

Composition and benefit of cropland agroforestry practices practised in Rajshahi district

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Abstract: Cropland agroforestry practices practiced by the farmers in Charghat, Putia and Paba upazilas in the Rajshahi district were surveyed to observe the extent of coverage with particular emphasis on its composition and economic benefit derived during the period of November to April, 2003. It was observed that the farmers practicing the cropland agroforestry plantation with trees were broadly of four types viz. (i) boundary plantation in and around the crop field, (ii) scattered plantation within the crop field, (iii) strip plantation within the crop field and (iv) composite plantation having timber trees in the boundary and fruit trees within the crop field. The composition of each of these practices has been elaborately described with supporting photographs. Economic evaluation of these different cropland agroforestry practices revealed that the farmers are getting significantly higher income from this simultaneous production system. From the findings, it is concluded that cropland agroforestry practices in Rajshahi district were economically profitable and fulfilling the demand of fuel wood and small timbers as well as increasing the tree coverage in comparatively drier part of the country.

Key words: Cropland agroforestry, composition, economic benefit

Introduction

Cropland agroforestry indicates the simultaneous production of perennial trees and annual crops in cropland. The practice of cropland agroforestry is comparatively new. However, it has been practiced in different regions of Bangladesh from long ago (Abedin and Quddus, 1991). This practice has been extended successfully by Swis Development Cooperation (SDC) through Village and Farm forestry Project (VFFP) at 16 districts of North Bengal (Roy et al., 1996). In North Bengal innovative farmers have spontaneously developed agroforestry systems to compensate crop losses arising from various adversities. These initiatives mostly take the form of boundary plantings on flood free land. In some cases trees irregularly planted on croplands having the capacity of natural regeneration are conserved to supply timber, fuel wood and fodder. Crisis of fuel wood and timber is intensifying throughout the country with particular importance in the Northern part. This was evidenced from the report of Kar et al (1990) who stated that in Barind Tracts, contribution of dung to household energy was 52% and that 70% of livestock dung produced is used as fuel. Thus the fertility of the soil of this area is decreasing sharply. Considering the situation, SDC and other NGOs encouraged the farmers during the last few years to increase tree coverage through plantation of multipurpose trees in their cropland to meet the demand of fuel and timber. This study dealt with the structural composition and economic benefit of cropland agroforestry practices introduced in Rajshahi district.

Materials and Methods

The research was conducted to evaluate the cropland agroforestry practices of Villaga and Farm Forestry Project (VFFP) in the selected nine unions under three upazilas in Rajshahi district. A sample of 90 farmers, 30 from each upazila was selected by stratified random sampling. Composition of agroforestry practices were determined through extensive travelling in the selected areas and all the different structural compositions were photographed for elaborate description. Data on economic benefits were collected by using a questionnaire. Incomes of a farmer practicing cropland

agroforestry were measured in terms of taka received from crop and tree produced from 1994 to 2002 in eight years rotation. Thus the incomes from crop production during the period from 1994-2002 was made by asking question to the individual farmer; while the incomes from trees were estimated considering the fuel value and price of trees considering the present market price.

Results and Discussion

Survey made on the existing cropland agroforestry practices in the selected areas in the Rajshahi district revealed that the farmers are practicing this production system in different ways. The cropland agroforestry practices followed in this area have broadly been classified into four categories viz. (i) Boundary plantation of trees in and around the crop field (ii) scattered plantation of trees within the crop field (iii) strip plantation of trees in single line at 8 m distances between the two lines and (iv) composite plantation.

