

Fruit Distribution and Diversity in the Homestead of a Southern Island of Bangladesh

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Abstract: The purpose of the study was to determine the diversity and distribution of fruit species in the homestead and to explore the relationship between farmers' characteristics and fruit diversity in their homestead. In the study, 28 fruit species were identified. Among 28 fruit species, Banana, Mango and Jujube were found in the 100% homestead surveyed. The Relative Prevalence of most common species like Banana, Betel nut, Coconut, Date, Mango, Papaya, Guava, Jujube were very high while that of less common species like Kaow, Pineapple, Litchi, Star apple etc. were found very low. Black berry and Jujube were found highly diverse (0.986) fruit species followed by Mango (0.984), Jackfruit (0.984). The traditional homestead fruit production system and fruit diversity in the study area was found very poor due to management practices. Fruit diversity should be increased to fulfill the nutritional needs as well as to conserve the genetic resources and environmental balance.

Key words: Fruit • Diversity • Preference • Distribution • Home garden

INTRODUCTION

The people of Bangladesh are directly related to agriculture. We have almost attained self-sufficiency in cereal production. But as regards fruit production, we do still depend on foreign supplies. For balanced nutritional needs sufficient fruit intake is necessary. Fortunately Bangladesh is favourite playground of nature. It offers a highly congenial environment for the growth of different varieties of fruits like Banana, Papaya, Pineapple, Litchi, Jackfruit etc, which are more nutritious compared to the imported foreign fruits like orange, grape, apple etc. The proverb goes that every season has its special fruits in Bangladesh. Even though having this situation, our fruit production is not sufficient to meet up our domestic need. During last three decades population of Bangladesh increased from 75 million to 129 million, simultaneously food grain production increased from 10 million to about 20 million tons. But fruit production did not increased at the same rate. The minimum dietary requirement of fruit per day per person is 85 g, where as our availability is only 30-35g. In view of the fact, the consumption and availability of fruits is very negligible. As a result, imbalanced nutrition and

nutrition deficiency diseases are being increased at an alarming rate.

There are 19.9 million homesteads in our country [1]. Their homesteads are the main source of fruits. Where there is a home, there is a homestead. Every farm families have large or small homestead area where different types of fruits are grown. Practical experience indicates that majority of the farmers cultivates homestead fruits in unplanned way. A large area of every homestead remain as follows because of poor plant population where as plantation of diversified fruit trees in planned way considering the harvesting period, a farmer can easily get year round fruit supply from his homestead garden and also can get more production of fruit from their garden. So fruit diversity in homestead is necessary [2-5].

It is necessary to develop sound plans and procedures for fruit diversification in homestead. For doing so it is first necessary to have a clear understanding of the present position of homestead fruit diversity and the factors related to fruit diversity in homestead of the farmers. Fruit diversity and its relationship with farmer's various characteristics greatly helpful for planning and implementing effective fruit

diversification program to increase balanced food intake of the farm family.

Therefore, the study was carried out to identify the fruit species being grown in the homesteads of Hatiya Island, to know the magnitude of diversity of fruits in the homesteads of the Island.

MATERIALS AND METHODS

The study was conducted in Hatiya Island. It is located in the southern part of Noakhali district of Bangladesh. It is located between 22°00' and 22°35' north latitude and between 90°58' and 91°14' East longitude. The population of this island is approximately 345000 and the total household number is 47747. Total area under homestead is 18,118 ha. The average area of homestead is 0.28 ha and the average size of the household is 7.377. Per-head land is 0.25ha including new "char".

The study area is located in the tropical belt and enjoys fairly equitable tropical monsoon climate. The temperature is almost uniform throughout the year. The maximum and minimum temperatures are normally recorded 35°C and 10°C, respectively. Mainly three seasons are seen among the six seasons. May to October is Rainy season, November to February is winter and March to April is summer season. The study area is under AEZ-18 [6]. The texture of topsoil ranges from loamy to clay loam. The subsoil texture is mainly clay loam, the sub-stratum is usually clay. The pH of soil of this island ranges from 6.6-8.3, from neutral to basic. The organic matter content ranges from 0.6% to 2.3% in the topsoil, slowly decreased in the sub soil.

