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Economic Analysis of Date palm in Agroforestry System in Jessore District

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ABSTRACT

The Major focus of the study was to assess the profitability of date palm in agroforestry system. Farm survey method was adopted to collect necessary data. Data were collected for the period of March 1997 to February 1998 through an interview schedule from 60 randomly selected date palm based agroforestry practicing farmers of three villages in Bagherpara and Sadar upzilla of Jessore district. Five major cropping patterns were identified under date palm based agroforestry system. In terms of economic viability, gross and net returns from date palm were Tk. 26,238.00 and Tk. 19,473.00 per hectare respectively. Intertemporal budgeting for date palm in agroforestry system showed higher discounted benefit-cost ratio (3.89), a large present value of benefit (Tk.103770) and a high internal rate of return (138%) which clearly indicated high profitability of date palm in agroforestry system.

Key words: Date palm, agroforestry, juice, gur, profitability.

INTRODUCTION

Forest resources of Bangladesh are decreasing rapidly due to converting forest areas to agricultural uses for growing food crops to feed the burgeoning population (Growth rate 2.17) (BBS, 1996). According to Haque (1991) only 7 per cent of land area is covered by trees. The average rate of deforestation in Bangladesh is about 10,000 hectares per year (WRI, 1990). As a result, serious imbalances have already been created in the eco-systems. Land in Bangladesh is scarce. There is no scope of horizontal expansion of forest plantation. It is really a dilemma for the government to maintain a balance between sufficiency in food and environmental equilibrium. In this situation agroforestry i.e, growing of trees and crops in the same field can play a vital role in this regard.

The date palm (*Phoenix sylvestris*) is grown well in Bangladesh where juice is the primary economic product. Extraction of juice starts from the 5th or 6th year after planting or emergence of the tree. During the tapping season, 200-250 litres juice is obtained from one tree from which 25-30 kg molasses (gur) can be prepared (Asaduzzaman *et al.* 1986). Thus, date palm can be an alternative source of sugar to supplement increased demand of sugar which may create a positive impact on sugar industry of Bangladesh.

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Date palm is also an important source of fuel, raw materials for manufacturing handicraft and generation of employment opportunity. Moreover, it acts as an insurance or economic security to farmers during the time of their economic hardship.

Date palm based agroforestry system is a promising cropping system of Bangladesh practiced in the Jessore region. But no systematic study has been undertaken to analyze profitability of date palm in agroforestry system. This study was, therefore, undertaken to assess economic potentiality of date palm in agroforestry system.

MATERIALS AND METHODS

Farm survey method was adopted to collect necessary data for this study. Keeping in mind the objectives of the study, Bagherpara and Sadar upazilla of Jessore district were selected purposively, because those two thanas are very much famous for date palm based agroforestry system. After preliminary visit to two upazillas, Panchbaria and Gaherpur village of Sadar upazilla and Gadighat village of Bagherpara upazilla of Jessore district were finally selected. Direct interview method was followed to collect data. The primary data were collected through an interview schedule from 60 randomly selected date palm based agroforestry practicing farmers from a population of 181 farm families of those three villages. The data for the period of March 1997 to February 1998 were collected. Collected data were compiled, coded, tabulated and analyzed for achieving objectives of the study. To assess economic viability of date palm in agro-forestry system gross margin analysis have been performed. In order to arrive a meaningful conclusion, tabular technique of analysis was intensively used. An intertemporal budgeting technique was also adopted to determine discounted benefit-cost ratio (BCR), net present value of benefit (NPV) and internal rate of return (IRR) for date palm component in the system. The BCR, NPV and IRR are estimated as follows:

Benefit-cost ratio (BCR): It is the ratio of discounted benefit divided by discounted cost. It implies the benefit derived per unit of investment.

$$\text{Benefit-cost ratio} = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+i)^t}}$$

Where;

Bt = Benefit from date palm product and by-product in t year,

Ct = Cost of date palm cultivation and product processing in t year,

t = Number of years (1, 2, 3, ... n) and

i = Interest rate.

