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PROFITABILITY OF BETEL LEAF (*Piper betle* L.) CULTIVATION IN SOME SELECTED SITES OF BANGLADESH

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Abstract

The study was conducted in four betel leaf growing areas, namely Barisal, Chittagong, Rajshahi and Kustia district during 2013-14 to assess the cultivation practices, physical productivity, profitability, and to explore the constraints to betel leaf cultivation. The study has been designed to investigate the economics of betel leaf production considering intensive cultivated areas for recent information in Bangladesh. From each district, two upazilas were selected considering the concentration of betel leaf growers and easy access. Also from each upazila, two blocks and from each block 20 farmers were selected with the consultation of Upazila Agriculture Officer and Sub Assistant Agriculture Officer. The study revealed that betel leaf cultivation was profitable in the study areas, although BCR in the first and second years was below one which was due to high initial cost. The highest yield and gross return of betel leaf cultivation were in the fifth year. The benefit cost ratio was found highest in 6-10 year followed by 5th and 11-15 year. The benefit cost ratio at 12%, 15% and 20% rate of interest were 1.27, 1.25 and 1.21 respectively. Internal rate of return (IRR) was calculated 62% in current situation, IRR 37% was found by 10% decrease of return and 39% by 10% increase of cost. The problems like leaf rot disease, high price of boroj materials, low price of betel leaf, high price of oilcake, etc. were facing by the betel leaf farmers.

Keywords: Betel leaf, BCR, IRR, NPV, Constraints.

Introduction

Betel leaf (*Piper betle* L.), locally known as *Paan*, is a masticatory having important socio-cultural and ceremonial uses in South and Southeast Asia, significant medicinal properties and nutritional values. The vine is native to Southeast Asia including Bangladesh which is thought to be one of the cradles of earliest agriculture. The betel leaf plant is an evergreen and perennial creeper, with glossy heart-shaped leaves and white catkin. It is a native of central and eastern Malaysia, which spread at a very early date throughout tropical Asia and later to Madagascar and East Africa (www.efymag.com/ admin/issuepdf/ Betel%20Leaf_April-12.pdf).

Betel leaf a kind of pepper used in wrapping the pellets of betel nut and lime, is commonly chewed in the orient. Betel leaf is an important cash crop in our

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country and is considered to be one of the ingredients for social entertainment. It has also a sharp taste and good smell, improves taste and appetite, tonic to the brain heart, liver, strengthens the teeth and clears the throat.

Table 1: Area and production of betel leaf in Bangladesh

Year	Area (ha)	Production (tons)	Yield (t/ha)
1995-96	13943	71910	5.16
1996-97	14595	77035	5.28
1997-98	14832	79080	5.33
1998-99	13820	73525	5.32
1999-00	15063	78780	5.23
2000-01	15346	82260	5.36
2001-02	14696	80540	5.48
2002-03	15472	83830	5.42
2003-04	16480	93425	5.67
2004-05	16771	93820	5.59
2005-06	16275	97415	5.99
2006-07	16536	101240	6.12
2007-08	17346	97947	5.65
2008-09	17643	105448	5.98
2009-10	17871	91681	5.13
2010-11	18247	105953	5.81
Mean	15934	88368	5.53
CV (%)	8.84	12.81	5.63
Growth rate (%)	1.80	2.50	0.70

Source: BBS, 2011

In 2010-11, the total betel leaf area was 18,247 ha (31% higher than the area in 1995-96) with a production of 1,05,953 tons (47% higher than the production in 1995-96) in Bangladesh. The area of this crop has been increasing at an increasing rate (1.8%) over the years (Table 1). Betel leaf has become a promising commodity with an increasing trend of export every year (Anonymous, 1984).