Boundary plantation: Boundary plantation of trees were made around the field boundary of an individual farmer or along the common ail (bund) of two different farmers. In such plantation, timber trees like mahogany, sissoo, date palm etc were planted in 1 m inside the field bund by the both farmers (Fig. 1a). The remnant areas were used to develop nursery of timber and fruit tree seedlings (Fig. 1b). The farmers owing the fields are cultivating sugarcane and dhaincha in each part of their field. The farmer who growing sugarcane continue to grow this crop for 2 to 3 years; while the other farmer growing dhaincha usually chopped them at the time of T-aman cultivation (Fig. 1b). In some areas, farmers developed mahogany plantation along the ail approaching the middle of his own land at 5 to 6 m distances and cultivating sugarcane til (sesame) etc. depending on the condition of the land (Fig. 1c). In other cases, some farmers developed boundary plantation in pieces of his land at north and west side of the field keeping south and east side free for easy cultivation of agricultural crops having minimum shade effect on the understorey crop (Fig. 1d). In some areas, boundary plantations were developed along the bund with mixture of perennial trees like mahogany

and date palm grown in alternate arrangement (Fig. 1e). The date palm is a very economic crop yielding handsome amount of money from its juice during the tapping season; while in other farms, farmers are growing valuable timber trees like mahogany in east and west boundaries, north and south border were planted with betel nut. The remaining vacant space within the field is cultivated with high price vegetable like pointed gourd, chilli, cole crops etc (Fig. 1f).

Cropland agroforestry practices in the form of boundary plantation were first initiated in the North Bengal in 1986 through the Village and Farm Forestry Project (VFFP) funded by Swiss agency for Development and Cooperation (SDC) (Ahmed, 2001). Now these practices were popularly adopted by a large number of farmers in the North Bengal areas. SDC initially started cropland agroforestry trial mainly with three species viz. *Acacia nilotica*, *Dalbergia sissoo* and *Eucalyptus camaldulensis* as the boundary plantation around the cropland (Ahmed, 2001). In the present survey it was found that the farmers are reluctant to grow *Dalbergia sissoo* as it is susceptible to insects and diseases at a certain stage of plant growth. Instead of *D. sissoo* farmers have now largely developed boundary plantation of mahogany. Cropland agroforestry, which is otherwise designated as khetland by VFFP accounted only 22.9% upto 1994 since its inception in 1986, it is now increased to 45.9% (Roy, 1997). According to Zabala (1990) boundary plantation along the borders of crop field were usually done with fast growing multipurpose trees which were lopped off periodically for fuel wood and fodder. In the sub-humid midlands of Kenya farm boundaries and internal borders were fully utilized for planting of fuel wood and fodder requirements of the house holds (Rocheleau and Hoek, 1984). In the present survey it was found that boundary plantations were developed by planting timber trees like mahogany and ipil-ipil for both fuel wood and timber.

Scattered tree plantation: Trees are grown in the crop field in scattered way usually maintaining 8 m spacing at different design. Some times the farmers did not follow any design and spacing. In that case, trees are grown disorderly in the crop field. In some places, the farmers planted eucalyptus scatteredly within the crop field having mahogany, date palm, sissoo etc. densely planted in the border areas of the field (Fig. 1g). The annual crops cultivated in such field by the farmers are sugarcane, banana etc. In other areas, farmers scatteredly planted ipil-ipil without considering any spacing. Such haphazard plantation mainly for fuel wood was observed in many areas (Fig. 1h). Sometimes the farmers planted ipil-ipil, date palm, sissoo in scattered fashion having sugarcane as the field crop.

Scattered plantation observed in the present study in greater Rajshahi district were made largely by mango, date palm, sissoo and ipil-ipil trees; whereas the plain land agroforestry modules allowed wide-spaced

scattered planting mainly with fodder and fuel wood trees usually in wide square spacing so that dense continuous shade is avoided. The crown could be beaten down by lopping of branches and root competition is minimized by root pruning through circular trenches around tree base (Bhuiyan, 1997). In the present study, scattered plantation with mango is quite evident most possibly due to the fact that these cropland areas were finally converted into mango orchard, which is highly profitable in the economic view point specially in northern areas.