The selection of the study site was purposive where natural vegetation was rich compared to the other area of Bangladesh. All households were grouped into five farm categories like marginal (0.15 ha), small (0.16-0.25 ha), medium (0.26-0.5 ha), large (0.51-0.75 ha) and very large (0.76-1.00 ha) according to size of homestead area. A sample of 80 households were selected, twenty from each union and five from each category. The collected lists were verified through survey the villages and discussion with the households.

Information was collected from both primary and secondary sources. These were gathered by survey as well as non-survey methods. The survey sources include interviews through a pre-tested interview schedule; key informant and farmers' group discussion while non-surveys include the information through field survey, direct observations and secondary sources. Both qualitative and quantitative data were collected. The

interview schedule was pre-tested with 10 households and then final shape was given to the interview schedule. The study was carried out for a period of 2 months time from October to December 2005. Data for fruit diversity of the homestead were collected using questionnaire. Information was recorded through interviews of family members like head of the family, housewife and others. Data were collected mainly on name and numbers of fruit species, demographical characteristics of the households, socio-economic information. In this study only fruit species was identified and calculated.

Relative Prevalence (RP) of species was calculated by using the following formula:

$$RP = \frac{\text{Population of the species per homestead}}{\% \text{ Homestead with the species}} \times$$

These relative prevalence values were used to rank the species in different regions according to Millat-e-Mostofa [7]. The mean dominance rank was determined by pooling the entire set of data of all the three regions. The most commonly used formula of Simpson [8] index (D) was used to calculate Species diversity (D) as follows:

$$D = 1 - \sum P_i^2$$

Where:

P_i is the proportional abundance of the i^{th} species such that,

$$P_i = N_i/N$$

N_i = Plant population of i^{th} species and

$$N = N_1 + N_2 + N_3 + \dots + N_n$$

where n is the number of species

Microsoft Excel® programs were used to process all collected information. SPSS® (Statistical Package for Social Science) software [9] was used to estimate the descriptive statistics of the data. Fruit Diversity was described under the headlines of Species richness, Relative Prevalence of species and Species diversity. The collected data were compiled, tabulated, coded and analyzed in accordance with the objectives of the study. Qualitative data were quantified by means of suitable scoring techniques. The statistical measures such as number and distribution were used for describing the variables of the study. In order to explore the relationships of the selected characteristics of the farmers with the fruit diversity of their homestead, the Pearson's products moment correlation was computed at five percent (0.05) and one percent (0.01) level of significance.

RESULTS AND DISCUSSION

Fruit Species Richness in Homestead: A wide variety of fruit species was found in the study area. All most 28 useful fruit species were identified in the homesteads surveyed in the study area of Hatiya upozilla in Noakhali district. The list of the identified plant species were presented in the Table 1.

The total number of fruit species per homestead in the study area ranged from 8 to 26 with a mean of 18.2. The higher number of fruit species was found in larger farms and less number of fruit species in smaller farms. The total number of fruit species per homestead in four different unions is presented in the Table 2.

From the study it was observed that species richness and fruit diversity of homestead is increasing day by day. But the increasing rate is very low. The distribution of the plant species was influenced by macro and micro-environmental factors of the homestead and the needs and choices of the family members. Species richness varied from one location to another and also from one farm category to another.

The observed 28 fruit species were belong to different family. All most 18 families were identified and presented in Table 3. Among these families, Palmaceae had the highest number of species.

The number of fruit producing species was higher than other species in each homegarden. The farmers

