

Distribution and Traditional Practice on Neem in the Rural Homesteads of Chittagong Coastal Plain of Bangladesh

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Abstract : Neem tree (*Azadirachta indica*), native to the Indian sub-continent, has been known since the ancient time for its medicinal and insect repellent properties. In recent years, Neem has attracted global attention due to its potential as a source of natural drugs and also environment-friendly pesticides. In the coastal plain of Bangladesh, the plantation of Neem in the homestead forests is the age-old practice of the households. The distribution and traditional practice on Neem can be important to the agriculturist, ethno-pharmaceutical developers and to the rural development practitioners in Bangladesh. An exploratory survey on the distribution and traditional practice on Neem tree in the rural homesteads of Chittagong coastal plain, Bangladesh, was conducted over a period of three months from September 2002 to November 2002. It was found that maximum, 64% households used seedling as planting material having 40% maximum sources as own homestead. Maximum, 30% households practiced watering on their plantation as tending operation. Within the major tree species present in the homesteads, Neem accounted for 12% among the total individuals. It was found that the availability of Neem trees was found maximum, 31%, in the homesteads of medium sized households. Maximum, 42% individuals of Neem were found within the DBH of 10.1 to 20 cm; and 37% within the 3.1 to 6 m height classes. Neem trees were found to be used maximum, 88% for furniture. The findings of the study will be of immense importance for the rural development practitioners and ethno pharmacological developers in Bangladesh.

Key words : DBH, height, planting materials, tending operation

Introduction

Homestead farming is the age-old well-established land use systems in Bangladesh (Leuschner and Khaleque, 1987). It is often characterized by extensive use of multipurpose tree species, shrubs, food crops and animals at the same time; and are important sources of food, fuel, timber and many other products (Fernandes *et al.*, 1984; Fernandes and Nair, 1986). In general, these systems are highly diverse, with a high-density of both forest and horticultural tree species and often have layered vertical structure. Mixed cropping of annual and perennial crops in homestead area is often referred to as a home or mixed garden. Personal preferences and attitudes, socio-economic status and culture often reflect the appearance, structure and function of the homestead lands. Species composition, structure and function of homestead lands

may be influenced by ecological, socio-economic and cultural factors (Lamont *et al.*, 1999).

The Neem tree, *Azadirachta indica* A. Juss, member of the Meliaceae family, is an ornamental evergreen hardy fast-growing shade tree that grows to a height of 8-17 m, which can be pruned to maintain height (Ketkar, 1982). Neem timber is termite resistant hardwood, mostly suited for furniture and building industries. With its origins in Northeast India, the Neem tree is now grown and sought after globally. All parts of the Neem tree i.e., leaves, fruit, seeds, bark, root and the oil derived from these have specific application in medicine, toiletries and cosmetics, public health, livestock production and health, agriculture and pest control (Anonymous, 2006a).

Scientific research has confirmed the Neem-based oil/extracts to be soft, nontoxic and effective organic anti-septic, antifungal, antibacterial, antiviral, dermatological, dental and spermicidal agents (Anonymous, 2006a). Azadirachtin, a tetranortriterpinoid, is the major active

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ingredient isolated from Neem, which is known to disrupt the metamorphosis of insects (Tomlin, 1996). Neem seed oil/extracts in particular have been the subject of continuing worldwide research. The focus has largely been on developing nontoxic organic alternatives to synthetic pest control used in agriculture and horticulture. The Neem is a naturally mild insect repellent tree that protects the plants around it. It is grown almost anywhere though it prefers well-drained soils. It can grow on dry, infertile, stony, acidic and poor soils. The fallen Neem leaves help neutralize the soil also (NRC, 1992).

Chittagong coastal plain of Bangladesh encompasses the landscape characterized by agricultural lands, homesteads and marginal lands along roads, courtyards, canals and ponds (*pers. obs.*). Neem grows in good numbers over the Chittagong coastal plain (*pers. obs.*). The distribution and traditional practice on Neem trees are the prime research questions to show the rural agroforestry system of the region. It was hypothesized that Chittagong coastal plain possessed a particular type of Neem tree production and utilization system. Thus, the study was concerned to assess the distribution, growth performance and end-uses of Neem produces.

Materials and Methods

The study involves a socio-biological survey to explore the distribution and traditional practice on Neem. The household owner, associated persons, and all other key informants were interviewed and the information was verified personally by visiting the site. However, the study was carried out by several visits to the study site during three months from September 2002 to November 2002. The following steps were followed for data collection.

