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ANNUAL AND PERENNIAL SPECIES PREFERENCE IN DIFFERENT CROPPING SYSTEMS IN RAJSHAHI DISTRICT OF BANGLADESH

Md. Wasiul Islam*

Forestry and Wood Technology Discipline, Khulna University, Khulna 9208, Bangladesh

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Abstract: Different types of annual and perennial crop species have been detected in cropland agroforestry (CAF), homestead agroforestry (HAF) and annual cropping (AC) system in four *Upazilas* (Bagha, Charghat, Puthia and Tanore) under Rajshahi district of Bangladesh. The objectives of the study were to assess and compare farmer's preference to different types of annual and perennial species in homestead agroforestry, cropland agroforestry and annual cropping systems, and to find out the financial values of the species among different cropping systems. The sample size was 150 small agroforestry farmers of which 50 were from cropland agroforestry, 50 from homestead agroforestry and 50 from annual cropping system. Banana (BCR = 3.85) was found as the most financially profitable species in AC system in the study area. However, four types of paddy (41% of total preference) were identified as the most preferred species in AC system. Farmers usually grew 25 different annual crop species on their croplands. Blackgram was the most profitable (BCR = 4.02) annual crop species in CAF system. Sugarcane was the most financially profitable species as a crop combination and also as sole crop. For getting quick return farmers grow sissoo in their croplands. Among 19 HAF species, sweet gourd (27%) was the most preferred species (14%) and financially beneficial annual crop. Out of total 21 tree species in HAF system, mahogany was planted by 21% farmers 21%. However, mango was recorded as the most planted and profitable species in respect to the plot number (90%).

Keywords: Species preference, cropping system, agroforestry, financial analysis

Introduction

The field of economics of agroforestry is still in infancy stage in the world because of the assorted complications of agroforestry due to the disparity in scale, time, location, diversity, ecological characteristics, government policy, marketing etc. This important field of agroforestry is also very infant in Bangladesh. Only some limited study has been carried out in this field in our country.

Growing of tree species in crop fields was found to be extremely location specific. The land mostly determined by the species choice and soil type followed by family needs, market demands, crop-tree interactions and tradition. Given suitable land and soil, market demand influences the species choice more than other factors. Large farmers have more trees per farm (Abedin and Quddus, 1991). Of the 8.6 million ha of cultivated land in Bangladesh, about 2.49 million ha (29%) is situated above normal flood level (Anon, 1991b). This 29% of the cultivated land is potential land for cropland agroforestry in Bangladesh (Anon, 1999). According to FAO (Anon,

* Corresponding author: Phone: 880-41-720721-3, Extn.: 228; Fax: 880-41-731244; <wasiulislam7@yahoo.com>

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1995), paddy is the single most important crop grown on about four-fifths of the cultivable area of Bangladesh. Jute and wheat rank next. In the study, annual cropping means the agricultural practice which takes not more than one year for its final output. Bangladesh contains 0.50 million ha of culturable waste land and 0.36 million ha of current fallow land (Anon, 1999). If proper steps for the improvement of these areas can be taken then it will obviously enhance the agricultural production. Mixed cropping of annual and perennial crops in homestead area is often defined as homestead agroforestry (MacDicken, 1990). Homestead is the easiest niche for planting trees as it is the place where farmers usually grow a wide variety of trees. The system which is practiced in croplands by introducing woody vegetation with the annual crops in spatial or temporal sequence to get benefits from both the crops is known as cropland agroforestry. Generally, trees are grown naturally in croplands and sometimes these are intentionally planted on the crop fields.

The objectives of the present study were (i) to assess and compare the preference of different annual and perennial species by the farmers in homestead agroforestry, cropland agroforestry and annual cropping systems; and (ii) to evaluate financial values of the species under different cropping systems in the study area.

