		

Data represented in Table 9 revealed that the small size of homestead fruit trees areas constitutes the highest proportion 53.33% followed medium sized homestead fruit trees areas (31.11%) and the lowest 15.56% in large size homestead fruit trees areas. The findings of the study reveal that majority fruit growers were small to medium sized in their homestead fruit trees areas.

4.2 Knowledge on management of homestead fruit cultivation and practice

Knowledge on management of homestead fruit cultivation and practices of fruit growers homestead fruit growers in Haor areas could range from 10 to 64 against the possible range of 0-70 with the mean and standard deviation of 28.36 and 15.98, respectively. On the basis of Knowledge on management of homestead fruit cultivation and practices scores, the fruit growers were classified into three categories namely, 'low knowledge', 'medium knowledge' and 'high knowledge'. The distribution of the fruit growers in Haor areas according to their knowledge on management of homestead fruit cultivation and practices is given in Table 10.

Table 10. Distribution of the fruit growers according to their knowledge on management practices of homestead fruit cultivation

Categories (Score)	Fruit growers		Mean	Standard deviation
	Number	Percent		
Low Knowledge (up to 20)	19	42.22	28.36	15.98

Medium Knowledge (21-40)	17	37.78		
High Knowledge (above 40)	9	20.00		
Total	45	100.00		

Data of Table 10 reveal that majority (42.22%) of the fruit growers felt in low knowledge category followed by 37.78% in medium knowledge category in Knowledge on management of homestead fruit cultivation and practices and only 20.00% in high knowledge category. Knowledge is to be considered as vision of an explanation in any aspect of the situation regarding homestead fruit production activities. It is act or state of understanding, clear perception of fact or truth that helps an individual to foresee the consequence he may have to face in future. It makes individuals to become rational and conscious about related field. To perform optimum fruit production, fruit growers should have adequate knowledge on different aspects of the concern homestead fruit production technology. The findings of the present study revealed that 80.00% of the homestead fruit growers in Haor areas in the study area had low and medium knowledge on homestead fruit production activities.

Most of the households in Haor areas involved in crop cultivation and fishery activities they have clear idea on that issue. With the discussion of them it was clear that they involved in crop cultivation and they perform seedling raising, transplanting, weeding, irrigation activities and harvesting and post-harvesting operation in crop cultivation. They have clear idea on high yielding varieties, planting method of crop, seedling age, different insect and pests and many other aspects of crop cultivation. In case of vegetable, they know the time of planting in different vegetable with appropriate management procedure. They have clear idea on varieties, sowing time, fertilizer and manure, insect and pests and also their control method for vegetable cultivation

In fruit cultivation in homestead areas, they have an idea for placement of different fruits in different area based on their light requirements and they knew it from their past experiences. They have an idea on the propagating materials of

different fruits and physical and cultural management for different fruit cultivation activities in their homestead areas.

4.3 Relationship of the selected characteristics of homestead fruit growers in Haor areas with their knowledge

Pearson Product Moment Correlation Co-efficient was computed in order to find out the extent of relationship between the selected characteristics of homestead fruit growers and their knowledge on management of homestead fruit cultivation and practices. To reject or accept the null hypothesis at 0.05 and 0.01 level of probability was used. Results of correlation have been shown in Table 11 as correlation matrix.

Relationship between age, level of education, family size, annual income, age of homestead, size of homestead, size of homestead fruit trees area and number of livestock in homestead and knowledge on management of homestead fruit cultivation and practices of the growers in Haor areas was determined by Pearson product moment correlation coefficient.

Table 11 revealed that level of education, annual income and size of homestead fruit trees area showed significant positive relationship with knowledge on management of homestead fruit cultivation and practices. This represent that level of education, annual income and size of homestead fruit trees area of the fruit growers was an important factor regarding knowledge on management of homestead fruit cultivation and practices. On the other hand, age showed significant negative relationship with knowledge of homestead fruit management of the growers in Haor areas which indicate that the old aged farmers had less knowledge on management of homestead fruit cultivation and practices in consideration of modern practices. Hossain (2000) found that the education of the respondents had significant positive relationship with their knowledge

Family size, size of homestead and number of livestock in homestead showed non significant positive relationship with knowledge of homestead fruit management

of the growers in Haor areas. Mamun (2011) reported that family size had non significant positive correlation with homestead farming knowledge.

Table 11. Correlation between different characteristics of the fruit growers, with their knowledge on management of homestead fruit production

Characteristics	Level of education	Family size	Annual income	Age of homestead	Size of homestead	Size of homestead fruit trees	Knowledge on management of homestead fruit production
Age	-0.455**	-0.018	-0.263	0.172	0.101	0.010	-0.411**
Level of education		0.043	0.574**	-0.444**	-0.003	0.221	0.844**
Family size			0.142	0.184	-0.054	-0.076	0.040
Annual income				-0.131	0.042	0.057	0.436**
Age of homestead					-0.005	-0.198	-0.417**
Size of homestead						0.852**	0.031
Size of homestead fruit trees							0.307*

** Correlation is significant at the 0.01 level * Correlation is significant at the 0.05 level

4.4 Different aspects and magnitude of different problems in homestead fruit cultivation

4.4.1 Different aspects of homestead fruit cultivation

Different aspects of fruit cultivation were identified in Haor areas as per the fruit growers of the fruit growers; the reason for fruit cultivation, procedure of fruit variety selection in homestead garden, procedure of fruit tree plantation and their management, management of fruit trees, affected of fruit trees by insects and diseases and application of pesticides. In case of reasons for fruit cultivation majority (60.00%) responded that the cultivate fruit for eating. For procedure of fruit variety selection in homestead garden the majority (51.11%) use own selection procedure. In relation to the procedure of fruit tree plantation majority (40.00%) use their own decision and opinion. In case of management of fruit trees, majority (48.89%) replied that they practices management procedure sometimes. The most of the fruit growers reported that there were no serious attacked of insects (73.33%) and diseases (64.44%) and majority (75.56%) did not applied any pesticides for controlling insects and diseases (Table 12). In Bangladesh, various studies explore the floristic composition in the homestead gardens (Islam, 1998; Ahmad, 1997; and Motiur, *et al*., 2005). The term 'fruit' is more conveniently used to refer to the part of the seed suitable for human consumption, eaten fresh, either ripe or young (Uddin and Mukul, 2007).