The country may earn a huge amount of foreign currency every year by exporting betel leaf in different countries. However, data and information regarding betel leaf production and the status of local and international marketing system are scarce in the country. A very few studies were conducted (Ahmed, 1985; Islam and Elias 1991 and Moniruzzaman, *et. al* 2008) regarding the profitability and

constraints to higher production as well as export potentiality of betel leaf production in Bangladesh. Earlier studies were conducted very limited areas and back dated. Thus, the present study has been designed to investigate the economics of betel leaf cultivation considering intensive cultivated areas. This study provides useful information to the policy makers to make policy guidelines for enhancing its production as well as its overall development in the near future. Therefore, the present study was undertaken with the following specific objectives:

1. To know the agronomic practices of betel leaf at growers level.
2. To determine the cost and return of betel leaf cultivation.
3. To estimate physical productivity and returns to investment in betel leaf cultivation, and
4. To find out the constraints of betel leaf cultivation at farm level.

Methodology

Study area and sampling technique: Multi-stage sampling technique was followed in this study. Four betel leaf growing districts namely Barisal, Chittagong, Rajshahi and Kustia were purposively selected. Again from each district, two upazilas were selected considering the concentration of betel leaf growers and easy access. Also from each upazila, two blocks were selected with the consultation of Upazila Agriculture Officer. A list of betel leaf growers from the selected blocks was prepared with the help of DAE personnel. Thus a total of $4\times2\times2\times16 = 256$ samples were randomly selected for the interview.

Data collection and period of study: Experienced field investigators with the direct supervision of the researchers collected data and information using a pre-tested interview schedule. Data were collected during the period of November to April, 2013-14.

Analytical technique: (a) Tabular method of analysis using descriptive statistics like average, percentage, ratio etc. was followed in presenting the results of the study. Data were categorized according to the age of betel leaf boroj. The age of the boroj were classified like 1^{st} year, 2^{nd} year, 3^{rd} year, 4^{th} year, 5^{th} year, $(6\text{-}10)^{th}$ year, $(11\text{-}15)^{th}$ year and (16 and above) th year. Because both cost of production and yield were vary year to year. Collected data were edited, summarized, tabulated and analyzed to fulfill the objectives of the study. (b) To measure the return to investment of betel leaf cultivating project appraisal technique. For measuring capital productivity, costs and returns were discounted at 12 %, 15% and 20% rate of interest. The Benefit cost ratio (BCR), Net present value(NPV) and Internal rate of return(IRR) in betel leaf cultivation were calculated with the help of following formula.

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

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

$$\text{Internal Rate of Return (IRR)} = \text{Lower discount rate} + \text{Difference between the discount rates} \times \frac{\text{Present worth of incremental net benefit stream (cash flow) at the lower discount rate}}{\text{Sum of the present worth of the incremental net benefit streams (cash flows) at the two discount rates, signs ignored}}$$

Where, B_t = Total benefit (Tk/ha) in t^{th} year

C_t = Total cost (Tk/ha) in t^{th} year

t = Number of year

i = interest (discount) rate.

Results and Discussion

1. Agronomic practices of betel leaf cultivation

Respondent farmers did not plough their land for betel leaf cultivation. They prepared their land by spading. The most appropriate planting time of the betel leaf is at the end of the rainy season mostly from July to October by the farmers. The respondent farmers used betel leaf vine as seed which was mostly local variety. Within local varieties, farmers mainly cultivated Mohanali, Chailtagota and Cherifuli in Barisal, Mithapaan, Dholshi in Chittagong, Banglapaan, Mithapaan in Rajshahi and Mistipaan, Khilipaan in Kustia district. Modern varieties of betel leaf are not available in the study areas. The average number of betel leaf seed (vine) was found to be 123845 to 172841 numbers per hectare. The average plant to plant distance was found 15.24-20.32cm and line to line spacing of betel leaf vine were found to be 45.72-55.88 cm in Barisal and Chittagong. But in Rajshahi and Kustia the line to line spacing were found 81.28-91.44 cm. The average number of earthing up, application of oilcake, weeding, spraying and irrigation were 1.96, 4.23, 1.86, 5.82 and 6.02 respectively (Table 2). In Table-1, the average number of irrigation was 6.02. But in

Rajshahi, it was more than 19 times. Naturally, Rajshahi is a dry area. Moreover the farmers of that area irrigated their betel leaf plot manually carrying water with different pots. For this reason more number of irrigation was needed.