Materials and Methods

The study was carried out in Rajshahi district of Bangladesh from December 2000 to February 2001 at eight villages under four *Upazilas* (i.e. sub-districts) namely, Atghori and Chatari village under Bagha *Upazila*, Baladiar and Charghat village under Charghat *Upazila*, Dhokrakol and Nokulbaria village under Puthia *Upazila*, and Hatisail and Dhantere village under Tanore *Upazila*. Rajshahi district is located between 24°07′ and 24°43′N latitude and between 88°17′ and 88°58′E longitude (Anon, 1991a). It covers Tropical monsoon climate like other parts of Bangladesh. It rains about 90% of the total rainfall in the rainy season. The mean maximum and minimum temperature is 35.3 °C in April and 11.2 °C in January respectively. The annual rainfall in winter, pre-rainy and rainy season is 46 mm, 232 mm and 1,276 mm respectively (Anon, 1996a). Topography of the four *Upazilas* is more or less plain in nature and is included in Ganga river floodplain area (Anon, 1996b). The field survey was conducted at the more or less same type of site factors for cropland agroforestry, homestead agroforestry and annual cropping practice to compare them in different aspects.

The sample size was 150 including 50 samples (plots) for cropland agroforestry, 50 samples for homestead agroforestry and the rest 50 sample plots for annual cropping system from the four *Upazilas*. The pre-mature and matured agroforest were surveyed. The agroforestry program of the region is in young stage. The sampling units were selected from the field by some stages because of the uneven and discrete distribution of agroforestry plot in the region. At first four *Upazilas* from Rajshahi district were selected purposively depending on the availability of agroforestry type of landuse. Then, two unions from each *Upazila* were selected randomly, after that one village from each union and finally, a required number of farm households were selected randomly for sampling. Two sets of diagnostic semi-structured questionnaire were surveyed for conducting the survey. One is for cropland agroforestry or pure agricultural crops on agricultural land. The second one was for homestead agroforestry survey. Only Benefit-Cost Ratio (BCR) method of profitability measurement has been used here due to unavailability of the required data which is necessary for calculating the other methods.

Labour cost has been divided into market price cost and opportunity cost which includes establishment (such as field preparation, fencing, etc.), maintenance (weeding, Irrigation, fertilizer and pesticides) and harvesting cost. Capital includes seeds, equipments or tools, ploughing, fertilizer (organic and inorganic), pesticides, Irrigation, fodder, stacking, marketing and other cost. After getting the total costs it is then compounded at 6% interest rate by using the compounding formula ($FV_n = PV(1+i)^n$ Where, PV = Present value, i = Discount rate, FV_n = A future value in year n, n = The number of years). For benefits, items such as food, fuel, fodder, timber and pole or post have been considered. Then calculating the total benefits, it is compounded at 6% rate of interest. Finally, the BCR is calculated by dividing the compounded benefits by compounded costs. The calculation has been done on the basis of per acre area per year basis.

Results

Annual cropping system: Annual cropping (AC) system is the most traditional method in our country as well as in study area. The main annual crops in the area are different types of paddy, wheat and sugarcane.

The top five crop combinations and the top five individual annual crops which are financially most benefited in each *Upazila* under AC system have been shown in Table 1. The combination of sugarcane, red amaranth (one kind of red leafy vegetable or shak) and giant taro is the most financially profitable (BCR = 4.27) combination compared to the other crop combination at Bagha *Upazila*. Sugarcane and red amaranth combination (BCR = 3.73) is in the next position of the financial profitability ranking table. Although according to the direct responses from the respondents of Bagha *Upazila*, sugarcane is the most profitable species for the crop combination and also as a sole crop but after the financial analysis giant taro *(Alocasia indica* (Roxb.) Schott*)* is found the most financially profitable (BCR = 5.47) compared to any other species at Bagha. If people grow these crops more then the possibility of their income increment will be higher. Red amaranth (3.99), sugarcane (3.32), *Aus* (1.80) and IRRI (1.53) rank the subsequent financial priorities as an individual annual crop in AC system at the same *Upazila*.

Table 1. Financially profitable crops in annual cropping system in Rajshahi district of Bangladesh.