Strip plantation: Trees are planted on the cropland in strips and crops are grown there as intercropping in between the strips. In strips, tree to tree distance was maintained 5 to 10 m. In strip plantation the farmers of the selected areas usually planted mahogany in single line keeping 6 m alley between two rows. In the alley sugarcane is cultivated (Figs. 1 i & j). The farmers growing timber trees like mahogany in strip plantation ultimately suspended agricultural crop cultivation when the canopy of timber trees sparse densely.

Strip plantation observed in the present study was usually done with mahogany in single line at about 4 m plant to plant distance keeping a 6 m alley between two rows. In general, strip plantation in plain land agroforestry were developed following alley cropping module having 10 m wide alleys in a north-south direction intercepted by strips of forest trees. The vacant alleys are cultivated for growing agricultural crops (Bhuiyan, 1997). In the present study, strip plantation made with mahogany is presently cultivated with sugarcane, which after a few years will not allow cultivating sugarcane; rather it will be converted in to the woodlot of mahogany.

Composite plantation: In this system, perennial fruit and timber trees are planted in the same unit of land as mixed cropping. The initial establishment of the plantation is done following taungya cultivation method wherein short term seasonal and annual agricultural crops are grown in the intervening spaces of the permanent fruit and timber trees (Figs. 1 k-q). In some areas, the farmers planted mahogany along the border of the row and mango within the field. In this type of cropland plantation, timber tree like mahogany was planted at 6 m distances and the fruit tree like mango was planted line wise in the middle portion of that land. In this system, the distances from tree to tree was maintained 8 m. Midterm crops like til (sesame), sugarcane etc. are usually grown in these fields (Fig. 1 k). Farmers of some areas of Rajshahi district having comparatively highland following a particular type of composite plantation with timber trees (mainly mahogany, sissoo and date palm) along the border areas of the crop field and mango as scattered plantation. In such plantation, at the initial stage the farmers are cultivating sugarcane, til, banana etc. as intercrops. The farmers owing this type of land usually expressed to convert this field into the mango orchard ultimately (Figs.1-q).



Figure 1(a) Mahogany plantation in 1m inside the common ail (field bund) of two farmers; (b) Nursey of timber and fruit trees in the vacant space along the common ail of two farmers; (c) Mahogany plantation along the middle ail in a sugarcane field; (d) Mahogany plantation along the north-west side in a crop field; (e) Alternate plantation of mahogany and date palm along the boundary of a crop field; (f) Plantation of timber trees along the boundary in east-west side in a farmer's field; (g) Scattered plantation of Eucalyptus within the crop field having boundary plantation of timber trees in a farmer's field; (h) Scattered plantation of ipil-ipil in haphazard fashion in the sugarcane field in Nimpara union under Charghat upazila; (i) Scattered plantation of different trees in sugarcane field of a farmer in Salua union under Charghat upazila; (j) strip plantation of mahogany in a single line in the sugarcane field of a farmer in Bhalukgachi union of Putia upazila; (k) strip plantation of mahogany along with palmyra palm in a farmer's field in Putia union of Putia upazila; (l) Composite plantation of mango in the sugarcane field with mahogany plantation along the border of the field; (m) Mixed plantation of mango and mahogany in scattered way in the sugarcane field of a farmer in Baneshwar union under Putia upazila; (n) Composite plantation of mango and mahogany in a field previously cultivated with wheat; (o) Composite plantation of mahogany, mango and palmyra palm in the sugarcane field of a farmer in Boragachi union under Paba upazila; (p) Composite plantation of mahogany, mango and date palm in a field along with til (sesame) in Putia.

Composite plantation detected in the present survey area of greater Rajshahi district mainly consisted of

long term tree crops, both fruit and timber. According to Bhuiyan (1997) this model is similar to common

homestead models, which form different vertical stories on account of their differential height growth. According to him this model needs intensive care and attention and it usually affords continuous cash flow to the farmer. Therefore, considering the socio-economic status of the farmers of this area, it will be a highly profitable agroforestry practices.