1. Methods

Mirsharai Upazila (subdistrict) of Chittagong District was chosen purposively for this study. The Upazila consists of 16 unions from which five unions, i.e., Saherkhali, Ichhakhali, Osmanpur, Mithanakra and Katchhara were selected randomly for the study. The study site is shown in the Figure 1. A preliminary socio-economic survey was carried out to ascertain important socio-economic features of the study areas to select respondents for detailed study. The households were interviewed to collect data about household information and vegetation characteristics. For the study, 20 homesteads of each of the union were surveyed. Thus, a total of 100 households were studied. All the key informants were carefully chosen and interviewed and the information later verified by visiting the households. A semi-structured questionnaire was used to collect the relevant informa-

tion. All the data on traditional practice on Neem were collected by the direct interviewing of the household heads. Enumerations of the individuals of the major tree species, DBH and height data of Neem were collected directly from the corresponding homesteads. For the enumeration of the individuals of all major tree species, individuals of DBH>3cm were selected. As the distribution of Neem trees in the homestead is the function of landholding capacity of the households, the households were stratified into marginal (0.21-0.50 ha), small (0.51-1.00 ha), medium (1.01-2.00 ha) and large (>2.00 ha). One-way ANOVA with post hoc test was carried out to show the differences within the parameters. The letters a, b, c, d, and e in the figures are used to show the significant ($p<0.05$) difference. Bars by the same letters are not significantly different. The different parameters were planting materials, sources of planting materials, tending operations, Neem individuals per households, household sizes, DBH and height class distribution. All the analyses were done through SPSS 13.0.

2. Description of the study site

The Upazila occupies an area of 482.88 km² including 59.72 km² river and 113.37 km² forest area. It is located

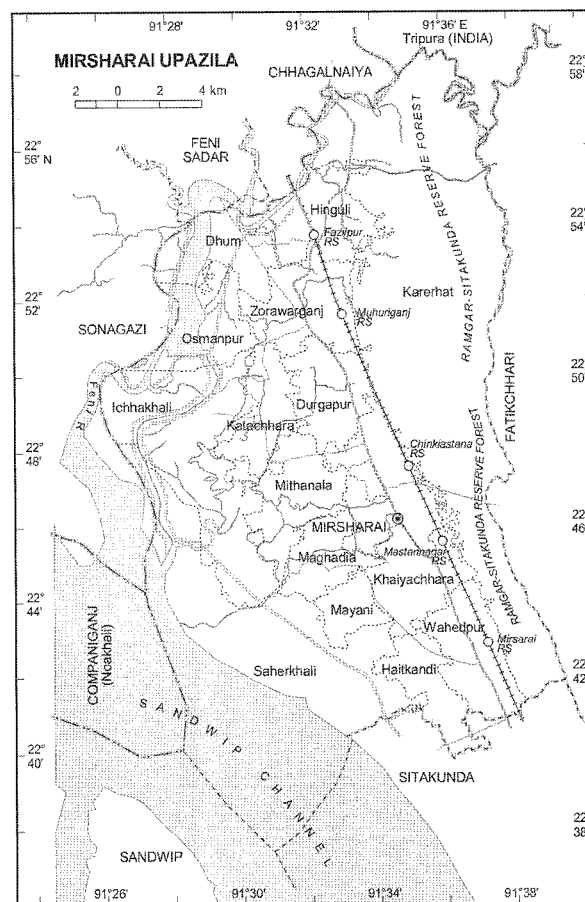


Figure 1. Specific study site in the Chittagong coastal plain of Bangladesh (Anonymous, 2006b).

between 22°39' and 22°59' north latitudes and between 91°27' and 91°39' east longitudes (BBS, 1997). The Upazila consists of 16 unions, 113 mauzas and 207 villages. The average population of each union, mauza and village are 32,571, 2,882 and 1,573, respectively (BBS, 1997).

In the Upazila, 54% of the households depend on agriculture as the main source of income with 34% in cultivation/sharecropping, 4% in livestock, forestry and fishery, 0.16% in pisciculture and 16% as agricultural labor. Other sources of household income are nonagricultural labor (4%), business (11%) and employment (17%). In urban area, main sources of household income are business (10%), employment (14%), nonagricultural labor (4%) and agriculture (51%)(BBS, 1997).