Table 2. Agronomic practices of betel leaf production followed in the study areas.

Agronomic practices	Locations				
	Barisal	Chittagong	Rajshahi	Kustia	All area
Month of plantation: (%)					
July	50	75	25	-	37
August	-	-	-	20	5
September	33	-	-	-	11
October	17	25	75	80	47
Earthing of soil (No./year)	3.4	2.0	1.5	1.0	2.0
Oilcake application (No./year)	5.0	5.4	2.8	3.8	4.2
Weeding (No./year)	1.9	2.1	2.0	1.6	1.9
Insecticides use (No./year)	4.0	8.4	5.8	2.7	5.9
Irrigation (No./year)	1.9	0.8	19.2	2.2	6.0
Number of vine per ha	165820	172841	123845	134652	149290
Plant distance (cm)	15.24	14.25	20.32	19.82	17.38

2. Input use

Human labour was required for seed(vine) planting, application of manures, fertilizing, spraying, weeding, irrigation and harvesting. On an average, 1665 mandays/ha was required for betel leaf cultivation (Table 3). The number of human labour varied from one year to another year due to change in the number of weeding, spraying insecticides, irrigation, and harvesting. Use of human labour was highest in third year old boroj. It might be due to more use of cowdung, TSP and irrigation. Respondent farmers used cowdung 2.55 t/ha. The highest 9.85 t/ha was used during the second year while the lowest 0.32 t/ha was used in 11-15 years boroj. It was observed that farmers having 16-22 old boroj did not use cowdung at all may be due to the low response in production. On an average, farmers used 2.5 t/ha oilcake in betel leaf cultivation. The highest amount of oilcake 3.2 t/ha was used in the boroj which were 16-22 years of age while the lowest in 3 years old boroj. The betel leaf farmers applied chemical fertilizers like urea 202 kg/ha, TSP 296 kg/ha, MoP 33 kg/ha and gypsum 35 kg/ha. The application of urea and TSP was observed to be higher in the case of 16-22 years old boroj.

Table 3. Per hectare input used for betel leaf cultivation in the study areas.

Parameters	Period of cultivation (Year)								
	1st	2nd	3rd	4th	5th	6-10	11-15	16 -22	All
Observations	*n=19*	*n=23*	*n=48*	*n=44*	*n=37*	*n=55*	*n=30*	*n=11*	*n=256*
Human labour (mandays)	1385	1509	1694	1619	1693	1598	1522	1491	1665
Own	662	655	790	666	718	667	605	679	718
Higher	723	854	904	953	975	931	917	812	947
Seed(Vine)	123748								
Cowdung(ton)	5.5	9.9	3.7	2.2	4.9	3.2	3.8	-	2.5
Oilcake(ton)	2.4	2.5	2.3	2.3	2.3	2.6	2.5	3.2	2.5
Fertilizer (kg):									
Urea	117	207	165	202	213	211	190	248	202
TSP	386	321	343	276	237	208	239	452	296
MP	21	56	37	24	22	20	63	15	33
Gypsum	33	87	53	110	36	35	9	45	55
Others*	26	20	5	17	12	12	-	2	12

* Others indicate DAP, Zn, Boron, etc.

3. Cost of production

The cost of production included human labour, boroj making materials, seed (vine), manures, fertilizers, pesticides, irrigation, insecticides, etc. Rental value of land was treated as fixed cost and was included in the total costs. Seed (vine) cost was needed only for the first year. The highest cost (Tk 1088333/ha) was incurred in the first year due to initial investment on seed (vine) and boroj making materials. The lowest cost (Tk 885035/ha) was observed for the boroj aged ranged from 11-15 years (Table 4). Among the cost items of betel leaf cultivation human labour incurred the highest cost (50%) followed by boroj materials cost (26%).

