ISSN 0258-7122 (Print), 2408-8293 (Online)
Bangladesh J. Agril. Res. 42(2): 343-351, June 2017

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

Q. M. S. ISLAM[1] AND M. A. MATIN[2]

## Abstract

The study was conducted in three betel leaf growing districts, namely Noakhali, Rajbari and Khulna during 2015-16 to assess the agronomic practices, profitability and to explore the constraints to betel leaf cultivation. The study revealed that betel leaf cultivation was profitable, although benefit cost ratio (BCR) in the first and second year were below one due to high investment cost and low yield. The highest yield and gross return were received by the farmers in the fourth year. The BCR was found highest in fourth year followed by third year and fifth year. The BCR at 12%, 15% and 20% rate of interest were 1.16, 1.15 and 1.14, respectively. IRR was 59% in current situation, 42% by 5% decrease of return and 52% by 5% increase of cost. The result indicated that betel leaf cultivation was profitable under changing situation of sensitivity analysis. Farmers faced some constraints like leaf rot disease, high price of *boroj* materials, non-availability of modern variety, low price of betel leaf, high price of oilcake, vine died, lack of capital, etc. Therefore, breeders should take initiative to develop high yielding varieties of betel leaf and pathologist may conduct research on betel leaf for controlling diseases.

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

## 1. 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 leave 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. The cultivation of this crop is spread throughout Bangladesh. The total betel leaf area is 22413 ha and production is 136284 MT in Bangladesh. The mean of area, production and yield were 16066, 89241 and 5.52 t/ha, respectively. The standard deviation of area was 2569, production was 21224 and yield was 0.41. The growth rate of area, production and yield were

[1]Principal Scientific Officer and [2]Chief Scientific Officer, Agricultural Economics Division, Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh.

2.27%, 3.06% and 0.79% respectively during the period from 1991 to 2013 (Table 1).

**Table 1. Area, production and per hectare yield of betel leaf in Bangladesh from 1990-91 to 2012-13**

| Year | Area (ha) | Production (MT) | Yield/ha (ton) |
|---|---|---|---|
| 1990-91 | 13320 | 67460 | 5.06 |
| 1991-92 | 13524 | 68810 | 5.09 |
| 1992-93 | 13628 | 70350 | 5.16 |
| 1993-94 | 13842 | 71485 | 5.16 |
| 1994-95 | 13949 | 72460 | 5.19 |
| 1995-96 | 13943 | 71910 | 5.16 |
| 1996-97 | 14595 | 77035 | 5.28 |
| 1997-98 | 15832 | 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 |
| 2011-12 | 22917 | 151814 | 6.62 |
| 2012-13 | 22413 | 136284 | 6.07 |
| Mean | 16066 | 89241 | 5.52 |
| Standard deviation | 2569 | 21224 | 0.41 |
| Growth rate (%) | 2.27 | 3.06 | 0.79 |

Source: BBS, 2013. MT= metric ton.

Betel leaf is an important cash crop in our 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. 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, 198; 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. Thus, the present study is designed to investigate the economics of betel leaf production in Bangladesh. 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:

i. To examine the agronomic practices of betel leaf cultivation.
ii. To find out the profitability level of betel leaf cultivation.
iii. To explore the constraints of betel leaf cultivation.

## 2. Methodology

*Sampling technique:* Multi-stage sampling technique was followed for the study. Three betel leaf growing districts namely Noakhali, Rajbari and Khulna were selected purposively in east, mid-western and western areas of Bangladesh. Previously in others studies another 6 betel leaf growing areas were considered. Again from each district three upazilas were selected considering the concentration of betel leaf growers and easy access. From each upazila one block considering intensive betel leaf growing area was selected with consultation of Upazila Agriculture Officer. A list of betel leaf growers from the selected block were collected with the help of DAE personnel. Thus a total of 3 x 3 x 15 = 135 samples were randomly selected for the interview.

*Method of data collection:* Data were collected by the experienced field investigators with direct supervision of the researchers using a pre-tested interview schedule.

*Analytical technique:* Data were categorized according to the year of cultivation. The age of the boroj were classified like 1st year, 2nd year, 3rd year, 4th year, 5th year, 6-10th year and 11-20 th year. Collected data were edited, summarized, tabulated and analyzed to fulfill the objectives of the study. Tabular methods of analysis using descriptive statistics like average, percentage, ratio etc. were followed in presenting the results of the study. For measuring capital productivity, costs and returns were discounted at 12 %, 15% and 20% rate of interest. The BCR, NPV and IRR in betel leaf cultivation were calculated with the help of following formula.

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

$$\text{Internal rate of return} = \sum_{t=1}^{t=n} \frac{B_t - C_t}{(1+i)^t} = 0$$

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.