The study area lies on the Chittagong coastal plain, one of the 30 agro-ecological zones in Bangladesh. This region occupies the plain land. It is a compound unit of piedmont, river, tidal and estuarine floodplain landscapes. Gray silt loams and silty clay loam soils are predominant. Acid sulfate soils occur in mangrove tidal floodplains. General fertility level of the soil is medium, but N and K are limiting. Organic matter content is low to moderate (FAO/UNDP, 1988). Soil pH varies from 5.5-7.3 (BBS, 1999).

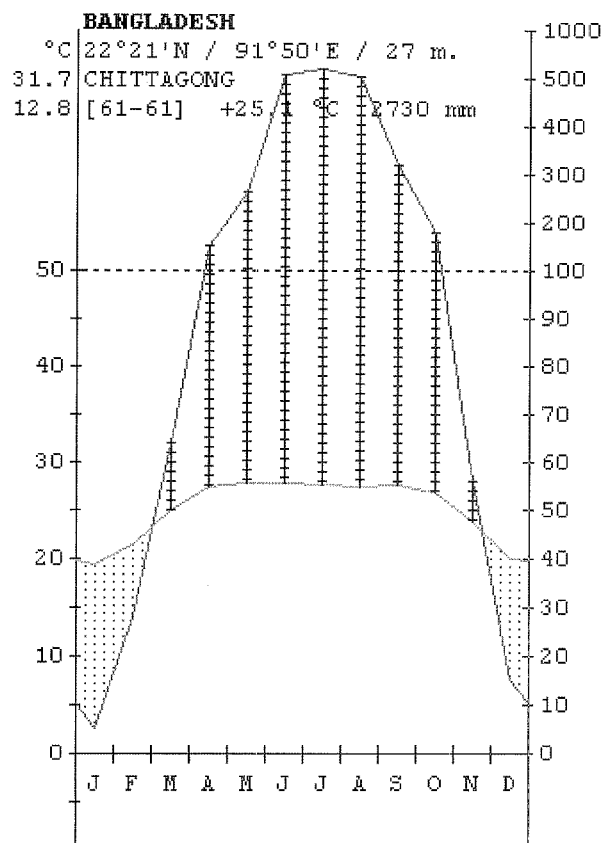


Figure 2. Climate diagram of Chittagong region in Bangladesh (Lieth *et al.*, 1999).

The area enjoys moist tropical maritime or monsoon climate. Usually high rainfall occurs during the monsoon from June to September. Dry period occurs from November to March for about 4-5 months. Relative humidity is high, usually 70-80%, with only minor variation. The mean annual temperature is 25°C with the mean annual rainfall 2730 mm (BBS, 1997). The climate diagram of the study area is shown in the Figure 2.

Results and Discussion

1. Planting materials and its sources

It was found that 64% households used seedling as planting materials and 16% households were found to use seed for that purpose. Only 4% households were found to use stump for plantation (Figure 3). The household number using the seedlings was significantly different from the households using seed, vegetative propagules and stump at $p < 0.05$ levels. But the households using seed and vegetative propagules were not significantly different.

About 40% household was found to collect planting materials from their own homestead. About 24% were found to collect it from the forest department and 20% from the local market. Only 4% were found to collect it from other sources (Figure 4). The households using own homesteads for the planting materials were significantly different from the households collecting planting materials from forest department, private nursery, market and others at $p < 0.05$ levels.

The households collecting planting materials from forest department and market were not significantly different. But the households collecting planting materials from private nursery and others were significantly different at $p < 0.05$ level.

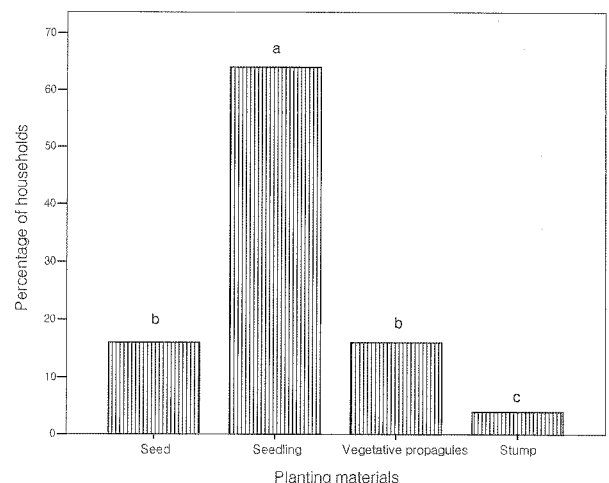


Figure 3. Planting materials used by the households for the plantation of Neem in the Chittagong coastal plain of Bangladesh.