4. Return

For estimating the yield of betel leaf, data were collected from the survey plot on the basis of local unit like bira, Sali, gadi, kuri, pon etc. After that yield data were converted into ton per hectare on the basis of average weight of betel leaf. On an average, the weight of 265 number of betel leaf is one kilogram (Moniruzzaman, 2008). On review of Table 3, it is observed that the yield started increasing during 2nd to 5th year and declined form thereafter. Among the betel leaf boroj,

Table 4. Per hectare cost (Taka/ha) of betel leaf cultivation in the study areas.

Parameters	Period of cultivation (Year)								
	1st	2nd	3rd	4th	5th	6-10	11-15	16-22	All
Observations	*N=19*	*n=23*	*n=48*	*n=44*	*n=37*	*n=55*	*n=19*	*n=11*	*n=256*
Human labour	415374	452671	508224	485694	507962	479331	456592	447296	499393(50)
Seed(Vine)	123748	-	-	-	-	-	-	-	-
Boroj materials	331792	276617	218067	233131	265255	231792	207407	281504	254973(26)
Manures:									
Cowdung	6435	11985	4516	2790	556	414	570	-	3117(.03)
Oilcake	92918	97730	85714	88049	86248	91669	99903	118497	95841(1)
Fertilizers :									
Urea	2307	3992	3191	3920	4178	4013	3464	4570	3870(.04)
TSP	9794	7842	8949	7163	5730	5092	5933	11070	7434(.08)
MP	323	886	595	400	361	328	1013	240	535(.005)
Gypsum	260	709	471	865	278	246	93	359	440(.004)
Others	985	545	716	2089	1453	1168	-	337	1091(.01)
Insecticide	16342	15886	18926	14184	17623	19194	21973	23169	18868(2)
Irrigation	19701	17428	21624	16749	18973	16759	12549	6699	18062(2)
Interest on opt. cap.	32982	32208	32330	32611	33625	32491	32300	33294	34065(3)
Rental value of land	43807	43807	43807	43807	43807	43807	43807	43807	45689(5)
Total cost	1088333	950321	942616	928663	985494	925891	885035	970843	989297(100)

Note: Figures in the parentheses are percent of total cost.

Table 5. Profitability of betel leaf cultivation in the study areas.

Item	Period of cultivation (Year)								All
	1st	2nd	3rd	4th	5th	6-10	11-15	16-22	
Observations	*n=19*	*n=23*	*n=48*	*n=44*	*n=37*	*n=55*	*n=19*	*n=11*	*n=256*
Yield(t/ha)	5.80	6.03	7.05	7.80	9.50	9.31	7.84	6.96	8.23
T. variable cost (Tk/ha)	504153	492317	494193	498485	513980	496652	493732	508927	520703
Gross return (Tk/ha)	703320	901711	1057955	1293160	1538651	1450796	1319287	1158579	1298985
Gross margin(Tk/ha)	289166	409393	563763	794676	1024672	954145	825555	649652	778282
Net return(Tk/ha)	51649	384808	558874	859750	1153620	913511	530785	115289	721116
BCR on full cost basis	0.73	0.95	1.12	1.39	1.56	1.57	1.49	1.19	1.38
BCR on cash cost basis	0.93	1.13	1.30	1.54	1.62	1.63	1.56	1.25	1.10
Returns to labour (Tk/man-day)	87	268	368	525	627	629	585	426	486

Table 6. Cost benefit analysis of betel leaf production in the study areas.