4.4.2 Different problems in homestead fruit cultivation

According to the fruit growers opinion lack of technical knowledge about materials is the 1st category problem in fruit cultivation followed by high rate of interest and adequate loan demand and also inadequacy and high price of inputs. On the other hand, interference of middle man to get loan, shortage of cold storage is the more manageable problems regarding to increases of homestead fruit production in Haor areas (Table 13). Homestead fruit production is quite prevalence in Bangladesh with some common problem (Alam and Masum, 2005). Comparison of magnitude of different problems in homestead fruit cultivation in Haor areas presented in Figure 1.

Table 12. Distribution of the fruit growers according to the different aspects of fruit cultivation

Characteristics	Categories	Fruit growers	
		Number	Percentage
Reason for fruit cultivation	For eating	27	60.00
	For marketing	11	24.44
	Both for eating and marketing	6	13.33
	Other reason (if any)	1	2.22
	Total	45	100
Procedure of fruit variety selection in homestead garden	From the information of agricultural office	8	17.78
	With own selection	23	51.11
	Information from neighboring people	12	26.67
	As the availability of variety in near by	2	4.44
	Total	45	100
Procedure of fruit tree plantation and their management	As per standard/appropriate procedure	11	24.44
	As per own decision and opinion	18	40.00
	Information from neighboring people	12	26.67
	As per the information of radio and TV	4	8.89
	Total	45	100
Is they follow the management of fruit trees?	No	18	40.00
	Sometimes	22	48.89
	Regularly	5	11.11
	Total	45	100
Is the fruit tress affected by insects?	Yes	12	26.67
	No	33	73.33
	Total	45	100
Is the fruit tress affected by diseases?	Yes	16	35.56
	No	29	64.44
	Total	45	100
Did you apply pesticides	Yes	11	24.44
	No	34	75.56
	Total	45	100

Table 13. Comparison of magnitude of different problems in homestead fruit cultivation in Haor areas

SL. No.	Problem	High (3)	Moderate (2)	Little (1)	Not at all (0)	PCI	Rank order
1	Inadequacy of inputs	27	13	3	2	110	4
2	High price of inputs	21	18	3	3	102	5
3	Low quality of materials	12	17	11	5	81	8
4	Lack of technical knowledge about materials	32	11	2	0	120	1
5	Shortage of cold storage .for fruit preservation	10	13	12	10	68	11
6	Decrease of weight in fruit preservation	16	8	12	9	75	10
7	Transport problem for marketing	8	21	10	6	76	9
8	Deprive from accurate sale price	17	22	3	3	98	6
9	Lack of loan facilities at optimum time	19	18	3	5	96	7
10	High rate of interest	34	6	5	0	119	2
11	Interfere of middle man to get loan	3	12	11	19	44	12
12	Inadequate loan than demand	27	18	0	0	117	3
Total		226	177	74	63	1106	--