Table 1: Species Richness of fruit in Hatiya Island

Sl. No.	English Name	Local Name	Scientific Name	Family
1	Amla	Amloki	<i>Phyllanthus emblica</i>	Euforbiaceae
2	Banana	Kola	<i>Musa Sp.</i>	Musaceae
3	Betel Nut	Shupari	<i>Areca catechu</i>	palmaceae
4	Black Berry	Jaam	<i>Syzygium cumini</i>	Myrtaceae
5	Bullocks heart	Ata	<i>Annona reticulata</i>	Annonaceae
6	Carambola	Kamranga	<i>Averrhoa carambola</i>	Averrhoaceae
7	Coconut	Narikel	<i>Cocos nucifera</i>	Palmaceae
8	Date	Khejur	<i>Phoenix sylvestris</i>	Palmaceae
9	Elephant apple	Chalta	<i>Dillenia indica</i>	Dilleniaceae
10	Guava	Peara	<i>Psidium guajava</i>	Myrtaceae
11	Hog palm	Amra	<i>Spondias mangifera</i>	Anacardiaceae
12	Indian Olive	Jolpai	<i>Elaeocarpus floribundus</i>	Elaeocarpaceae
13	Jack fruit	Kathal	<i>Artocarpus heterophyllus</i>	Moraceae
14	Jujube	Kool	<i>Zizyphus mauritiana</i>	Rhamnaceae
15	Kawphal	Kaow	<i>Garcinia cowa Roxb</i>	Guttiferaceae
16	Lemon	Lebu	<i>Citrus limon</i>	Rutaceae
17	Litchi	Lichu	<i>Litchi chinensis</i>	Sapindaceae
18	Mango	Aam	<i>Mangifera indica</i>	Anacardiaceae
19	Monkey Jack	Dewa	<i>Artocarpus lakoocha</i>	Moraceae
20	Palmyra Palm	Tal	<i>Borassus flabellifer</i>	Palmaceae
21	Papaya	Paypay	<i>Carica papaya</i>	Caricaceae
22	Pine apple	Anarosh	<i>Ananas comosus</i>	Bromiliaceae
23	Pomegranate	Dalim	<i>Punica granatum</i>	Punicaceae
24	Shaddock	Jambura	<i>Citrus grandis</i>	Rutaceae
25	Tamarind	Tetul	<i>Tamarindus indica</i>	Fabaceae
26	Velvet apple	Bilati Gab	<i>Diospyros discolor</i>	Ebenaceae
27	Wax Jambu	Jamrul	<i>Syzygium samarangense</i>	Myrtaceae
28	Wood apple	Bel	<i>Aegle marmelos</i>	Rutaceae

Table 2: Number of fruit species in different four unions with 5 years and 10 years before

Sl. No	Name of the unions	Number of fruit species		
		Present	Before 5 Yrs	Before 10 yrs
01	Charishshor	18.50	17.15	12.50
02	Charking	19.30	18.55	15.85
03	Tomoraddi	17.45	15.65	11.65
04	Burirchar	18.00	17.65	15.70

Table 3: Distribution of the species according to their family

Sl. No.	Name of Family	Frequency
1.	Anacardiaceae	2
2.	Annonaceae	1
3.	Averrhoaceae	1
4.	Bromiliaceae	1
5.	Caricaceae	1
6.	Dilleniaceae	1
7.	Ebenaceae	1
8.	Elaeocarpaceae	1
9.	Euforbiaceae	1
10.	Fabaceae	1
11.	Guttiferaceae	1
12.	Moraceae	2
13.	Myrtaceae	3
14.	Palmaceae	4
15.	Punicaceae	1
16.	Rhamnaceae	1
17.	Rutaceae	3
18.	Sapindaceae	1

concentrate on fruit species because of their subsistence and cash need. Jackfruit (*Artocarpus heterophyllus*), Mango (*Mangifera indica*), Coconut (*Cocos nucifera*), Banana (*Musa spp.*), Guava (*Psidium guajava*), Jamun (*Syzygium cumini*), Date Palm (*Phoenix sylvestris*), Bullocks heart (*Annona reticulata*), Betel nut (*Areca catechu*), Papaya (*Carica papaya*), Tamarind (*Tamarindus indica*), Jujube (*Zizyphus mauritiana*) were cultivated in more than 80% of the homesteads. Among them Mango, Jackfruit, Coconut, Banana, Betel nut were the dominant species in homesteads at all locations and had the most diverse utility among all other fruit species. Even Mannan *et al.* [10] identified fifty-seven different varieties in the 150 homesteads of Bangladesh.