Year of boroj	Cost (Tk/ha)	Discount factor (DF)			Discounted cost at			Gross return (Tk/ha)	Discounted benefit at		
		12%	15%	20%	12%	15%	20%		12%	15%	20%
1	1088333	0.89	0.87	0.83	971726	946377	906944	793320	708321	689843	661100
2	950321	0.80	0.76	0.69	757590	718579	659945	901711	718838	681823	626188
3	942616	0.71	0.66	0.58	670935	619785	545495	1057955	753032	695623	612243
4	928663	0.64	0.57	0.48	590182	530966	447851	1293160	821827	739369	623631
5	985494	0.57	0.50	0.40	559196	489965	396048	1538651	873072	764982	618350
6-10	925891	0.51	0.43	0.33	469085	400288	310079	1450796	735019	627219	485869
11-15	885035	0.29	0.21	0.13	254426	190232	119115	1319287	379263	283572	177560
16-22	970843	0.16	0.11	0.05	158371	103753	52513	115858	18899	12381	6267
Total					5925083	5204426	4287452		7542975	6505648	5200813

the highest yield (9.50 t/ha) was found in the 5 years old boroj and the lowest yield (5.80 t/ha) in one year old boroj (Table 5). On an average, 8.23 t/ha betel leaf was harvested. Which was higher than national yield of 5.81 t/ha (BBS, 2011). Gross return was calculated through multiplying yield and price of betel leaf. Betel lean price was varied area to area and season to season. This ranged from Tk. 20 to Tk. 120. Average gross return was Tk. 1298985/ha in which the highest gross return was received in 5th year (Tk. 1538651/ha) and the lowest in 1st year (Tk. 793320/ha). Average gross margin was found (Tk. 778282/ha). On an average, Tk. 721116 was found as net return. Highest net retrun Tk. 1153620 was found in 5th year. Average returns to labour was found to be Tk. 486 which was higher than their opportunity cost (Tk 300/day). It was evident that labour use in betel leaf cultivation was profitable than the opportunity cost of labour.

5. Returns to investment

Normally, the best discount rate to use is the "opportunity cost of capital"- i.e., the profitability of the last possible investment in an economy given the total available capital. In most developing countries it is assumed to be somewhere between 10-12% (Gittinger, 1977). To calculate a range of benefit-cost ratio (BCR), net present worth (NPV) and internal rate of return (IRR), the costs and returns were discounted at 12%, 15% and 20% rate of interest.

Firstly, the cost and benefit streams were discounted in order to find their present worth. Dividing the present worth of the gross benefits by the present worth of the gross cost it was found that the benefit cost ratio to be 1.27, 1.25 and 1.21 at 12%, 15% and 20% rate of interest. Net present worth is the difference between the present worth of benefits and present worth of costs. The discounted gross benefit has present worth at 12%, 15% and 20% rate of interest were Tk. 7542975/ha, Tk. 6505648/ha Tk. 5200813/ha and the discounted gross cost has present worth of Tk 5925083/ha, Tk 5204426/ha, Tk 4287452/ha (Table 6). The difference between the two net present worth at 12%, 15% and 20% discount rate is Tk 1617892/ha, Tk 1301222/ha, Tk 913361/ha. It signifies that betel leaf cultivation in the study areas is profitable.

Table 7. Rates of returns on investment in betel leaf production in the study areas.

Item	Discount factor (DF)		
	@12%	*@15%*	*@20%*
BCR	1.27	1.25	1.21
NPV (Tk)	1617892	1301222	913361
IRR (%)		62%	

The IRR for the investment is that discount rate which nullifies the present worth of cash flows and outflows. It represents the average earning power of

the money used in the project over the project life. In betel leaf project, IRR is 62%. It is acceptable, because it is much higher than the opportunity cost of capital (Table 8).

Sensitivity Analysis

To make a valid generalization it was necessary to conduct sensitivity analysis. This table has been reworked separately to see what happens on the profitability of betel leaf under varying conditions. The cost of betel leaf cultivation was considered constant, while benefit decreases at the rate of 10% or if benefit of the betel leaf cultivation remains the same but all costs increase at the rate of 10% then what would be the outcome.