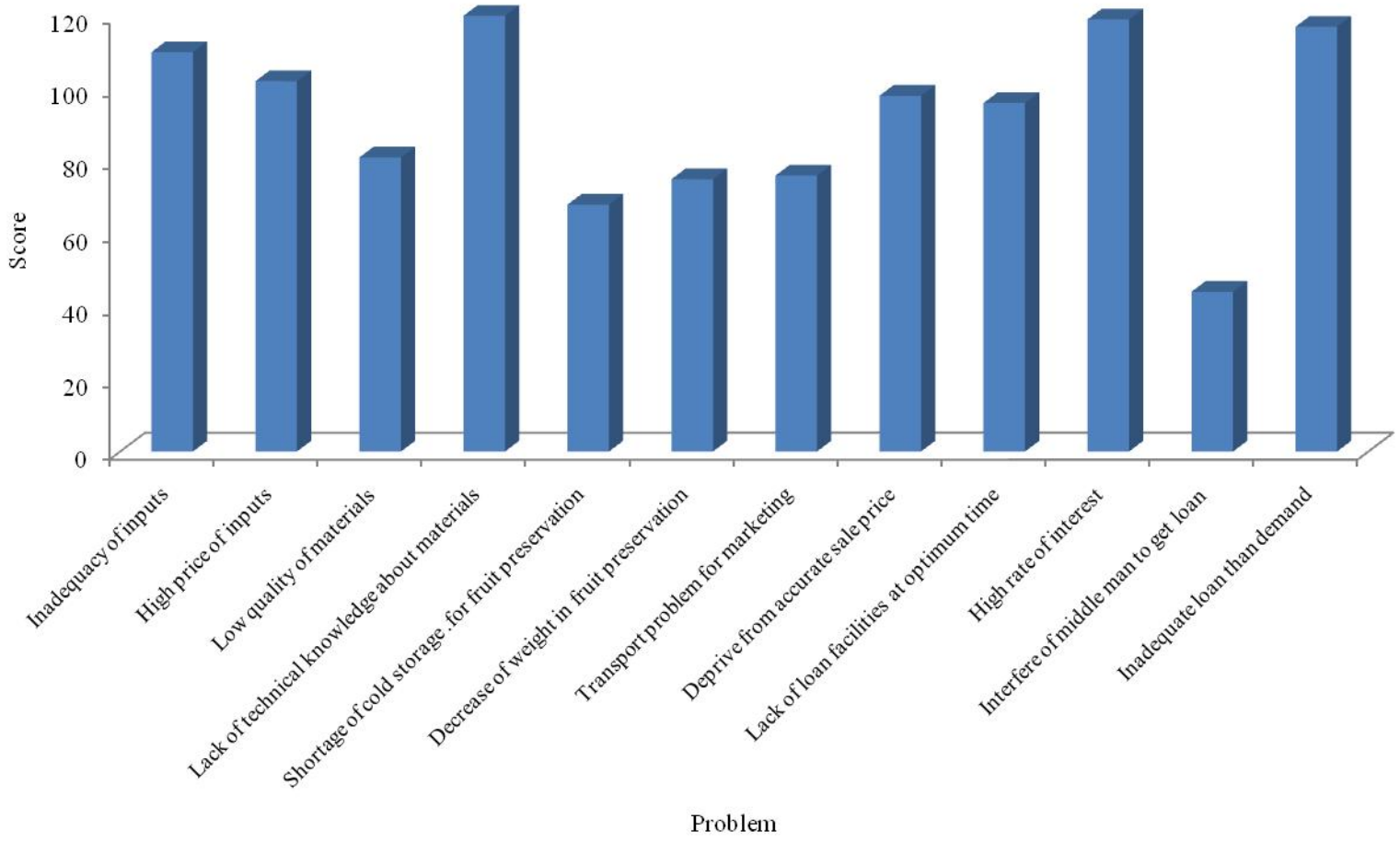

Figure 1. Comparison of magnitude of different problems in homestead fruit cultivation in Haor areas

4.5 Management practices in homestead fruit trees

4.5.1 Status of different management practices for different fruit trees

In case of different fruits, the fruit growers respond that they applied fertilizer, irrigation, hormone, mulching, pruning, thinning and training for homestead fruit production. In consideration of fertilizer application, for orange cultivation the highest 100% fruit growers applied fertilizers but for coconut cultivation around 75.56% did not use any fertilizers (Table 14). In context of irrigation, the highest 84.44% fruit growers applied irrigation in papaya cultivation, while highest 95.56% fruit growers did not use any irrigation for banana cultivation in their homestead areas. For hormone application, the highest 55.56% fruit growers applied hormone for mango cultivation, whereas the highest 100% fruit growers did not applied hormone for hog plum, banana, lemon, coconut, star fruit, pummel and wax apple cultivation. In consideration of mulching, the highest 64.44% fruit growers used mulched materials for banana cultivation, while the highest 95.56% fruit growers did not used any mulch materials for jujube cultivation. In consideration of thinning, the highest 40.00% fruit growers practiced thinning in papaya cultivation, while the highest 100% fruit growers did not practiced any thinning activities for coconut cultivation. For training, the highest 42.22% fruit growers practiced training in jujube plant, whereas the highest 100% fruit growers did not followed any training practices for banana cultivation in their homestead areas. For pruning in homestead fruit cultivation, the highest 100% fruit growers practiced pruning in jujube plant but the highest 100% fruit growers did not practiced and pruning for coconut trees. Data revealed that the different management practices used by different fruit growers for different fruit growing in their homestead areas. According to FAO (2010) in Bangladesh, there is no specific management plan for the homestead fruit trees which are being traditionally managed by the household owners. Motiur *et al*. (2006) reported that The management of the traditional homestead garden has evolved as a response to many factors such as cultural, economic and, environmental as well as personal preferences.

Table 14. Status of different management practices in homestead fruit trees in Haor areas

Fruit Trees	Application status of different management practices (%) as per the responses of fruit growers*													
	Fertilizer		Irrigation		Hormone		Mulching		Thinning		Training		Pruning	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Mango	84.44	15.56	51.11	48.89	55.56	44.44	35.56	64.44	6.67	93.33	13.33	86.67	75.56	24.44
Hog plum	68.89	31.11	24.44	75.56	0.00	100.00	13.33	86.67	26.67	73.33	4.44	95.56	33.33	66.67
Papaya	97.78	2.22	84.44	15.56	11.11	88.89	40.00	60.00	40.00	60.00	2.22	97.78	11.11	88.89
Banana	95.56	4.44	4.44	95.56	0.00	100.00	64.44	35.56	8.89	91.11	0.00	100.00	26.67	73.33
Orange	100.00	0.00	68.89	31.11	4.44	95.56	26.67	73.33	11.11	88.89	8.89	91.11	55.56	44.44
Lemon	86.67	13.33	15.56	84.44	0.00	100.00	40.00	60.00	24.44	75.56	31.11	68.89	48.89	51.11
Jujube	48.89	51.11	26.67	73.33	8.89	91.11	4.44	95.56	4.44	95.56	42.22	57.78	100.00	0.00
Coconut	24.44	75.56	6.67	93.33	0.00	100.00	33.33	66.67	0.00	100.00	2.22	97.78	0.00	100.00
Guava	82.22	17.78	35.56	64.44	13.33	86.67	26.67	73.33	6.67	93.33	37.78	62.22	24.44	75.56
Star fruit	28.89	71.11	13.33	86.67	0.00	100.00	15.56	84.44	15.56	84.44	11.11	88.89	35.56	64.44
Pummelo	33.33	66.67	17.78	82.22	0.00	100.00	24.44	75.56	11.11	88.89	24.44	75.56	40.00	60.00
Sapota	82.22	17.78	28.89	71.11	2.22	97.78	11.11	88.89	4.44	95.56	6.67	93.33	26.67	73.33
Wax apple	53.33	46.67	20.00	80.00	0.00	100.00	8.89	91.11	8.89	91.11	15.56	84.44	20.00	80.00

*Total fruit growers 45 number in Haor areas

4.5.2 Status of fertilizer management in different homestead fruit trees

Poor cropping is considered to be a serious and major problem that faces fruit growers. From the Table 15 it was found that status of different fertilizer management practices as per the responses of fruit growers varied markedly. Most of the fruit growers applied fertilizers once in a time for the homestead fruit cultivation. According to the fruit growers opinion the highest 91.11% fruit growers used fertilizer once in a year for orange cultivation but the highest 42.22% fruit growers used fertilizer twice per year for banana cultivation, while the highest 75.56% fruit growers did not use any fertilizer for coconut cultivation. The highest 80.00% fruit growers used maximum fertilizer for orange cultivation but the highest 69.23% fruit growers applied minimum doses of fertilizer for star fruit cultivation, whereas the highest 33.33% fruit growers applied average fertilizer for pummelo cultivation. In case of methods of use of fertilizer, the highest 44.19% fruit growers practiced furrow method for banana cultivation but the highest 83.78% fruit growers practiced ring method for sapota fruit cultivation, while the highest 47.73% fruit growers practiced spray method for papaya cultivation. Poor cropping is considered to be a serious and major problem that faces by fruit growers in Bangladesh and this problem is attributed mainly to poor fruit retention and/or extensive dropping of flowers and fruits. Unfavourable environmental conditions, imbalance use of nutrients, malnutrition, application of higher amounts of mineral N and undesirable physiological conditions around the trees are considered important reasons for such problem (Miller *et al*., 1990). Nutrients can exist in the soil in various forms, viz. dissolved in the soil solution, adsorbed on the soil particle surface or as constituents of the solid phase (sparingly soluble minerals, organic matter, and occluded material). The availability of a nutrient refers to that fraction of the nutrient which is accessible to plant roots. It is often observed that the total status of a particular nutrient in soil is high but the plants grown on this soil suffers from deficiency of that element (FRG, 2005).