Net present value (NPV): This is the present value of cash flow stream. It can be computed by subtracting total present value of cost from total present value of benefit.

Net present value = $\sum_{t=1}^{n} \frac{B_t - C_t}{(1+i)^t}$

B_t, C_t, t and i are defined as above.

Internal rate of return (IRR): It is the discounted rate which just makes net present value of cash flow equal to zero. It represents the highest possible rate of return from an investment over project life. Internal rate of return is that discount rate at which NPV is zero. We calculated IRR by using the following operating formula:

$IRR = LDR + DTDR (NPV_L / ADPV)$

Where;

LDR = Lower discount rate,

DTDR = Difference between two discount rates,

NPV_L = Present value of cash flow at the lower discount rate and

ADPV = Absolute difference between the present value of cash flow at two discount rates.

To determine profitability of date palm in agroforestry system, the costs and returns were estimated. Cost includes human labour, fuel cost and cost of chemicals for molasses and solid gur preparation. Return of date palm comes from different sources. Juice is the primary product, molasses and solid gur are the major processed product. Timber and other materials were considered as by-product.

RESULTS AND DISCUSSION

Five major cropping patterns with date palm based agroforestry systems were identified in the study area. These were Aus-Fallow-Lentil, Fallow-Aman-Boro, Aus-Aman-Mustard, Aus-Fallow-Wheat and Jute-Aman-Lentil. Cost and return analysis for date palm cultivation in different cropping patterns are presented in Table 1. Gross cost for date palm in selected five patterns ranged from Tk.5,611.00 to Tk.8,468.00 and gross return ranged from Tk.23,929.00 to Tk.30,630.00/ha. The highest gross return per ha was obtained in Aus-Fallow-Wheat pattern. Net return/ha ranged from Tk.18,318.00 to Tk.22,163.00. The highest net return/ha was also obtained in Aus-Fallow-Wheat pattern with a tree density of 172/ha.

It was observed that tree density varied in different cropping pattern. Number of tree in different cropping pattern ranged from 91 to 172/ha. Net return per tree ranged from Tk.129.00 to Tk.202.00. The highest net return per tree was obtained from the plantation of 91 trees per ha in Jute-Aman-Lentil pattern. It is evident from the study that with increase of tree density both gross and net return per hectare increase but net return per tree is decreased. The BCR (undiscounted) for date palm in selected cropping patterns ranged from 3.58 to 4.26. The highest BCR was obtained from Jute-Aman-Lentil pattern with a tree density of 91/ha and the lowest BCR was observed in Aus-Fallow-Wheat pattern with a tree density of 172/ha. It implies that return over per unit cost decreases with the increase of tree density. Considering all the cropping patterns average

141kg solid gur, 866 kg molasses and 843 litre juice was obtained from 124 trees ha^{-1} as a supplement of sugar. Besides, 3.02 tons of timber and 3.56 tons of fire wood were also obtained which make a total net return of Tk.19,471.77 ha year. Table 2 shows intertemporal budgeting which includes gross cost, gross benefit and cash flow of date palm cultivation by age of trees, over a life span of 15 years. Agroforestry system showed that discounted BCR was 3.89, NPV of benefit was Tk.103770/ha and IRR was 138% which clearly indicated a high profitability of date palm in agroforestry system.

It is evident from the study that date palm in agroforestry system may be an alternative contrivance to supplement increased demand for sugar as well as an economic enterprise for the farmer. Intertemporal budgeting also indicated a high profitability of date palm in agroforesry system. So it can be concluded that date palm in agroforestry system has a great economic potentiality.

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Table 1. Cost and return from date-palm in different cropping pattern.