To make a valid generalization it was necessary to conduct sensitivity analysis. These tables have been reworked separately in this section to see what happens on the profitability of betel leaf under the varying conditions. For all the study areas, all costs of the betel leaf were considered constant while benefit decreases at the rate of 5% or if benefit of the betel leaf remains the same but all costs increase at the rate of 10% then what would be the outcome.

## 3. Results and Discussion

### 3.1 Production Technology

Farmers in the study areas prepared their land by spading for betel leaf cultivation. The farmers planted betel leaf from July to September. It was observed that farmers of Noakhali and Rajbari planted betel leaf within September. The farmers used betel leaf vine as seed. Farmers in all the areas cultivated local varieties of betel leaf. Within local varieties, farmers mainly cultivated mohanali and Jhalpaan in Noakhali, mistipaan in Rajbari and Jhalpaan in Khulna district. They did not know about modern varieties of betel leaf, though BARI developed two betel leaf varieties. On an average, per hectare betel leaf seed (vine) was found to be 114838.

On an average, number of earthing up was 3 times, application of oilcake was 4 times, weeding was 2 times, number of spraying was 3 times and irrigation was one time per year (Table 2). It was observed that, weeding was done more in Khulna and insect infestation was found more in Noakhali.

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

| Agronomic practices | Locations | | | |
|---|---|---|---|---|
| | Noakhali | Rajbari | Khulna | All areas |
| Time of plantation: (%) | | | | |
| July | 50 | 33 | 17 | 33 |
| August | 25 | 50 | 50 | 42 |
| September | 25 | 17 | 33 | 14 |
| Earthing (No./year) | 2.25 | 2.00 | 1.50 | 1.92 |
| Oilcake application (No./year) | 4.00 | 4.50 | 3.75 | 4.08 |
| Weeding (No./year) | 1.65 | 1.50 | 2.04 | 1.73 |
| Pesticides application (No./year) | 5.78(100) | 1.38(89) | 1.91(87) | 3.02(92) |
| Irrigation (No./year) | 0.44(42) | 1.07(67) | 1.29(23) | 0.93(53) |

Figures in the parentheses indicate percent farmer respondent.

### 3.2 Input use

Human labour was required for land preparation, seed (vine) planting, application of manures, fertilizing, spraying, weeding, irrigation and harvesting of betel leaf.

On an average, 1364 mandays/ha was required for betel leaf cultivation (Table 3). The numbers of human labour varied from one year to another year due to change in number of weeding, spraying pesticides, irrigation, and harvesting. Use of human labour was highest in first year due to land preparation, plantation of seed (vine) and *boroj* making in first year. In the study areas, farmers used 569 kg/ha/year cowdung. Highest (988 kg/ha/year) cowdung was used in 6-10 years while the lowest (76 kg/ha/year) was used in the fourth year. On an average, farmers used 2110 kg/ha/year oilcake in betel leaf cultivation which was highest (2429 kg/ha/year) in the fourth year *boroj*. The betel leaf farmers applied chemical fertilizers like urea 135 kg/ha/year, TSP 229 kg/ha/year and MP only 12 kg/ha/year. The application of urea and MP was highest in fourth year and TSP was observed to be highest in the fifth year 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 | All |
| *Sample number* | *n=4* | *n=13* | *n=25* | *n=24* | *n=25* | *n=33* | *n=11* | *n=135* |
| Human labour (mandays) | 1447 | 1409 | 1393 | 1434 | 1349 | 1317 | 1243 | 1364 |
| Own | 363 | 553 | 547 | 593 | 423 | 460 | 524 | 504 |
| Higher | 1084 | 856 | 845 | 841 | 926 | 857 | 719 | 860 |
| Seed (Vine no.) | 116245 | - | - | - | - | - | - | - |
| Cowdung(kg) | 0 | 0 | 640 | 76 | 962 | 988 | 216 | 569 |
| Oilcake(kg) | 2079 | 1906 | 2280 | 2429 | 2133 | 1974 | 1633 | 2110 |
| Fertilizer (kg): | | | | | | | | |
| Urea | 109 | 119 | 114 | 194 | 169 | 125 | 40 | 135 |
| TSP | 133 | 137 | 194 | 257 | 286 | 242 | 222 | 229 |
| MP | 0 | 15 | 0 | 25 | 17 | 5 | 15 | 12 |
| Others* | 43 | 45 | 25 | 59 | 21 | 20 | 33 | 32 |
| Pesticides (Tk/year) | 6006 | 6830 | 11120 | 5128 | 10458 | 8280 | 8310 | 8444 |

* Others indicate Gypsum, Zn etc.