Table 15. Status of fertilizer management in different homestead fruit trees in Haor areas

Fruit Trees	Status of different fertilizer management practices (%) as per the responses of fruit growers*									
	Yearly times of fertilizer application				Amount of fertilizer application			Methods of fertilizer application		
	Once	Twice	Thrice	No	Maximum	Minimum	Average	Furrow method	Ring method	Spray method
Mango	60.00	22.22	2.22	15.56	50.00	21.05	28.95	21.05	71.05	7.89
Hog plum	42.22	20.00	6.67	31.11	70.97	6.45	22.58	12.90	67.74	19.35
Papaya	48.89	35.56	13.33	2.22	40.91	27.27	31.82	25.00	27.27	47.73
Banana	28.89	42.22	24.44	4.44	74.42	20.93	4.65	44.19	25.58	30.23
Orange	91.11	8.89	0.00	0.00	80.00	11.11	8.89	20.00	68.89	11.11
Lemon	51.11	26.67	8.89	13.33	30.77	58.97	10.26	7.69	71.79	20.51
Jujube	35.56	11.11	2.22	51.11	36.36	54.55	9.09	13.64	77.27	9.09
Coconut	17.78	4.44	2.22	75.56	27.27	63.64	9.09	36.36	63.64	0.00
Guava	68.89	8.89	4.44	17.78	70.27	5.41	24.32	18.92	64.86	16.22
Star fruit	24.44	4.44	0.00	71.11	15.38	69.23	15.38	23.08	53.85	23.08
Pummelo	26.67	4.44	2.22	66.67	20.00	46.67	33.33	26.67	60.00	13.33
Sapota	64.44	11.11	6.67	17.78	62.16	13.51	24.32	13.51	83.78	2.70
Wax apple	28.89	20.00	4.44	46.67	12.50	62.50	25.00	25.00	70.83	4.17

*Total fruit growers 45 number in Haor areas

4.5.3 Status of water management in different homestead fruit trees

Irrigation is a vital management practice in fruit production regions of the world, particularly in arid and semi-arid climates. Better understanding and utilization of tree physiological parameters is needed for management of irrigation water of fruit crops and this will ultimately lead to achieving optimum yield and fruit quality while conserving water resources. Data reveled that different fruit trees showed different status of water management practices as per the responses of the fruit growers (Table 16). In consideration of the times of application of water in homestead fruit trees the highest 26.67% and 42.22% fruit growers applied irrigation for one time and two times in papaya, respectively while the highest 95.56% fruit growers applied no irrigation for banana cultivation. The highest 66.67% fruit growers applied water before blooming in star fruit and the highest 90.91% fruit growers applied water after blooming for hog plum, whereas the highest 25.00% fruit growers applied water in dry season for pummelo cultivation. For method of water application, the highest 50.00% fruit growers applied water in flood method for banana cultivation but the highest 100% fruit growers applied water in ring method for coconut cultivation, while the highest 18.75% fruit growers applied water in cane watering for guava cultivation. These physiological variables, growth, and fruit production should be correlated with soil water content prior to determining the appropriate amount of water to apply to an orchard. Little is known about the response of temperate fruit crop, such as apple, and tropical fruit crop, such as star-fruit, to changes in soil water content under field conditions in humid-temperate and subtropical climates. Al-Yahyai (2012) reported that for better understanding and utilization of tree physiological parameters is needed for management of irrigation water in fruit crops and this will ultimately lead to achieving optimum yield and fruit quality while conserving water resources. Fereres (1997) reported that irrigation scheduling is especially important in horticultural crops because net returns are normally higher than those of other crops although the fruit growers of Haor homestead did not practices it’s accordingly.

Table 16. Status of water management in different homestead fruit trees in Haor areas

Fruit Trees	Status of water management practices (%) as per the responses of fruit growers*									
	Yearly times of water application				Time of water application			Methods of water application		
	Once	Twice	Thrice	No	Before blooming	After blooming	In dry season	Flood method	Ring method	Cane watering
Mango	11.11	31.11	8.89	48.89	30.43	69.57	0.00	39.13	56.52	4.35
Hog plum	15.56	6.67	2.22	75.56	9.09	90.91	0.00	18.18	81.82	0.00
Papaya	26.67	42.22	15.56	15.56	18.42	73.68	7.89	31.58	65.79	2.63
Banana	2.22	2.22	0.00	95.56	50.00	50.00	0.00	50.00	50.00	0.00
Orange	22.22	26.67	20.00	31.11	25.81	70.97	3.23	9.68	83.87	6.45
Lemon	8.89	4.44	2.22	84.44	28.57	57.14	14.29	28.57	71.43	0.00
Jujube	20.00	4.44	2.22	73.33	16.67	75.00	8.33	16.67	66.67	16.67
Coconut	6.67	0.00	0.00	93.33	33.33	66.67	0.00	0.00	100.00	0.00
Guava	4.44	26.67	4.44	64.44	12.50	75.00	12.50	12.50	68.75	18.75
Star fruit	4.44	6.67	2.22	86.67	66.67	16.67	16.67	16.67	66.67	16.67
Pummelo	8.89	6.67	2.22	82.22	25.00	50.00	25.00	12.50	87.50	0.00
Sapota	8.89	13.33	6.67	71.11	23.08	69.23	7.69	15.38	84.62	0.00
Wax apple	15.56	2.22	2.22	80.00	22.22	55.56	22.22	11.11	77.78	11.11