Economic benefits of agroforestry practices: Incomes of the selected 30 farmers, ten in each of the three unions Viz. Bhayalakshampur, Nimpara and Salua under Charghat upazila during the eight years rotation (1994-2002) from cropland trees was Tk. 1448120 (average 48270 Tk./farm). Value of agricultural crops and intermediate products (fuel wood, fruit, juice etc) were Tk. 954800 (average 318226 Tk./farm) and Tk. 395760 (average 13192 Tk.), respectively (Table 1).

The average income generated during the eight years rotation in the selected unions viz. Baneshwar, Bhalukgachi and Putia under Putia upazila from cropland trees were Tk.695000 (average 56016 Tk./farm). On the other hand, value of agricultural crop during the rotational period was Tk. 9309440 (average 310314 Tk./farm); while the income from intermediate products were Tk. 317140 (average 10517 Tk./farm) and Tk. 141850 (average 4728 Tk./farm) respectively (Table 1). In Paba upazila, the selected 30 farmers of the three unions got benefits from trees amounting to Tk. 1475720 (average 49190 Tk./farm); while the income from agricultural crops and intermediate products were Tk. 1111600 (average 37053 Tk./farm) and Tk. 255780 (average 8526 Tk./farm) respectively (Table 1).

Table 1. Production and income from agricultural crops and trees recorded from cropland agroforestry practices in the selected upazilas of Rajshahi district from six year rotational period, 1994 - 2002

Location		Species of tees grown	Cropland agro-forestry coverage (ha)	Agric-ultural crops grown	Value of crops (Tk.)	Value of intermediate products (fuel, fruits, juice etc in Tk.)	Value of wood (Tk.)	Total income (Tk.)
Upazila	Union							
Charghat	Nimpara	-do-	11.30	-do-	2531200	101780	429260	3062240
	Salua	-do-	15.51	-do-	3474240	160020	645360	4279620
	Bhaya Lakshampur		7.29		1632960	133960	373500	2140420
	Total	-do-	34.1	-do-	954800	395760	1448120	9482280
Putia	Baneshwar	-do-	11.47	-do-	321160	110160	351200	3030640
	Bhalukgachi	-do-	14.61	-do-	409080	67520	633400	3973560
	Putia		15.48		433440	139460	695900	4302880
	Total	-do-	41.56	-do-	1163680	317140	1680500	11307080
Paba	Nowhata	-do-	14.79	-do-	3312960	115520	609300	4037780
	Borgachi	-do-	11.91	-do-	2681280	58460	418020	744660
	Parila	-do-	12.94	-do-	2898560	81800	448400	820060
	Total		69.06		1111600	255780	1475720	5602500

Cropland agroforestry practices as an alternate forestry program were initiated with a view to supply fuel wood, timber and other forest products under severe crisis of above demands and indirectly to increase the tree coverage area of the country. However, report on the economic gain or loss due to plantation of trees in the cropfield was so far not made. Therefore, the result on the economic evaluation recorded in the survey area of the present study was difficult to compare with other findings. Abedin *et al.* (1998) made survey in the Ganges flood plain region of Bangladesh and described the traditional cropland agroforestry system. According to them the *Phoenix sysvestris* based system,

Borassus flabellifer based systems, *Acacia nilotica* based systems *Dalbergia sissoo* based systems and *Artocarpus heterophyllus* based systems were the most traditional and profitable cropland agroforestry in the country. Abedin and Quddus (1991) made an economic evaluation of the traditional agroforestry systems of Bangladesh and found that *Phoenix sysvestris* based systems gave a gross returned of Tk. 10000 to 12000 per hectare with crops like rice, wheat, pulses and oilseeds, and Tk. 60000 to 75000 with sugarcane; while *Borassus flabellifer* based systems yield a returned of Tk. 26000 to 48000 having 130 to 150 trees per hectare.

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