Relative Prevalence of Species: The Relative Prevalence of fruit species found in 80 homesteads of study area is given in Table 4. The Relative Prevalence of most common species like Banana, Betel nut, Coconut, Date, Mango, Papaya, Guava were very high while that of less common species like Kaow, Pineapple, litchi, Star apple, were found

Table 4: Relative Prevalence of different fruit species

Sl. No.	Name of species	Locality					All
		Charking	Charishor	Tomoraddi	Burirchar	All	
1	Amla	75.00	63.25	52.25	57.50	61.88	
2	Banana	2310.00	2095.00	2115.00	2165.00	2171.25	
3	Betel Nut	2675.00	1776.50	1579.50	1015.00	1759.26	
4	Black Berry	270.00	234.00	190.00	295.00	234.72	
5	Bullock's heart	97.50	148.00	51.00	108.50	98.79	
6	Carambola	78.00	98.00	78.00	110.50	91.00	
7	Coconut	1500.00	905.00	992.75	760.00	1039.24	
8	Date	451.50	608.00	896.00	760.00	698.06	
9	Elephant apple	18.00	40.50	22.50	19.25	24.72	
10	Guava	700.00	655.00	472.50	445.00	566.72	
11	Hog palm	55.00	45.00	31.50	81.25	51.69	
12	Jack fruit	345.00	256.50	375.00	301.50	318.25	
13	Jujube	375.00	390.00	275.00	405.00	361.25	
14	Kawphal	6.00	17.50	0.25	18.00	8.16	
15	Lemon	220.50	195.00	176.00	198.75	198.00	
16	Litchi	15.75	51.75	9.00	3.75	16.53	
17	Mango	930.00	785.00	775.00	585.00	768.75	
18	Monkey jack	40.00	84.50	57.00	32.00	51.69	
19	Olive	45.00	40.00	17.50	37.50	34.09	
20	Palm	57.50	100.75	46.00	34.00	57.28	
21	Papaya	544.50	978.50	255.50	600.00	576.88	
22	Pine Apple	10.50	11.50	40.00	2.50	10.88	
23	Pomegranate	117.00	180.00	152.00	139.75	149.53	
24	Shaddock	31.50	38.00	31.50	11.25	27.09	
25	Tamarind	49.50	135.00	40.50	78.00	71.91	
26	Velvet apple	33.25	55.00	65.25	36.00	46.75	
27	Wax jambu	13.75	42.75	18.00	24.50	24.02	
28	Wood Apple	22.75	66.00	40.50	42.75	41.58	

Table 5: Ranking of fruits in different union according to their Relative Prevalence

Sl. No.	Name of species	Locality					All
		Charking	Charishor	Tomoraddi	Burirchar		
1	Aonla	15	19	16	17	16	
2	Banana	2	1	1	1	1	
3	Betel Nut	1	2	2	2	2	
4	Black Berry	10	10	10	10	10	
5	Bullock's heart	13	13	17	14	13	
6	Carambola	14	16	13	13	14	
7	Coconut	3	4	3	3	3	
8	Date	7	7	4	4	5	
9	Elephant apple	24	24	24	24	24	
10	Guava	5	6	6	7	7	
11	Hog palm	17	22	22	15	18	
12	Jack fruit	9	9	7	9	9	
13	Jujube	8	8	8	8	8	
14	Kawphal	28	27	28	25	28	
15	Lemon	11	11	11	11	11	
16	Lichi	25	21	27	27	26	
17	Mango	4	5	5	6	4	
18	Monkey jack	20	17	15	22	19	
19	Olive	19	25	26	19	22	
20	Palm	16	15	18	21	17	
21	Papaya	6	3	9	5	6	
22	Pine Apple	27	28	21	28	27	
23	Pomegranate	12	12	12	12	12	
24	Shaddock	22	26	23	26	23	
25	Tamarind	18	14	19	16	15	
26	Velvet apple	21	20	14	20	20	
27	Wax jambu	26	23	25	23	25	
28	Wood Apple	23	18	20	18	21	

very low. Alam *et al.* [11] found mango as the most prevalent among the horticultural species followed by guava, jackfruit, coconut and jujube. Chowdhury and Sattar [12] found coconut as the most prevalent among the fruit species followed by jackfruit, date palm, banana and mango. Mannan [13] observed Mango as the most prevalent among the fruit species followed by Jackfruit, guava, jujube, coconut etc.

Ecological factor is one of the determinants of species grown in the farms. Besides the ecological reasons, the socio-economic condition of the household was also a major determinant of the species-mix prevailing in a home garden. There are minor differences in Relative Prevalence of less common species and significant differences of most common species among the farm categories. Clearly farmers of that area prefer some species to grow in their farms. The decision of which trees to grow depends on a combination of price and yield, both depending on the location of the farm in terms of ecological zone and proximal to consumption center.