*Total fruit growers 45 number in Haor areas

4.5.4 Status of hormone management in different homestead fruit trees

Hormone or plant growth regulators (PGR's) are organic compounds, which in small amounts, somehow modify a given physiological plant process. It plays an essential role in many aspects of plant growth and development, stem elongation and flower development. In respect of hormone application data revealed that most of the fruit growers did not applied any hormone for homestead fruit cultivation (Table 17). In case of time of application the highest 50.00% fruit growers applied hormone before blooming in orange cultivation but the highest 100% fruit growers applied hormone after blooming in sapota cultivation, while the highest 32.00% fruit growers applied in another time in mango cultivation. In case of amount of hormone the highest 100% fruit growers applied maximum amount in sapota cultivation while the highest 75.00% fruit growers' applied in minimum amount for jujube cultivation. Among the fruit growers the highest 100% received success of hormone in papaya cultivation but the highest 50.00% fruit growers did not received any success for orange cultivation. The responses to a particular growth regulator depend upon factors such as the plant, the chemical, and the environment. Fruit per plant, fruit size and weight per fruits are the yield components which may vary on the application of different PGR's. Generally fruit per plant, fruit size and weight per fruits was the yield components although it was minimum practiced by the fruit growers of Haor homestead. Ouzounidou *et al.* (2008) reported that hormone plays an essential role in many aspects of plant growth and development, stem elongation and flower development. Leclerc *et al*. (2006) reported that plant growth regulators can be used to modify growth and development in various ways. Some growth regulators affect primarily on vegetative growth; others influence the fruit; still others may induce modifications in vegetative and fruiting parts and it is in small amounts, somehow modify a given physiological plant process and responses depends to a particular growth regulator depend upon factors such as the plant, the chemical, and the environment.

Table 17. Status of hormone management in different homestead fruit trees in Haor areas

Fruit Trees	Status of hormone management practices (%) as per the responses of fruit growers*										
	Times of hormone application/year				Time of hormone application			Amount of application		Success of hormone application	
	Once	Twice	Thrice	No	Before blooming	After blooming	In another time	Maximum	Minimum	Yes	No
Mango	51.11	2.22	2.22	44.44	20.00	48.00	32.00	72.00	28.00	96.00	4.00
Hog plum	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Papaya	6.67	2.22	2.22	88.89	40.00	40.00	20.00	60.00	40.00	100.00	0.00
Banana	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Orange	2.22	2.22	0.00	95.56	50.00	50.00	0.00	50.00	50.00	50.00	50.00
Lemon	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jujube	6.67	2.22	0.00	91.11	25.00	75.00	0.00	25.00	75.00	75.00	25.00
Coconut	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Guava	11.11	2.22	0.00	86.67	33.33	66.67	0.00	33.33	66.67	83.33	16.67
Star fruit	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pummelo	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sapota	2.22	0.00	0.00	97.78	0.00	100.00	0.00	100.00	0.00	100.00	0.00
Wax apple	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*Total fruit growers 45 number in Haor areas

4.5.5 Status of mulch management in different homestead fruit trees

Mulches prevent weeds from germinating, reduce evaporative loss from soil surfaces, add organic matter to soils thereby increasing their mineral content and increase soil-borne disease suppression. In case of mulch, the highest (53.33%) fruit growers used mulched materials in one time for banana cultivation. The highest (6.67%) fruit growers used mulch materials for two time in mango, papaya and banana cultivation, while the highest three times were used in banana, lemon and pummel cultivation. On the other hand the highest (95.56%) fruit growers did not used any mulch materials for jujube cultivation (Table 18). For the consideration of time of mulch materials application, the highest (93.33%) used mulch materials in dry season for coconut cultivation but the highest (71.43%) fruit growers used during blooming for star fruit cultivation, while the highest (50.00%) fruit growers used mulch material during fruiting for jujube and wax apple cultivation. In case of mulch materials, the highest (90.91%) fruit growers used rice straw mulch for pummelo cultivation but the highest (25.00%) fruit growers used plastic materials for orange cultivation, whereas the highest (50.00%) fruit growers used other mulch materials for jujube cultivation. The benefit most desired from mulch applications is for more growth or better growth of trees. Downer (1998) reported that mulching with organic materials derived from trees increases the mineral content of underlying soils, and many positively charged nutrients contained in plants (including toxic ions) tend to accumulate in fine textured soils under organic mulches. Generally, mulch effects on growth depend on the age of the tree, whether newly planted or an established specimen, tree species and site factors such as water applications, soil types and their mineral nutrient content as well as the presence or absence of pathogenic fungi in soil. The benefit most desired from mulch applications is for more growth or better growth of trees and the increased growth of trees has been associated with organic mulches in several studies (Downer and Faber, 2005; Greenly and Rakow, 1995; Foshee *et al*., 1996).

Table 18. Status of mulching management in different homestead fruit trees in Haor areas

Fruit Trees	Status of mulching management practices (%) as per the responses of fruit growers*									
	Times of mulching application/year				Time of mulching application			Materials for mulching		
	Once	Twice	Thrice	No	In dry season	During blooming	During fruiting	Rice straw	Plastic paper	Others
Mango	26.67	6.67	2.22	64.44	6.25	56.25	37.50	75.00	6.25	18.75
Hog plum	11.11	2.22	0.00	86.67	16.67	66.67	16.67	66.67	0.00	33.33
Papaya	31.11	6.67	2.22	60.00	27.78	61.11	11.11	50.00	11.11	38.89
Banana	53.33	6.67	4.44	35.56	20.69	62.07	17.24	72.41	10.34	17.24
Orange	24.44	2.22	0.00	73.33	16.67	66.67	16.67	58.33	25.00	16.67
Lemon	31.11	4.44	4.44	60.00	5.56	66.67	27.78	83.33	5.56	11.11
Jujube	4.44	0.00	0.00	95.56	0.00	50.00	50.00	50.00	0.00	50.00
Coconut	31.11	2.22	0.00	66.67	93.33	6.67	0.00	86.67	0.00	13.33
Guava	20.00	4.44	2.22	73.33	41.67	33.33	25.00	75.00	0.00	25.00
Star fruit	13.33	2.22	0.00	84.44	14.29	71.43	14.29	71.43	0.00	28.57
Pummelo	17.78	2.22	4.44	75.56	54.55	27.27	18.18	90.91	0.00	9.09
Sapota	6.67	2.22	2.22	88.89	60.00	20.00	20.00	80.00	0.00	20.00
Wax apple	4.44	4.44	0.00	91.11	0.00	50.00	50.00	75.00	0.00	25.00