Table 8. Result of sensitivity analysis of betel leaf cultivation in the study areas.

Situation	Discount measures		
	BCR at 12%	NPV at 12%	IRR (%)
Base parameter	1.27	Tk. 1617892	62
Decrease of return:			
10%	1.04	Tk. 271086	37
Increase of gross cost:			
10%	1.16	Tk. 102583	39

The results of sensitivity analysis considering the above mentioned situation are presented in Table 8. It was revealed from the table 7 that BCR of betel leaf is greater than one, NPV is positive at 12% discount rate and IRR is also higher than the opportunity cost of capital. This implies that if the returns decrease at 10% the cost of betel leaf remains unchanged investment in betel leaf is profitable from the point of view of the owner. Again, BCR of the betel leaf is greater than one. NPV is positive and IRR is higher than the opportunity cost of capital, if gross cost increases at 10% the returns remain same. This means that the owner of betel leaf boroj can also make profit if all costs slightly increase in near future. The result of the study indicates that the owners of betel leaf boroj can earn profits under changing situation.

Constraints

Every farmer opined one or more than one problems (Table 9). Leaf rot disease was a common problem in the study areas. About 79% farmers opined that it is a serious problem for betel leaf cultivation. High price of boroj materials was another problem reported by the farmers. Many farmers reported that vine died at the end of the vine and sometimes 2-3 ft upper was a common problem which hampered the betel leaf production. About 45% farmers faced the problem of capital shortage during betel leaf cultivation. Cumbersome procedure of

institutional credit was also a common problem in the study area. Price of betel leaf is very low during rainy season i.e. during the months of June to August. Regarding seed (vine), respondents had mentioned the problem of non-availability of quality seed. They did not know about the modern varieties of betel leaf. Though BARI released two betel leaf varieties but these were not reached to the farmer's field. Farmers used much quantity of oilcake in their boroj. Some of the responded opined that price of oilcake was very high. For this reason some of the farmers were unable to apply oilcake according to their desired level. Huge number of labour is required for betel leaf cultivation. About 17% farmers faced the problem of non-availability of labour. Non-availability of irrigation water was also a problem opined by 13% respondent. It is essential to irrigate the betel leaf boroj during dry period. High price of insecticides was also mentioned by 7% farmers. Besides, some farmers mentioned that insect infestation, excess cold, lack of transportation facilities were also the constraints of betel leaf cultivation.

Table 9. Constraints faced by the respondent betel leaf growers in the study areas.

Constraints	% of responses (*n=256)*
1. Infection of leaf rot disease	79
2. High price of boroj materials	56
3. Seed (vine) died	52
4. Lack of capital	45
5. Low price of betel leaf	41
6. Non-availability of modern varieties	32
7. High price of oilcake	21
8. Non-availability of labour	17
9. Non-availability of irrigation water	13
10. High price of insecticides	7
11. Others*	27

* Others indicate insect infestation, excess cold, lack of transport facilities etc.

Conclusion and Recommendation

The study has estimated the agronomic practices, profitability, returns to investment of betel leaf cultivation and constraints to its cultivation at farm level. The benefit cost ratio, net present worth and internal rate of return indicate that betel leaf cultivation is profitable. Sensitivity analysis also indicates that the owners of betel leaf boroj can earn profit under changing situation. Although betel leaf cultivation is profitable, but farmers faced various problems such as infection of leaf rot disease, high price of boroj materials, vine died, lack of

capital, low price of betel leaf, high price of oilcake, non-availability of modern variety, labour scarcity, and lack of irrigation water.

For controlling leaf rot disease of betel leaf, pathologist may conduct research on this aspect. It is also imperative to carry out more research on developing high yielding varieties of betel leaf and develop appropriate production technologies for maximizing the yield as well as income and minimizing the cost. Extension works with publicity need to be strengthened to popularize the modern varieties of betel leaf in order to expand its cultivation area.

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