The fruit species were ranked and presented in the Table 5 according to their relative prevalence in four different unions named Charking, Charishor, Tomoroddi and Burirchar. Among 28 fruit species Banana, Mango and Jujube were found in the 100% homestead surveyed. Banana was found most prevalent in all the unions except Charking union. In the Charking union Betel nut was most prevalent. The next prevalent species were coconut, Mango, Date etc. Mannan [13] found Mango as the most prevalent followed by guava, jackfruit, coconut etc.

Distribution of the Species: Frequency of occurrence of a particular species in an area is one of the indications of its biodiversity at that area.

It was observed from the Table 6 that mango, banana and jujube were found in 100% homestead in the study area followed by Coconut (98.7%), guava (97.5%), Betel nut (96.2%) and Jackfruit (95%). Among the rest Papaya, Date, Lemon, Pomegranate were found at more than 50% homesteads of the study area. Abedin and Quddus [14] found mango at 95% homesteads of Tangail

Table 6: Distribution of fruit species in the homesteads of four unions

Sl. No.	Name of species	Locality				
		Charking	Charishor	Tomoraddi	Burirchar	All
1	Mango	100	100	100	100	100
2	Black Berry	100	90	80	100	92.5
3	Jack fruit	100	90	100	100	95.0
4	Jujube	100	100	100	100	100
5	Coconut	100	100	95	100	98.7
6	Date	70	80	90	100	85.0
7	Guava	100	100	90	100	97.5
8	Litchi	35	45	20	15	28.7
9	Lemon	90	75	80	75	80.0
10	Papaya	90	95	70	100	88.7
11	Palmyra Palm	50	65	40	40	48.7
12	Wax Jambu	25	45	40	35	36.2
13	Carambola	60	70	65	65	65.0
14	Indian Olive	60	50	35	50	48.7
15	Aonla	60	55	55	50	55.0
16	Pine apple	15	10	10	5	10.0
17	Wood apple	35	60	45	45	46.2
18	Bullocks heart	75	80	60	70	71.2
19	Monkey Jack	50	65	60	40	53.7
20	Velvet apple	35	50	45	40	42.5
21	Elephant apple	40	45	45	35	41.2
22	Pomegranate	65	75	85	65	72.5
23	Hog palm	55	50	45	65	53.7
24	Tamarind	55	25	45	60	58.7
25	Betel Nut	100	95	90	100	96.2
26	Banana	100	100	100	100	100
27	Shaddock/Pummelo	45	40	45	25	38.7
28	Kawphal	20	35	5	30	22.5

Table 7: Species diversity of fruit in the homesteads of four unions

Sl. No.	Name of species	Locality				
		Charking	Charishor	Tomoraddi	Burirchar	All
1	Mango	0.940	0.943	0.922	0.944	0.984
2	Black Berry	0.948	0.943	0.928	0.947	0.986
3	Jack fruit	0.936	0.939	0.928	0.943	0.984
4	Jujube	0.946	0.948	0.941	0.948	0.986
5	Coconut	0.911	0.938	0.911	0.941	0.978
6	Date	0.917	0.928	0.845	0.946	0.972
7	Guava	0.930	0.935	0.920	0.944	0.982
8	Litchi	0.840	0.881	0.691	0.640	0.948
9	Lemon	0.941	0.931	0.930	0.929	0.983
10	Papaya	0.934	0.940	0.909	0.945	0.982
11	Palmyra Palm	0.873	0.918	0.847	0.865	0.970
12	Wax Jambu	0.793	0.881	0.846	0.847	0.961
13	Carambola	0.908	0.921	0.910	0.917	0.948
14	Indian Olive	0.907	0.891	0.840	0.889	0.971
15	Aonla	0.899	0.904	0.892	0.986	0.974
16	Pine apple	0.582	0.491	0.500	0.000	0.835
17	Wood apple	0.840	0.909	0.864	0.859	0.968
18	Bullocks heart	0.929	0.935	0.907	0.922	0.981
19	Monkey Jack	0.883	0.917	0.898	0.852	0.973
20	Velvet apple	0.837	0.893	0.820	0.870	0.961
21	Elephant apple	0.864	0.870	0.880	0.843	0.964
22	Pomegranate	0.921	0.932	0.932	0.917	0.981
23	Hog palm	0.890	0.889	0.878	0.918	0.974
24	Tamarind	0.895	0.926	0.852	0.914	0.975
25	Betel Nut	0.931	0.932	0.871	0.942	0.978
26	Banana	0.931	0.947	0.907	0.948	0.983
27	Shaddock/Pummelo	0.878	0.864	0.867	0.741	0.962
28	Kawphal	0.722	0.840	0.00	0.819	0.937