*Total fruit growers 45 number in Haor areas

4.5.6 Status of training and pruning in different homestead fruit trees

Training is a practice that allows tree growth to be directed into a desired shape and form. Training in young fruit trees is essential for proper tree development. In case of training, most of the fruit growers did not practices any training for homestead fruit cultivation but the highest 28.89% fruit growers practiced training once in a year for jujube cultivation. For time of training, the highest 100% fruit growers' practices training yearly for papaya cultivation but the highest 100.00% fruit growers practiced training within 2 years for coconut plant, while the highest 66.67% fruit growers practiced training within 5 years for mango cultivation in homestead areas (Table 19). Basically, the goal of tree training is to direct tree growth and to minimize pruning and removing a portion of the tree, although dormant pruning is always going to be needed. Training young fruit trees is essential for proper tree development. It is more efficient to direct tree growth with training than to correct it with pruning. Olsen (2011) reported that untrained fruit trees can become infestation sites for serious insect and disease pests and untrained trees can make it difficult for commercial growers in the region to control key pests.

In considering of pruning, the highest 97.78% fruit growers' practices one time pruning for jujube cultivation but the highest 20.00% twice time pruning for mango cultivation and most of the fruit growers did not practiced any pruning for homestead fruit cultivation. In case of time of pruning 100% fruit growers practiced pruning before flowering in banana, while the highest 93.33% fruit growers practiced fruiting after fruit harvest for hog plum (Table 19). Pruning is most often accomplished during the winter, commonly referred to as dormant pruning. Michael, 2004 reported that minimize pruning and removing a portion of the tree, although dormant pruning is always going to be needed. The best ways for homeowners to control the height of a fruit tree are to plant a dwarfing rootstock, prune well, or use a trellis system.

Table 19. Status of training and pruning management in different homestead fruit trees in Haor areas

Fruit Trees	Status of pruning and training management practices (%) as per the responses of fr										
	Yearly times of training				Yearly times of pruning				Time of training		
	Once	Twice	Thrice	No	Once	Twice	Thrice	No	Yearly	Within 2 years	Withi 5 years
Mango	8.89	2.22	2.22	86.67	53.33	20.00	2.22	24.44	16.67	16.67	66.67
Hog plum	2.22	2.22	0.00	95.56	31.11	2.22	0.00	66.67	0.00	50.00	50.00
Papaya	2.22	0.00	0.00	97.78	8.89	2.22	0.00	88.89	100.00	0.00	0.00
Banana	0.00	0.00	0.00	100.00	22.22	2.22	2.22	73.33	0.00	0.00	0.00
Orange	6.67	2.22	0.00	91.11	46.67	6.67	2.22	44.44	25.00	50.00	25.00
Lemon	24.44	4.44	2.22	68.89	40.00	4.44	4.44	51.11	64.29	21.43	14.29
Jujube	28.89	6.67	6.67	57.78	97.78	2.22	0.00	0.00	84.21	10.53	5.26
Coconut	2.22	0.00	0.00	97.78	0.00	0.00	0.00	100.00	0.00	100.00	0.00
Guava	20.00	6.67	11.11	62.22	17.78	4.44	2.22	75.56	82.35	11.76	5.88
Star fruit	6.67	2.22	2.22	88.89	26.67	4.44	4.44	64.44	40.00	40.00	20.00
Pummelo	15.56	6.67	2.22	75.56	33.33	4.44	2.22	60.00	54.55	36.36	9.09
Sapota	2.22	2.22	2.22	93.33	17.78	4.44	4.44	73.33	66.67	33.33	0.00
Wax apple	8.89	2.22	4.44	84.44	13.33	4.44	2.22	80.00	57.14	28.57	14.29

*Total fruit growers 45 number in Haor areas

CHAPTER V

SUMMARY AND CONCLUSIONS

The study was conducted in Ajmiriganj upazila under Habigonj district and it was a Haor area. There are five unions in Ajmiriganj upazila, viz. Ajmiriganj, Kakailseo, Jalsuka, Badalpur, and Shibpasha. Through a survey under the project BAS-USDA-PALS an update list of 45 family were made who have the fruit trees of Mango, Hog plum, Papaya, Banana, Orange, Lemon, Jujube, Coconut, Guava, Star fruit, Pummelo, Sapota and Wax apple in their homestead areas. Thus, 45 homestead fruit growers constituted the sample of the study. The 45 homesteads were surveyed to understand their knowledge regarding homestead fruit cultivation and also identify the present fruit production system of them. A well structured interview schedule was developed based on objectives of the study. The independent variables were: age, level of education, family size, annual income, age of homestead, size of homestead and size of homestead fruit trees area. The dependent variable of this study was the knowledge on management of homestead fruit production and practices. After completion of field survey all the interview schedule were compiled, tabulated and analyzed according to the objectives of the study. Various statistical measures such as frequency counts, percentage distribution, average, and standard deviation were used in describing data. SPSS (version 11.5) computer program were used for analyzing the data.

5.1 Summary of findings

5.1.1 Characteristics of the fruit growers

The middle aged homestead fruit growers in Haor areas comprise the major proportion (48.89%) followed by old aged category (44.44%) and the young aged constitute the lowest (6.67%) proportion.

‘Illiterate’ category constitute the highest proportion (53.34%) compared to 31.11% ‘secondary level category and 11.11% above secondary level category. On the other hand, the lowest (4.44%) constitute primary level category.

The highest proportion (57.78%) followed by the medium family (37.78%). Only 4.44% fruit growers had large family size.