Upazilla	Crops/Combination	BCR	Individual crop	BCR
Bagha	Sugarcane+Red amaranth+ Giant taro	4.27	Giant taro	5.47
	Sugarcane+ Red amaranth	3.73	Red amaranth	3.99
	Sugarcane	3.08	Sugarcane	3.32
	IRRI + Wheat	1.69	Aus	1.80
	Aman+IRRI+Aus	1.61	IRRI	1.53
Charghat	Sugarcane	2.67	Dhaincha	3.33
	Garlic+Chilli	2.44	Chilli	3.14
	Sugarcane+Garlic	2.27	Sugarcane	2.56
	Banana	2.20	Pointed gourd	2.22
	Wheat+IRRI+Garlic+Dhaincha	2.18	Banana	2.19
Puthia	Banana	4.11	Banana	4.11
	Sugarcane+Lentil	2.88	Sesame	3.90
	Wheat+IRRI+ Sesame	2.46	Eggplant	3.79
	Eggplant+Onion	2.41	Sugarcane	2.50
	Wheat+*Aman*	1.68	IRRI	2.11
Tanore	Mustard+*Boro*	2.51	Potato	2.99
	Aman+Potato+*Boro*+Aus	2.48	*Boro*	2.48
	Boro+Aus+*Aman*	2.26	Aus	2.26
	Aman+*Boro*+Wheat	2.05	*Aman*	2.25

Source: Field survey, 2001.

At Charghat *Upazila*, sugarcane (BCR = 2.67) is the most profitable species in annual crop combination. Garlic with chilli (2.44) stands the next priority. But as a sole crop *dhaincha* (*Sesbania bispinosa* Sawatt.) (one kind of leguminous plant) (BCR = 3.33) is the most financially profitable species. Chilli (3.14) and sugarcane (2.56) place in second and third position respectively in the priority list of the annual crops. But the villagers don't grow garlic (only 10% of the total growing) and chilli (8%) in large scale. They grow sugarcane in large scale (20%) in their fields. Pointed gourd (2.22) and banana (2.19) locate the subsequent ranking in the table. Banana is the best annual crop as associate (BCR = 4.11) as well as a sole crop (4.11) at Puthia. Mustard with *Boro* paddy (2.51) ranks top for Tanore. *Aman*+potato+*Boro*+*Aus* (2.48) stand the next position. Potato (2.99) is the most profitable sole crop at Tanore. *Boro* (2.48) and *Aus* (2.26) stand the second and third position respectively.

Banana (BCR = 3.85) is the most financially profitable annual crop species among the most common cultivated annual crops in the study area (Table 2). Eggplant (3.78), Chilli (3.40), potato (2.95), sugarcane (2.93) locate in the subsequent positions of the ranking table indicates their relative profitability in AC system. Wheat (1.42) and onion (1.39) indicate the lowest profitability.

Paddy of various types (41% of the total frequency) is shown most preferred species by the farmers among the annual cropping system in the study area (Fig. 1). Wheat (13%) and sugarcane preferred (10%) the next to cultivate in their fields.

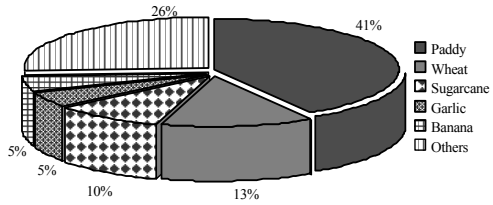

Fig. 1. Annual crop species growing preference in the study area.

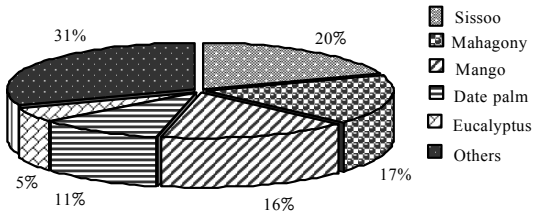

Fig. 2. Perennial species growing preference in the study area.

Table 2. Ranking of financially profitable species among the four *Upazilas* under Rajshahi district of Bangladesh.

Name of crops	Botanical name	BCR
Banana	*Musa* spp.	3.85
Eggplant	*Solanum melongena*	3.78
Chilli	*Capsicum annuum*	3.40
Potato	*Solanum tuberosum*	2.95
Sugarcane	*Saccharum officinarum*	2.93
Lentil	*Lens culinaris*	2.32
Mustard	*Brassica nigra*	2.17
Aman	*Oryza sativa*	2.09
Aus	*Oryza sativa*	2.06
Boro	*Oryza sativa*	1.91
Garlic	*Allium sativum*	1.59
IRRI	*Oryza sativa*	1.42
Wheat	*Triticum aestivum*	1.42
Onion	*Allium cepa*	1.39

Source: Field survey, 2001.