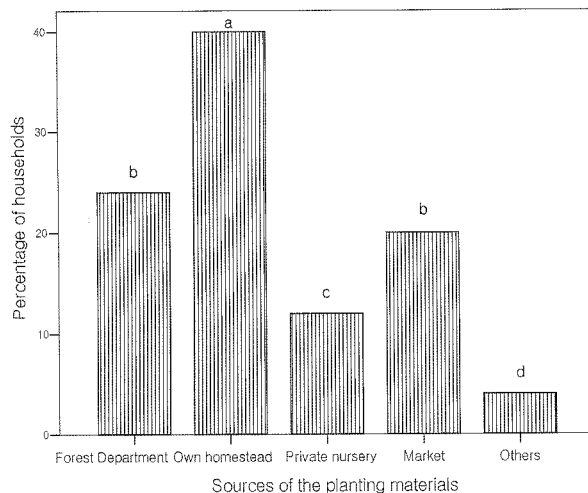


Figure 4. Sources of planting materials of Neem availed by the households in the Chittagong coastal plain of Bangladesh.

Now a days the trend of nursery establishment in the study area is good (*pers.obs.*). Most of the nurseries are privately owned and smaller in comparison to the nurseries owned by the forest department. However, they were producing a large numbers of seedlings of the economic forest tree species including Neem. Because of this availability of the nurseries in the study area, the maximum households might use the seedlings as the planting materials. The use of seedlings as the planting materials is also found in other areas of the country for all the economic trees. Miah (2001) found the same trend in the Narsingdi region of Bangladesh. In addition to this most of the households were reported to use their own homesteads to produce some planting materials. In this case, the households mostly collect seeds from their own homesteads to use it as planting materials. Usually the households in Bangladesh like to use their own rather than buying from the other sources.

2. Pattern of tending operation

It was found that 30% household practiced watering in their plantation as tending operation followed by pruning as 24%. About 16% were found to practice both weeding and fertilizing. In case of mulching operation, the corresponding value was 10%. A small portion of the households, 4%, practiced thinning in their plantation as shown in the Figure 5. The households using watering were significantly different from the households using the other tending operations at $p < 0.05$ levels. The households using weeding and fertilizing were not significantly different, but both were different from the households using thinning, pruning and mulching at $p < 0.05$ levels.

Water supply is available free at every rural household in Bangladesh. So, it is easier to practice watering in the plantation of the homestead. But it was reported to be

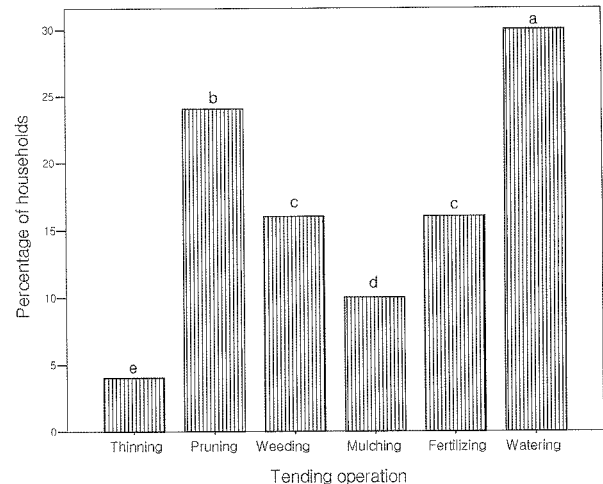


Figure 5. Tending operation of Neem practiced by the households in the Chittagong coastal plain of Bangladesh.

performed within three years of plantation at the season of winter only. As the plantation of tree species in the homesteads is not performed every year, so tending operations to the early aged tree is not problematic. Pruning was reported to be done not to develop the stand structure in the homestead rather than for the purpose of fuelwood to be used for the household cooking. Weeding and fertilizing were reported to be performed to the multipurpose economic tree species at the early stages of the plantation. As Neem was regarded as a multipurpose tree species, so it was under the practice of weeding and fertilizing. Weeding and fertilizing was reported to be performed within 5 years and 3 years of plantation, respectively. Thinning and mulching was not the regular practice by the households. There was no specific design of thinning and mulching reported in the study area. It was the random practice to maximize the sunlight and other nutrients for the other individuals in the homesteads. It was reported that no cost was incurred to perform these tending operations for the trees. The family members of the respective households performed all the tending operations. Among them women contribution was more observed than men. Christanty (1985) reported that personal preferences and attitudes, socio-economic status, and culture often reflect the appearance, structure, and function of the homestead forests. The status of the tending operations in the homesteads is also determined by these social factors.