and at above 67% homesteads of Ishurdi, Jessore, and Rangpur. Alam *et al.* [11] observed that mango, jackfruit, coconut and banana were available at more than 65% homesteads of Jessore.

Species Diversity: Fruit species diversity varied from region to region and species to species in the Bangladesh homesteads. For overall understanding of plant biodiversity, species diversity was also worked out considering the four unions as a whole. It might help to understand the fruit diversity in respect of Hatiya Island. Species diversity of fruit was ranged from 0 to 0.986 over the study site (Table 7). Black berry and Jujube were found highly diverse fruit species in both respect of regions as well as region mean. Second highest intra species diversity was found in Mango (0.984) and Jackfruit (0.984). Another 24 species of fruits were also having a considerable in this study area.

REFERENCES

1. BBS (Bangladesh Bureau of Statistics), 2004. Statistical Year Book of Bangladesh, Bangladesh Bureau of Statistics. Ministry of Planning. Dhaka.
2. Deshmukh, I., 1986. Ecology and Tropical Biology. Palo Alto, California: Blackwell Scientific Publications.
3. Cristanty, L., 1985. Homegardens in tropical Asia. A special reference to Indonesia. Paper presented at the First International workshop on Tropical Homegardens. Institute of Ecology Padjadjaran University, Bandung, Indonesia.
4. Bashar, M.K., 1993. Adoption of Intercropping in Sugarcane Cultivation. M.Sc. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.
5. Sellathurai, P., 1997. Homegarden Agroforestry and sustainability in Kandy district, Srilanka. M.Sc. Thesis. Agricultural University of Norway.
6. Brammer, H., 1971. Soil Resources. Soil Survey Project Bangladesh. Agril. St. Pak. 6. Technical Reports. UNDP/FAO.
7. Millat-e-Mustafa, M., 1997. Floristic and Indigenous Management Techniques of Homegardens in Bangladesh. In: Agroforestry: Bangladesh Perspective. By M.K. Alam, F.U. Ahmed and S.M.R. Amin (Eds.). APAN, NAWG, BARC, Bangladesh.
8. Simpson, E.H., 1949. Measurement of diversity. *Nature*, 163: 688.
9. SPSS (Statistical Package for Social Sciences), 2006. SPSS (Computer based software package) v. 16. SPSS Inc., New York.
10. Mannan M.A, M.A.K. Mian, M.A. Aziz and H. Haq, 2004. Evaluation of some stone originated Mango Accession. Bangladesh JPL Breeding and genetics, 17(1): 25-29.
11. Alam, M.S., M.F. Haque, M.Z. Abedin and S. Akter, 1990. Homestead trees and household fuel uses in and around the FSR site, Jessore. In: Homestead plantation and agroforestry in Bangladesh. By M.Z. Abedin, C.K. Lai and M.O. Ali (Eds.). BARI Joydebpur Bangladesh, pp: 106-119.
12. Chowdhury, M.K. and M.A. Satter, 1992. Agroforestry practice in traditional farming system of Bangladesh. A report prepared for BARC/Winrock Intl., Dhaka, Bangladesh.
13. Mannan, M.A., 2000. Plant biodiversity in the homestead of Bangladesh and its utilization in Crop improvement. Ph.D. thesis, Bangabandhu Sheikh Muzibur Rahman Agricultural University, Gazipur, Bangladesh.
14. Abedin, M.Z. and M.A. Quddus, 1990. Household fuel situation, home gardens and agroforestry practices at six agro-ecologically different locations of Bangladesh (Abedin *et al.* eds.) Proceedings of a national workshop held 17-19 July 1988 in Joydebpur, Bangladesh. BARI/RWEDP/WINROCK, pp: 19-53.