Table 3. Different crops growing percentage among the fifty survey plots in Rajshahi district of Bangladesh.

Crops	Botanical name	Freq.	% freq*	Rank
Paddy		43	86	1
Aman	*Oryza sativa*	14	28	a
Boro	*O. sativa*	14	28	b
IRRI	*O. sativa*	9	18	c
Aus	*O. sativa*	6	12	d
Wheat	*T. aestivum*	14	28	2
Sugarcane	*S. officinarum*	10	20	3
Garlic	*A. sativum*	5	10	4
Banana	*Musa* spp.	5	10	4
Others		27	54	

Source: Field survey, 2001. *% of total plot = (no. of plot for a species/total no. of plots) x 100

Out of 50 plots, 43 plots i.e., 86% of the total plots have been cultivated by the four types of paddy (Table 3). Of the 43 plots, 14 plots have been used for *Aman* paddy (28% of the total plots). The same percentage for *Boro*, IRRI and *Aus* are 28%, 18% and 12% respectively. Wheat, sugarcane, garlic and banana are grown 28%, 20%, 10% and 10% respectively of the total plot frequency.

Cropland agroforestry system: Cropland Agroforestry (CAF) system is a new concept of cropping system in the study area. Now people are growing trees in their cropland with agricultural crops to get some extra benefits from the same piece of land. This cropping system is getting popularity in the area.

Twenty-five different annual crop species were detected during the survey that the farmers usually grow on their cropland. Blackgram (pulse) is the most financially benefited (BCR = 4.02) annual crop in CAF system (Table 4). But the people do not cultivate the crop (only 1.92% of the total frequency) intensively in the study area. BCR of Sesame is 3.28 which is also not so widely cultivated (1.92%) in the area. Wheat ranks in the third position (2.56) which is cultivated throughout the area. Turmeric, wheat, *Aus* paddy, lentil, chilli, banana, sugarcane, *Aman*, *Boro*, potato, pointed gourd, garlic and mustard stand the subsequent positions in the ranking. Paddy of three types: *Aus*, *Aman* and *Boro* are extensively (33.65%) cultivated by the farmers and the average BCR of these three types of paddy is 2.06 which is much lower than the other crops. Sugarcane (21.15%) is also widely cultivated in the CAF cropping system. This indicates that these annual crops are well grown in CAF system and thus the farmers like to grow these in the area.

Out of 178, total frequencies from total 50 CAF plot, sissoo occurs 35 times i.e., 20% of the total no. of plots (Fig. 2). So, the people like it most for growing it on their croplands. Mahogany was recorded 17% in the study and noticed 17 plots out of total 50 plots. Mango is in the next (16%) position but in some places of the study area mango is grown vigorously as it is a very popular cash crop. Date palm 11%, *Eucalyptus* 5% and other species grows 31% of the total CAF plots.

Table 4. Financial benefits of annual crop species in CAF system in Rajshahi district of Bangladesh.

Name of crops	Botanical name	BCR	% Freq.	Rank
Blackgram	*Vigna mungo*	4.02	1.92	1
Sesame	*S. indicum*	3.28	1.92	2
Wheat	*T. aestivum*	2.56	5.77	3
Turmeric	*C. domestica*	2.44	1.92	4
Aus	*Oryza sativa*	2.30	12.50	5
Lentil	*Lens culinaris*	2.27	3.85	6
Chilli	*C. annuum*	2.24	2.88	7
Banana	*Musa* spp.	2.08	2.88	8
Sugarcane	*S. officinarum*	2.06	21.15	9
Aman	*Oryza sativa*	1.97	11.54	10
Boro	*Oryza sativa*	1.90	9.62	11
Potato	*S. tuberosum*	1.77	6.73	12
Pointed gourd	*T. dioica*	1.52	6.73	13
Garlic	*Allium sativum*	1.49	5.77	14
Mustard	*Brassica nigra*	1.46	4.81	15

Source: Field survey, 2001.

Table 5. Percentage of tree species in CAF in Rajshahi district of Bangladesh.