3. Neem within the major tree species

Among the total individuals of the major tree species present in the homesteads, it was found that Neem accounted for 12%. The other major tree species were *Mangifera indica*, 31%; *Artocarpus heterophyllus*, 28%; *Samanea saman*, 9%; *Swietenia mahagony*, 9%; *Euca-*

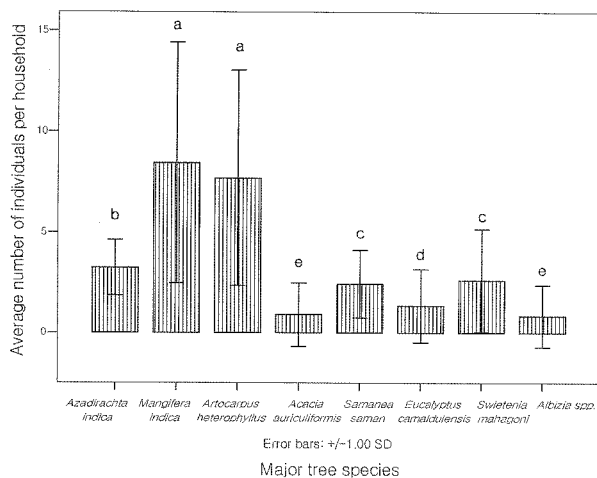


Figure 6. Relative presence of Neem in the homesteads of the Chittagong coastal plain of Bangladesh.

lyptus camaldulensis, 5%; *Acacia auriculiformis*, 3% and *Albizia spp.*, 3%. The presence of the individuals of *M. indica* per household was relatively higher than the other species (Figure 6). The lowest number of individuals was for *A. spp.* The presence of Neem individuals was significantly different from the individuals of the other major tree species at $p < 0.05$ levels.

The presence of the major tree species in the homesteads of Chittagong region also had been confirmed by Misbahuzzaman and Ahmed (1993), Akhter *et al.* (1997), Alamgir *et al.* (2000) and Alamgir *et al.* (2004). Among the major tree species in the homesteads, Neem, *M. indica* and *A. heterophyllus* are planted for the multipurpose use throughout the whole country. Other species are planted for the timber (Alam *et al.*, 1996). Because of the multipurpose use, the presence of *M. indica* followed by *A. heterophyllus* was comparatively higher than the other species. In the rural homesteads of Bangladesh, usually multipurpose characteristics of the tree species are preferred (Uddin *et al.*, 1998). Even though Neem was regarded as the multipurpose trees, but the presence was not observed satisfactory. It might be because of the ignorance by the households on the multipurpose especially medicinal uses.

4. Distribution of Neem in the household categories

It was found that Neem trees were found maximum, 31%, in the medium household followed by the large household, 26% (Figure 7). The presence of Neem in the small households was 24% and in the marginal was the minimum, 19%. Among the household categories, the presence of Neem individuals in the medium category was significantly different from the other categories at $p < 0.05$ level. But between small and large categories, there was no significant difference.

In Bangladesh, the medium and large size households

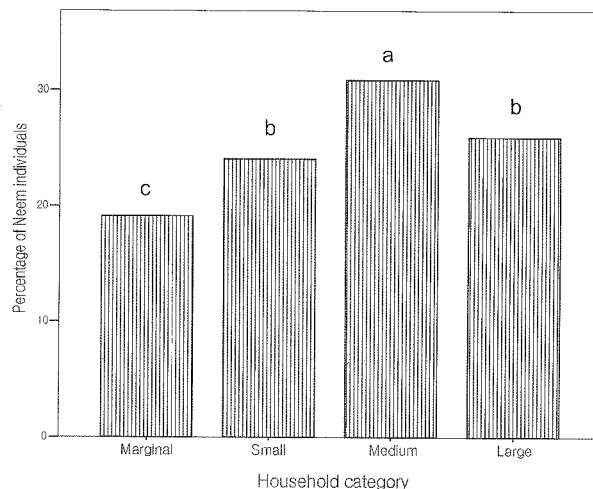


Figure 7. Distribution of Neem trees in the different household categories in the Chittagong coastal plain of Bangladesh.