The homestead fruit growers in Haor areas having medium income constitute the highest proportion (62.22%) followed by high annual income (28.89%) and the low income group constitute the lowest annual income group (8.89%).

Age of homestead of fruit growers under high aged category constitutes the highest proportion (42.22%) compared to 35.56% of medium aged homestead and the lowest percentage 22.22% low aged homestead.

The medium size of homestead constitutes the highest proportion 44.44% followed by 28.89% with large size homestead and the lowest 26.67% in small size homestead.

The small size of homestead fruit trees areas constitutes the highest proportion (53.33%) followed medium sized homestead fruit trees areas (31.11%) and the lowest 15.56% in large size homestead fruit trees areas.

5.1.2 Knowledge on management practice of homestead fruit cultivation

The majority (42.22%) of the respondents felt in low knowledge category followed by medium knowledge category (37.78%) in homestead fruit production activities and only 20.00% in high knowledge category.

5.1.3 Results of hypothesis testing

Age, level of education, family size, annual income, age of homestead, size of homestead and size of homestead fruit trees area and knowledge on management of homestead fruit production and practices in Haor areas was determined by Pearson product moment correlation coefficient. Level of education, annual income and size of homestead fruit trees area showed significant positive

relationship with knowledge on management of homestead fruit production and practices in Haor areas. On the other hand, age showed significant negative relationship with knowledge of homestead fruit management of the growers in Haor areas. Family size and size of homestead showed non significant positive relationship with knowledge on management of homestead fruit production and practices of the fruit growers in Haor areas.

5.1.4 Status of different management practices for different fruit trees

In case of different fruits, the respondents respond that they applied fertilizer, irrigation, hormone, mulching, thinning, training and pruning for homestead fruit production. In consideration of fertilizer application, for orange cultivation the highest 100% fruit growers applied fertilizers but for coconut cultivation around 75.56% did not use any fertilizers. In context of irrigation, the highest 84.44% fruit growers applied irrigation in papaya cultivation, while highest 95.56% fruit growers did not use any irrigation for banana cultivation in their homestead areas. For hormone application, the highest 55.56% respondents applied hormone for mango cultivation, whereas the highest 100% respondents did not applied hormone for hog plum, banana, lemon, coconut, star fruit, pummel and wax apple cultivation. In consideration of mulching, the highest 64.44% respondents used mulched materials for banana cultivation, while the highest 95.56% respondents did not used any mulch materials for jujube cultivation. For pruning in homestead fruit cultivation, the highest 100% respondents practiced pruning in jujube plant but the highest 100% respondents did not practiced and pruning for coconut trees. In consideration of thinning, the highest 40.00% respondents practiced thinning in papaya cultivation, while the highest 100% respondents did not practiced any thinning activities for coconut cultivation. For training, the highest 42.22% respondents fruit growers practiced training in jujube plant.

Conclusion:

Based on the findings of the study the following conclusions have drawn:

1. The majority (80.00%) fruit growers in Haor areas were in low to medium knowledge category. So, it is necessary to initiate different initiatives for increasing the knowledge of fruit growers in Haor areas regarding fruit production and practices.

2. Considering the magnitude of different problems in homestead fruit cultivation in Haor areas, the fruit growers faced the highest problem in terms of lack of technical knowledge about materials and the second highest is high rate of interest and the third is inadequate loan than demand.

3. Level of education showed positive relationship with knowledge on management of homesteads fruit cultivation and practices. Technical training may upgrade their knowledge level.

4. Annual income demonstrated positive relationship with knowledge on management of homesteads fruit cultivation and practices.

5. Size of homestead fruit trees showed positive relationship with knowledge on management of homesteads fruit cultivation practices.

6. Age showed positive relationship with knowledge of homesteads fruit management of the growers in Haor areas. For better management, young and middle aged people may involve in homestead fruit production and practices in Haor areas.

APPENDICES

Appendix I. A map of study area of Ajmiriganj upazila

Appendix II. A copy of interview schedule

DEPARTMENT OF HORTICULTURE
SHER-E-BANGLA AGRICULTURAL UNIVERSITY
DHAKA 1207

An interview schedule for a research study entitle

"EVALUATION OF FRUIT TREE MANAGEMENT PRACTICES IN HAOR HOMESTEADS OF BANGLADESH"

Serial No.....

Respondent Name :

Village : Union : Upazila:

[Please provide following information. Your information will be kept confidential and will be used for research purpose only]

PART-I

1. Age

What is your present age? ..... Years

2. Level of education

What is the level of your education?

a) Illiterate ( ) b. Can sign only ( ) c. Have passed class….....

d. Did not read in School/Madrasha but can read and write and level of education is equivalent to class.....

3. Family size

State the number of your family members….....

4. Annual income

Please mention the amount of annual income from the following sources

a) Income from Agricultural Crop

SL. No.	Crop Name	Production (Maund)	Price/Maund (Tk)	Total Income (Tk.)
1	Rice			
2	Wheat			
3	Maize			
4	Potato			
5	Jute			
6	Pulse crop			
7	Oil crop			

8	Spice crop			
9	Vegetable			
10	Fruits			
Total				

b) Income from domestic animals and fish resources

SL. No.	Income resources	Total Income(Tk.)/year
1	Domestic animal	
2	Poultry	
3	Fish resources	
4	Others (if any, please specify)	
Total		

c) Income from another sources

SL. No.	Income resources	Total Income (Tk.)/year
1	Services	
2	Business	
3	Day labour	
4	Fishing	
5	Other family members' income	
6	Others (if any, please specify)	
Total		

5. Age of homestead

What is your present age of your homestead area?..... Years

6. Size of homestead

Please mention the area of your homestead according to use

Sl. No.	Type of land use	Area of land	
		Acre	Hectare
A	Residential areas/House areas		
B	Homestead premises		
C	Pond area		
D	Cow/livestock shade		
E	Areas of homesteads garden		
F	Trees plantation areas/forest		
G	Others (if any, please specify)		
Total farm size = A + B + C + D + E + F + G			