Tree crops	Botanical name	Freq.	% Freq.*	Rank
Sissoo	*D. sissoo*	1909	38.56	1
Mahogany	*S. mahagoni*	1044	21.09	2
Eucalyptus	*E. camaldulensis*	597	12.05	3
Mango	*M. indica*	528	10.66	4
Date Palm	*P. sylvestris*	505	10.20	5
Others		368	07.43	
Total		4951	100	

Source: Field survey, 2001. *% Total no. = No. of trees/Total no. of tree x 100.

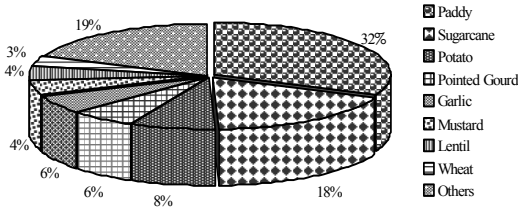

Fig. 3. Annual crop growing preference in the study area.

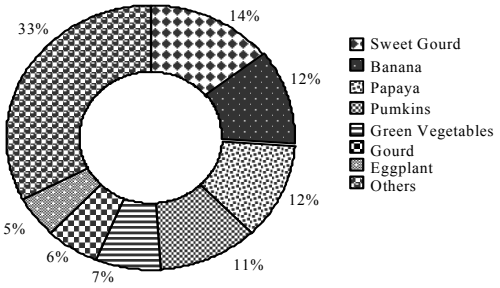

Fig. 4. Percentage of annual crops of the total species in the study area

Sissoo grows the most intensively (38.56%) in CAF at the study area due to its multipurpose uses (Table 5). People like sissoo most for its fast growing criteria as they can get some quick returns from the tree. But due to the massive mortality of sissoo for the mysterious reason, now the people are not so interested on sissoo. Mahogany (21.09%) ranks in the second position from the number of the total plantation point of view. It is also an imperative species for the cropland agroforestry system in that area. The long and clear boles, fast growth and high timber value of mahogany magnetize the farmers very much for its plantation in their croplands. As sissoo facing dilemma so people are now getting attention towards mahogany. They planted these species in hexagonal pattern in boundary line or in randomize form inside the cropland. *Eucalyptus* (12.05%) is getting the popularity among the people for its fast growing characteristics. It is used as fuelwood in the locality. It is very tall in height and casts a very scattered shade on the annual crops that grow on the same floor. It brings quick financial returns for the farmers. Mango (10.66%) is another popular perennial fruit species in CAF. In most of the places it is very popular in croplands depending on the soil quality and the level of land because mango can't stand in water stagnation condition. Date palm (10.20%) mainly grows in the cropland naturally. But people also plant it in the boundary of the cropland. It gives juice and molasses. It is also used to make mat and as fuel. Other tree species account the rest 7.43% of the cropland at the study area. Paddy (32%) is shown most preferred species among the annual crops in CAF system (Fig. 3) followed by sugarcane (18%), potato (8%), pointed gourd (6%), garlic (6%), mustard (4%), lentil (4%) and wheat (3%).

Homestead agroforestry system: Homestead agroforestry (HAF) system is also a traditional cropping system in the study area. It has been practicing in the area from ancient period of time. Now, some improved technologies are applied in the system to increase the profitability. There are nineteen species of annual crops grown in the homesteads of the study area. From the above

doughnut chart (Fig. 4), sweet gourd (14%) is shown most preferred species among the annual crops in HAF system. Banana (12%), papaya (12%), pumpkins (11%), different types of green leafy vegetables (7%), pointed gourd (6%) and eggplant (5%) stand at the subsequent positions in respect to their availability in HAF cropping system. Other types of annual crops cover the rest 33% of the total annual crop species.

Among the total 21 perennial species in the study area the above mentioned (Table 6) species are found the most common species in HAF. Out of 50 surveyed plots in the study area mango was found in 45 plots in the four *Upazilas* i.e., 90% of the total plots which ranks the first position in the table. Coconut was recorded 84% of the total plots make the second position. The tall and robust coconut trees are very common feature in the villages. 70% of Mahogany, 60% of jackfruit, 58% of date palm are noticed and ranked in the 3rd, 4th and 5th position respectively in HAF. Blackberry (50%), guava (44%), sissoo (40%), betel nut (36%) and bamboo (24%) are found in the subsequent positions in the ranking.

Table 6. Percentage of perennial species growing in the study area.