are usually connected with higher education level and good awareness. Their awareness on the environment is better than the other household categories. They may be better known on the multipurpose use of the Neem than the other household categories. Because of this cause, the presence of Neem in their households is higher than the other categories. But the difference between the medium and large categories are unknown. The marginal and small households categories are usually oriented to draw the short-term benefits from their homesteads because of their subsistence livelihoods. Leuschner and Khaleque (1987) and Ahmed and Islam (1994) also asserted this people's attitude in Bangladesh. They usually plant fruit tree species in their homesteads to meet the short-term needs. But the difference between marginal and small households is clearly unknown.

5. DBH and height class distribution

It was found that maximum, 42% individuals were found within the DBH of 10.1 to 20 cm and minimum, 7%, in the 40.1 to 50.0 cm DBH classes. About 29% were found in the 1.0 to 10.0 cm; 11% in the 20.1 to 30 cm; and 11% were found in the 30.1 to 40 cm DBH classes (Figure 8). The DBH classes, 10.1-20.0 cm were significantly different from the other DBH classes at $p < 0.05$ level. But the DBH classes between 20.1-30.0 cm and 30.1-40 cm were not significantly different. The mean DBH of the classes 1.0-10.0, 10.1-20.0, 20.1-30.0, 30.1-40.0 and 40.1-50.0 cm were 6.38 ± 1.78 cm, 15.81 ± 2.27 cm, 26.09 ± 2.26 cm, 35.68 ± 2.20 cm and 43.41 ± 2.06 cm, respectively.

It was found that maximum, 37% trees were found in the 3.1 to 6.0 m height class. About 36% in the 6.1 to 9.0 m; 25% in the 9.1 to 12.0 m and only 2% were found in the 12.1 to 15.0 m height classes (Figure 9).

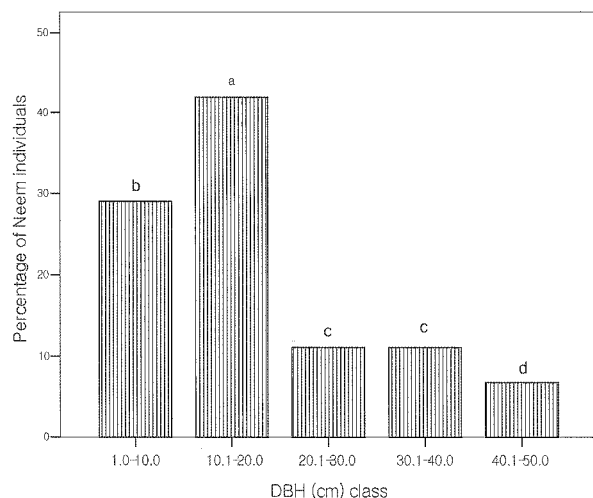


Figure 8. DBH class distribution of Neem trees in the homesteads of the Chittagong coastal plain of Bangladesh.

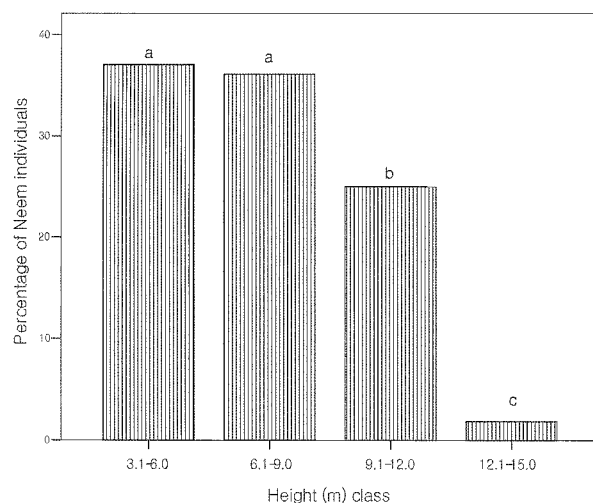


Figure 9. Height class distribution of Neem in the homesteads of the Chittagong coastal plain of Bangladesh.