Item	Cropping Pattern											
	Aus-Fallow-Lentil		Fallow-Aman-Boro		Aus-Aman-Mustard		Aus-Fallow-Wheat		Jute-Aman-Lentil		All	
	Quantity	Cost/return	Quantity	Cost/return	Quantity	Cost/return	Quantity	Cost/return	Quantity	Cost/return	Quantity	Cost/return
No. of tree/ha	136.69	-	118.24	-	104.26	-	172.21	-	90.50	-	124.38	-
A. Gross cost (Tk./ha)	-	**6016.50**	-	**7302.65**	-	**6435.45**	-	**8467.52**	-	**5611.35**	-	**6766.69**
Human labour (m/d)	91.88	4802.20	125.87	5883.29	107.17	4995.84	150.00	6749.99	88.55	4588.05	112.69	5403.87
Fuel wood (ton)	1.373	926.21	1.581	1167.64	1.564	1154.12	1.828	1352.97	1.032	810.78	1.47	1082.34
Other cost*	-	288.08	-	251.72	-	285.49	-	364.65	-	212.52	-	280.49
B. Gross return (Tk/ha)	-	**24779.38**	-	**26129.44**	-	**25723.87**	-	**30630.15**	-	**23929.46**	-	**26238.46**
a) Product												
Solid gur (kg)	117.77	3081.15	137.26	3751.81	147.38	2947.95	193.65	3988.36	107.12	3064.11	140.64	3366.68
Molasses (Kg)	864.23	17284.52	755.13	14917.19	970.35	13239.50	1123.87	17554.19	718.72	14129.71	886.46	15425.02
Juice (liter)	657.07	1314.14	978.29	1956.56	867.72	1563.61	800.28	1752.69	913.50	2283.79	843.37	1774.16
b) By Product												
Timber (ton)	1.106	1247.15	2.845	3168.61	4.585	5158.81	3.982	3750.25	2.573	3830.30	3.02	3431.02
Fuelwood (ton)	2.744	1852.43	3.164	2335.26	4.943	2813.75	4.916	3584.66	2.063	1621.55	3.56	2441.53
C. Net return (Tk./ha)	-	**18762.89**	-	**18826.78**	-	**19288.42**	-	**22162.63**	-	**18318.11**	-	**19471.77**
Net return per tree	-	**137.27**	-	**159.23**	-	**185.00**	-	**128.69**	-	**202.41**	-	**162.52**
Benefit-cost-ratio	-	**4.12**	-	**3.58**	-	**4.00**	-	**3.62**	-	**4.26**	-	**3.92**

* Other cost includes cost of pot for molasses, chemicals used in molasses processing.

Table 2. Intertemporal budgeting (per ha) for date-palm plantation in agroforestry system for 15 years

Age of Date-palm (Years)	Gross cost (Tk.)	Gross benefit (Tk.)	Cash flow (Net benefit)	Cost discounted at 12%	Benefit discounted at 12%	Cash flow discounted at 12%	Cash flow discounted at 100%	Cash flow discounted at 150%
1	905	-	-905	808	-	-808	-453	-362
2	206	-	-206	164	-	-164	-52	-33
3	412	618	206	293	440	147	26	13
4	824	1236	412	523	785	262	26	11
5	1177	1854	677	667	1051	384	21	7
6	10446	40978	30532	5296	20776	15480	476	125
7	10446	40978	30532	4722	18522	13800	238	49
8	10446	40978	30532	4220	16555	12335	119	20
9	10446	40978	30532	3771	14793	11022	60	8
10	10446	40978	30532	3364	13195	9831	30	3
11	10446	40978	30532	2998	11761	8763	15	1
12	10446	40978	30532	2685	10531	7847	7	1
13	10446	40978	30532	2392	9384	6992	4	-
14	10446	40978	30532	2141	8400	6259	2	-
15	10446	73944	63498	1912	13533	11620	2	-
Total				35956	139726	103770	521	-157

$$\text{Discounted BCR} = \frac{139726}{35956} = 3.89$$

NPV = 139726-35956 = 103770

$$\text{IRR} = 100+(150-100)\left\{\frac{521}{521-(-157)}\right\} = 138$$