Common name	Botanical name	Freq.	% of total plot*	Rank
Mango	*Mangifera indica*	45	90	1
Coconut	*Cocos nucifera*	42	84	2
Mahogany	*Swietenia mahagoni*	35	70	3
Jackfruit	*Artocarpus heterophyllus*	30	60	4
Date palm	*Phoenix sylvestris*	29	58	5
Blackberry	*Syzygium cumini*	25	50	6
Guava	*Psidium guajava*	22	44	7
Sissoo	*Dalbergia sissoo*	20	40	8
Betel nut	*Areca catechu*	18	36	9
Bamboo	*Bambusa* spp.	12	24	10

Source: Field survey, 2001. * % of total plot = Species frequency/Total plot x 100. Total plot no. = 50.

Mahogany (20%) has been planted the highest in respect to the total number of the individuals (508 out of 2406 individuals) in the HAF cropping system (Fig. 5). But mango has been recorded the most planted species in respect to the plot number (45 out of 50 plots) in the same system. But the number of mango tree (13%) is not as much as mahogany (35 out of 50 plots). After mahogany date palm (15%), coconut (13%), betel nut (10%), sissoo (6%), jackfruit (4%) and the other species take the subsequent positions in the ranking.

Table 7. Financially benefited annual crops in HAF system in Rajshahi district of Bangladesh.

Name of crops	Botanical name	%
Sweet gourd	*Cucurbita moschata*	27
Banana	*Musa* spp.	16
Papaya	*Carica papaya*	14
Pointed gourd	*Lagenaria vulgaris*	9
Pumpkins	*Benincasa hispida*	9
Bean	*Lablab purpureus*	7
Others		18
Total		100

Source: Field survey, 2001.

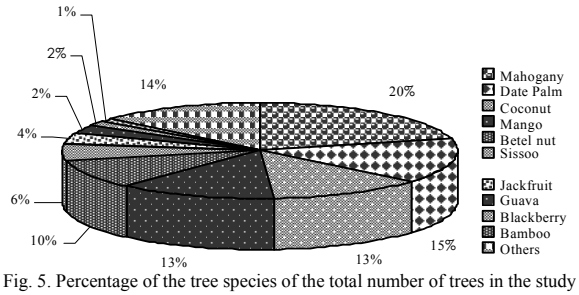

Fig. 5. Percentage of the tree species of the total number of trees in the study area.

The calculation of BCR of the annual crop in HAF was not possible due to the unavailability of the financial data separately for an individual species of annual crop. So, the opinion and preference of local people in respect to the financial benefit of the annual crop was carried out through the interview and informal discussion. Total respondents were 50. According to the respondents of the four *Upazilas*, sweet gourd (27%) is the most financially benefited annual crop in their HAF system (Table 7). Generally it grows on the roof or some time on special type of raft made by bamboo, jute stick and other local materials for the support. Banana (16%), papaya (14%), pointed gourd (9%), pumpkins (9%) and bean (7%) stand the next positions in HAF. Other species (like eggplant, potato, green leafy vegetables etc.) accounts the rest 18% of the total response for its financial benefits in HAF. As like as the annual crops, the calculation of BCR for

tree crops in HAF has been estimated by the opinion and preference of the local people. According to the respondents of the four *Upazilas*, mango (37%) is the most financially benefited tree species in their HAF system followed by jackfruit (17%), mahogany (15%), coconut (7%) and bamboo (7%). Other species like date palm, guava, palmyra palm, wood apple etc. account the rest 17% of the total response for its financial benefits in HAF.

Table 8. Overall species growing percentage of the four *Upazila*.

Upazilla	Mango	Coconut	Mahogany	Jackfruit	Date palm	Blackberry	Sissoo	Guava	Palmyra
Bagha	100	75	58	58	43	58	75	29	29
Charghat	92	85	85	33	54	62	33	33	17
Puthia	92	100	76	77	69	60	50	60	10
Tanore	75	58	43	67	58	29	29	58	58
Total	90	79	65	59	56	52	47	45	28
Rank	1	2	3	4	5	6	7	8	9

Source: Field survey, 2001.