7. Size of homestead fruit trees areas

State the size of your homestead fruit trees areas.....Acre/hectares

8. Knowledge on homestead fruit production and practices

Please answer the following questions

Sl. No.	Questions	Assigned score	Obtained marks
1	Mention about homestead fruit cultivation	2	
2	Mention the site in homestead area that suitable for homestead fruit cultivation	2	
3	Name two year round fruit producing plant	2	
4	What is vegetative propagation?	2	
5	Mention the elements that presents in soil	2	
6	Do you know how to prepare a seedbed for fruit trees?	2	
7	Mention the time of management of fruit trees in homestead area	2	
8	Mention the name of different fruit tree management practices	2	
9	What type of soil is suitable for homestead fruit production	2	
10	What is organic manure?	2	
11	Mention the time of the application of organic manure	2	
12	What is balanced fertilizer?	2	
13	What do you know about composting?	2	
14	Do you know when fertilizers are to be applied fruit trees?	2	
15	Do you know the different doses of fertilizer for fruit trees?	2	
16	Do you know the methods of fertilizers application?	2	
17	Mention the importance of irrigation in fruit tress	2	
18	Mention the yearly times of irrigation application in fruit plants	2	
19	What precautions are needed at the time of fertilizer application in homestead fruit production?	2	
20	Mention the methods of irrigation application in fruit trees	2	
21	Mention the yearly times of irrigation application in fruit plants	2	
22	Importance of irrigation in fruit trees	2	
23	What precautions are needed at the time of irrigation application in homestead fruit production?	2	
24	What is hormone?	2	
25	Mention the importance of hormone application in fruit tress	2	
26	Mention name of some commonly used hormones	2	
27	Mention the amount of hormone for fruit trees	2	
28	What precautions are needed at the time of hormone application in homestead fruit production?	2	
29	What is mulching?	2	
30	What are the reasons for the application of mulch?	2	

31	Mention the time of mulch application	2	
32	Mention some commonly used mulch materials	2	
33	What is pruning and training?	2	
34	Mention the importance of pruning and training	2	
35	Mention the times of pruning and training	2	
Total		70	

PART-II

1. Different aspects of homestead fruit cultivation in Haor areas

Please answer (✓) the following questions

Characteristics	Categories
Reason for fruit cultivation	▪ For eating ▪ For marketing ▪ Both for eating and marketing ▪ Other reason (if any)
Procedure of fruit variety selection in homestead garden	▪ From the information of agricultural office ▪ With own selection ▪ Information from neighboring people ▪ As the availability of variety in near by
Procedure of fruit tree plantation and their management	▪ As per standard/appropriate procedure ▪ As per own decision and opinion ▪ Information from neighboring people ▪ As per the information of radio and TV
Is they follow the management of fruit trees?	▪ No ▪ Sometimes ▪ Regularly
Is the fruit tress affected by insects?	▪ Yes ▪ No
Is the fruit tress affected by diseases?	▪ Yes ▪ No
Did you apply pesticides	▪ Yes ▪ No

2. Mention the severity of different problems in homestead fruit cultivation

SL. No.	Problem	High (3)	Moderate (2)	Little (1)	Not at all (0)
1	Inadequacy of inputs				
2	High price of inputs				
3	Low quality of materials				
4	Lack of technical knowledge about materials				
5	Shortage of cold storage .for fruit preservation				
6	Decrease of weight in fruit preservation				
7	Transport problem for marketing				
8	Deprive from accurate sale price				
9	Lack of loan facilities at optimum time				
10	High rate of interest				
11	Interfere of middle man to get loan				
12	Inadequate loan than demand				

3. Mention the different management practices in homestead fruit trees

Fruit Trees	Different management practices													
	Fertilizer		Irrigation		Hormone		Mulching		Thinning		Training		Pruning	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Mango														
Hog plum														
Papaya														
Banana														
Orange														
Lemon														
Jujube														
Coconut														
Guava														
Star fruit														
Pummelo														
Sapota														
Wax														

apple														

4. Mention the fertilizer management for different homestead fruit trees

Fruit Trees	Fertilizer management practices						
	Times of fertilizer application/year	Amount of fertilizer application/per plant			Methods of fertilizer application		
		Maximum	Minimum	Average	Furrow method	Ring method	Spray method
Mango							
Hog plum							
Papaya							
Banana							
Orange							
Lemon							
Jujube							
Coconut							
Guava							
Star fruit							
Pummelo							
Sapota							
Wax apple							

5. Mention the water management for different homestead fruit trees

Fruit Trees	Water management practices						
	Times of water application /year	Time of water application			Methods of fertilizer application		
		Before blooming	After blooming	In dry season	Flood method	Ring method	Sprinkler method
Mango							
Hog plum							
Papaya							
Banana							
Orange							
Lemon							
Jujube							
Coconut							
Guava							
Star fruit							
Pummelo							

Sapota							
Wax apple							

6. Mention the hormone management for homestead fruit trees

Fruit Trees	Hormone management practices			
	Times of hormone application /year	Time of hormone application	Amount of application	Success of hormone application
Mango				
Hog plum				
Papaya				
Banana				
Orange				
Lemon				
Jujube				
Coconut				
Guava				
Star fruit				
Pummelo				
Sapota				
Wax apple				

7. Mention the mulching management for homestead fruit trees

Fruit Trees	Mulching management practices						
	Times of mulching application/year	Time of mulching application			Materials for mulching		
		In dry season	During blooming	During fruiting	Rice straw	Plastic paper	Others
Mango							
Hog plum							
Papaya							
Banana							
Orange							
Lemon							
Jujube							
Coconut							
Guava							
Star fruit							
Pummelo							
Sapota							
Wax apple							

8. Mention the pruning and training management for homestead fruit trees

Fruit Trees	Yearly times of training	Yearly times of pruning	Time of training			Time of pruning	
			Yearly	Within 2 years	Within 5 years	Before flowering	After fruit harvest
Mango							
Hog plum							
Papaya							
Banana							
Orange							
Lemon							
Jujube							
Coconut							
Guava							
Star fruit							
Pummelo							
Sapota							
Wax apple							

Thanks for your co-operation.

Signature of the interviewer with Date