### 3.3 Cost of production

Cost of production included human labour, *boroj* making materials, seed (vine), manures, fertilizers, pesticides, irrigation, pesticides etc. Rental value of land was treated as fixed cost and was shown in the total costs. Seed (vine) cost was needed only for the first year. The highest cost (Tk 1127272/ha) was observed in the first year due to seed (vine) and *boroj* making. The lowest cost (Tk 882806) was observed in the 11 and above years old *boroj* (Table 4). Among the cost items, human labour incurred the highest (49%) cost followed by *boroj* making cost.

### 3.4 Return

Betel leaf was harvested round the year but peak harvesting period was June to August. Regarding yield, 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 in ton per hectare on the basis of average weight of betel leaf. On an average, 265 number of betel leaf constituted 1(one) kg i.e. 1 ton equal to 265000 number of betel leaf (Moniruzzaman *et. al.*, 2008). It was observed that the yield started increasing during 2nd to 4th year and it declined thereafter. On an average, 8.28 t/ha betel leaf was harvested, which was higher than national yield (6.07 t/ha) (BBS, 2013). The highest yield 9.44 t/ha was found from four year old boroj and lowest yield of 6.81 t/ha from one year old boroj (Table 5). Price was found to vary area to area and season to season. This ranges from Tk. 20 to Tk. 100 per bira (80 no. of betel leaf). The price fall from March to May due to growing new leaves and peak production. Average gross return was obtained Tk. 1203258/ha with highest in 4th year (Tk. 1448751/ha) and lowest in 1st year (Tk. 922178/ha). Average gross margin was found Tk. 689875/ha which was also highest in 4th year (Tk. 941193/ha) and lowest in 1st year (Tk. 304015/ha). Highest BCR on full cost basis was found in 4th year (1.50) followed by 3rd and 5th year 1.27.

### 3.5 BCR, NPV and IRR

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 benefit-cost ratio (BCR), net present value (NPV) and internal rate of return (IRR) the cost and returns were discounted at 12%, rate of interest.

Firstly, the cost and benefit streams of 15 years 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 measured benefit cost ratio to be 1.16, 1.15 and 1.14 at 12%, rate of interest.

The most straightforward discounted cash flow measures of the project worth are the net present worth. It is the difference between the present worth of benefits and present worth of costs. The discounted gross benefit has present worth at 12%, rate of interest were Tk.8353017/ha and the discounted gross cost has present worth of Tk 7184153/ha (Table 6). The difference between the two net present worth at 12% discount rate is Tk 1168864/ha. It signifies that betel leaf cultivation is profitable (Table 7).

The internal rate of return 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, the internal rate of return is 59%. It is acceptable, because it is much higher than the opportunity cost of capital.

**Table 4. Per hectare cost of betel leaf cultivation in the study areas**

***Taka/ha***

| Parameters | Period of cultivation (Year) | | | | | | | All |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th | 5th | 6-10 | 11-15 | |
| *Sample number* | *n=4* | *n=13* | *n=25* | *n=24* | *n=25* | *n=33* | *n=11* | *n=135* |
| Human labour | 531255 | 501728 | 476455 | 479802 | 466543 | 465355 | 443219 | 473850(49) |
| Seed(Vine) | 97612 | 0 | 0 | 0 | 0 | 0 | 0 | 2892 (0.30) |
| Boroj materials | 339794 | 326079 | 343148 | 313261 | 336198 | 318996 | 300692 | 325442(34) |
| Manures: | | | | | | | | |
| Cowdung | 0 | 0 | 640 | 76 | 962 | 988 | 216 | 569 (0.06) |
| Oilcake | 72861 | 66269 | 80325 | 89085 | 81028 | 73015 | 61009 | 77077(8) |
| Fertilizers : | | | | | | | | |
| Urea | 2131 | 2067 | 2122 | 3258 | 2969 | 2232 | 645 | 23829 (0.25) |
| TSP | 3335 | 3886 | 6128 | 6937 | 8586 | 7592 | 7038 | 6860 (0.71) |
| MP | 0 | 235 | 0 | 426 | 279 | 101 | 305 | 200 (0.02) |
| Others | 1801 | 1536 | 1381 | 1249 | 1143 | 1074 | 1408 | 1268 (0.13) |
| Pesticide | 6006 | 6830 | 11120 | 5128 | 10458 | 8280 | 8310 | 8444 (0.88) |
| Irrigation | 3314 | 2739 | 2767 | 4523 | 2804 | 2278 | 2413 | 2951 (0.31) |
| Interest on opt. cap. | 40441 | 32806 | 33563 | 33205 | 35659 | 33372 | 28827 | 33586 (3.48) |
| Rental value of land | 28724 | 28724 | 28724 | 28724 | 28724 | 28724 | 28724 | 28724 (2.98) |
| Total cost | 1127272 | 972899 | 986372 | 965676 | 975353 | 942007 | 882806 | 964246 (100) |

Note: Figures in the parentheses indicate the percentage of total cost.