Mango (90%) is grown the most that occupies the 1st place of the species growing preference list (Table 8) in HAF among the four *Upazilas*. Mango grew 100%, 92%, 92% and 75% at Bagha, Charghat, Puthia and Tanore respectively with the respect of the total no. of plots of the *Upazilas*. Coconut (79%), mahogany (65%), jackfruit (59%), date palm (56%), blackberry (52%), sissoo (47%), guava (45%) and palmyra palm (28%) places in the next positions respectively in the list.

Discussion

By the ranking of financially profitable species in annual cropping system in Rajshahi district of Bangladesh (Table 1) it can be incurred a decision that sugarcane is a good associate crop in the AC system at Bahga especially when they are in early stage of their development. Giant taro and red amaranth *(Amaranthus* spp.*)* were found excellent profitable sole crop at Bagha *Upazila* (Table 1) but these were not practiced in general at the study area (Table 2) due to the choice of the farmers as well as the demand of those products. As like this, banana was found the most financially profitable species (BCR = 3.85) among the four *Upazilas* (Table 2). But banana is found less preferred by the farmers for its growing (Table 3). Many of them are not so concerned about the profitability of the annual crops. They grow according to their needs and sometimes as tradition. If they would be able to know the profitability ranking for a particular specification of land, climate and other resources then they would be interested on the crops which are more profitable than the others. Every people want to earn more. But many of them do not know how to earn the more money. That's why the Table 2 and Table 3 are so dissimilar.

Sugarcane is a good associate in different crop combination in CAF particularly at the early stage of their development when the bush and shade of sugarcane is not so close and dense that might harm the under grown other annual crops. The farmers use every parts of sugarcane. That is why villagers are very fascinated for growing this species in their fields. But sometimes the farmers don't receive the actual value of this crop from the sugarcane dealer or sugar mills due to various reasons. It was not possible to find out the single or individual tree crop in respect to the financial benefit criteria in case of CAF hence the informants were unable to inform the returns of the individual tree crop. According to the informants mango is the most financially benefited crop in CAF. The socio-economic development of this area depends largely on its production. The seasonal mango is their main source of income for all around the year. Mango tree based agroforestry with the association of some agricultural crops are practiced for some years prior to starting of giving dense shade of the trees on the annual crops. The first 5-6 years from establishing mango trees do not harm the annual crops economically but after this stage the economic return from the annual crop starts to decline and after 10-12 years the canopy closer become dense. As a result the production of the annual crops becomes drastically harmful. After 15 years age of mango trees, the production of agricultural crops under the trees is not profitable or justified. So, at the stage the clever farmers are not enthusiastic to grow the agri-crops further more and the site is converted into a mango orchard for the maximum benefits.

The profitability criterion of HAF is the best between the other two systems (AC and CAF) in the every *Upazila*. The overall average NPV (Net Present Value) of HAF is Tk. 880,305 while for AC and CAF it is only Tk. 206,661 and Tk. 415918.00 respectively. The BCR (12.89) and IRR (Internal Rate of Return) (36.16%) of HAF are also higher than the other two systems in the all respective *Upazilas*. These profitability criteria indicate clearly that HAF system is the best financially profitable system compared to the other two systems in the study area (Rakkibu *et al.,* 2003).

Agrosilvicultural and scattered farm tree systems are the most common practices adopted in the areas. About 77% of the total tree planted by the farmers are timber producing or non-fruit species (e.g., sissoo, mahogany, *Eucalyptus* etc.) while the remaining 23% were meant for fruit species (e.g., mango, date palm etc.) in CAF. About 33% of the total tree planted by the farmers are timber producing or non-fruit species (e.g., sissoo, mahogany, *Eucalyptus* etc.) while the remaining 67% are meant for fruit species (e.g., mango, date palm etc.) in HAF. Forestry for the poor is the best focused on fruit and other multipurpose trees.

Conclusion

Different species of plants (both annual and perennial) provide financial benefits to farmers as social, economic and environmental benefits. Farmers adopted agroforestry systems for a number of reasons. Initially, most of the farmers were interested in producing tree products for cash and household uses i.e., construction materials, posts and poles, fuel wood etc. The results indicate that the BCR depends on tree species, demand and marketability of produces and intensity of management practices. Generally, tree planting on the farmlands is financially favourable in all localities irrespective of tree species planted. It is suggested that management practices in these plantations should be intensified by large financial and technical inputs to make them a financially sound undertaking.

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