The presence of Neem individuals was not significantly different between the 3.1-6.0 and 6.1-9.0 m height classes. But the classes of 9.1-12.0 and 12.1-15.0 m were significantly different among them and the other two height classes at $p < 0.05$ level. The mean height of the classes 3.1-6.0, 6.1-9.0, 9.1-12.0 and 12.1-15.0 m were 4.57 ± 1.08 m, 7.68 ± 1.09 m, 10.50 ± 1.32 m and 14.15 ± 1.02 m, respectively.

The gradual decrease of the presence of Neem individuals from the lower DBH and height classes to the higher DBH and height classes is because of the recent trend of Neem plantation in the homesteads irrespective of the household categories. It also marks that harvesting of Neem with higher DBH and height are being occurred more than the planting, which is making the Neem stock unsustainable in the homesteads.

Table 1. Different types of uses of Neem by the households (%) in the Chittagong coastal plain of Bangladesh.

Uses	Parts used			
	Timber	Oil	Leaves	Bark
Medicine	-	40	84	-
Fuel	8	-	4	-
Furniture	88	-	-	-
Pesticide	-	-	4	4

6. Pattern of uses of Neem trees

Maximum, 88% households were found to use Neem as timber for furniture followed by 84% as leaves and 40% as oil for medicine. About 8% households were found to use it for fuel wood. Only 4% households was found to use bark and leaves for fuel and pesticide.

Neem produces a moderately dense wood, similar to mahogany (*Swietenia mahagoni*). The wood has a specific gravity of 0.52-0.85, averaging 0.68 (NRC, 1992). The wood is hard, durable, dull to lustrous, aromatic and resistant to insects and fungi. It is especially used for making wardrobes, bookcases, and closets, because the wood repels insects (Stoney, 1997). Because of these good qualities of timber, Neem is used as furniture by the maximum numbers of the households. The principal active compound in the leaves of Neem is azadirachtin, which repels pests, acts as an antifeedant, and disrupts insects' growth and reproduction. The azadirachtin has been proved to be used for different ailments of human kinds. So, a notable percentage of the households (84%) were seen to use Neem leaves for different diseases. Grover *et al.* (2002) and Gupta *et al.* (2004) described the antidiabetic effect of Neem. Parida (2002) proved the antidengue virus effect of the crude aqueous extract of Neem leaves. Raizada *et al.* (2001) and Gajalakshmi and Abbasi (2004) proved the use of Neem products as the effective pesticide. Akhtar (1998) also proved the effect of Neem product for the biological control of plant-parasitic nematodes in agricultural soil. Neem seeds yield 40-50% oil when dry kernels are crushed or pressed through an oil mill (Stoney, 1997). The households of the study area were reported to grind the Neem seeds manually for the external use of different physical injuries in human and animal bodies. The roundwood is also used as fuelwood and good charcoal. At 14% moisture content the wood gives an energy value of 16.92 megajoules/kg (Lemmens *et al.*, 1995).

Conclusion

The tendency of using planting materials and its sources points out there is a good nursery practice existing in the study area to supply the seedlings of Neem.

Using own homesteads for planting materials also shows there has much positive attitude been created in the study area for planting Neem. The traditional pattern of tending operation in the homestead plantation suggests a positive tendency of the households to nourish and develop the homestead trees. But the coexistence of Neem trees with the other major tree species in the homesteads signals that still the plantation of Neem is not stressed much like the other multipurpose tree species. It shows the ignorance on the multipurpose characteristics of Neem. It has been also confirmed with the variation of the presence of Neem trees in the different households categories. The DBH and height class distribution of Neem individuals shows the stock of Neem is not sustainably maintained in the study area. But it shows the recent positive trend of plantation of Neem in the homesteads. Pattern of uses of Neem for different purposes points to that medicinal uses of Neem is not still stressed in the study area. But the discussion on the effects of Neem products on different human ailments and agricultural pests shows that Neem might be regarded more economic and valuable than the other major tree species if the medicinal and pesticidal use of Neem were properly addressed. However, to make the Neem tree sustainable and popular in the study area, extension program can be provided to the households by the government and nongovernment organizations. Introduction of modern technology for extracting azadirachtin from Neem in Bangladesh and proper marketing may encourage the households. The results of this study may be useful to promote Neem and Neem product as well as for the rural development of Bangladesh.

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