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

| Item | Period of cultivation (Year) | | | | | | | All |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th | 5th | 6-10 | 11-15 | |
| *Sample number* | *n=4* | *n=13* | *n=25* | *n=24* | *n=25* | *n=33* | *n=11* | *n=135* |
| Yield(t/ha) | 6.81 | 7.08 | 8.63 | 9.44 | 8.53 | 8.14 | 6.82 | 8.28 |
| T. variable cost (Tk/ha) | 618164 | 501462 | 513040 | 507558 | 545069 | 510116 | 440642 | 513383 |
| Gross return (Tk/ha) | 922178 | 941263 | 1250055 | 1448751 | 1234057 | 1155084 | 1047648 | 1203258 |
| Gross margin(Tk/ha) | 304014 | 439801 | 737015 | 941193 | 688988 | 644968 | 607006 | 689875 |
| Rate of return: | 2.41 | 2.13 | 2.81 | 3.37 | 3.07 | 2.87 | 2.53 | 2.87 |
| Cash cost basis | | | | | | | | |
| Full cost basis | 0.82 | 0.97 | 1.27 | 1.50 | 1.27 | 1.23 | 1.19 | 1.25 |

Table 6. Benefit cost analysis of betel leaf production in the study areas

| Year | Cost (Tk./ha) | Discount factor (DF) | Discounted cost at | Gross return (Tk./ha) | Discounted benefit at |
|---|---|---|---|---|---|
| | | 12% | 12% | | 12% |
| 1 | 1127272 | 0.89 | 1006493 | 922178 | 823374 |
| 2 | 972899 | 0.80 | 775589 | 941263 | 750369 |
| 3 | 986372 | 0.71 | 702080 | 1250055 | 889764 |
| 4 | 965676 | 0.64 | 613705 | 1448751 | 920708 |
| 5 | 975353 | 0.57 | 553442 | 1234057 | 700237 |
| 6-10 | 942007 | 0.51 | 477250 | 1155084 | 585201 |
| 11-15 | 882806 | 0.29 | 253786 | 1047648 | 301174 |
| Total | | | 7184153 | | 8353017 |

### 3.6 Sensitivity Analysis

The results of sensitivity analysis are presented in Table 8. It was revealed 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 5%, the cost of betel leaf remains unchanged and investment in betel leaf is profitable from the point of view of the owner. On the other hand, if gross cost increases at 5% the returns remain same. This means that the owner of betel leaf boroj can also make profitable 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.

### 3.7 Constraints

Farmer's opinion on the constraints related to cultivation is highlighted in Table 9. Leaf rot disease was a common problem in the study areas. About 83% farmers opined that it is the serious problem for betel leaf cultivation. High price of boroj materials was another problem reported by 74% farmers. Sixty five percent farmers reported that non-availability of modern varieties were the common problem which hampered the betel leaf production. Price of betel leaf is very low during rainy season (June to August). Regarding high price of oilcake, seed (vine) died and lacks of capital were the major problems of betel leaf cultivation. Besides these, some farmers mentioned that insect infestation, excess cold were also the constraints of betel leaf cultivation.

**Table 7. BCR, NPV and IRR of betel leaf cultivation in the study areas**

| Item | Discount factor (DF) | | |
|---|---|---|---|
| | 12% | 15% | 20% |
| BCR | 1.16 | 1.15 | 1.14 |
| NPV | 1168864 | 935546 | 664394 |
| IRR | | 59% | |

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

| Situation | Discount measures | | |
|---|---|---|---|
| | BCR at 12% | NPV at 12% | IRR (percentage) |
| Current situation | 1.16 | 1168864 | 59 |
| Decrease of return: | | | |
| 5% | 1.10 | 751213 | 42 |
| Increase of gross cost: | | | |
| 5% | 1.11 | 809652 | 52 |

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

| Constraints | Percent farmer's responded |
|---|---|
| 1. Leaf rot disease | 83 |
| 2. High price of boroj materials | 74 |
| 3. Non-availability of modern varieties | 65 |
| 4. Low price of betel leaf | 55 |
| 5. High price of oilcake | 41 |
| 6. Seed (vine) mortality | 38 |
| 7. Lack of capital | 33 |
| 8. Others* | 15 |

* Others indicate insect infestation, excess cold etc.

## 4. Conclusions and Recommendations

All the betel leaf farmers in the study areas cultivated local varieties. The benefit cost ratio, net present worth and internal rate of return indicate that betel leaf cultivation is profitable for the farmers in the study areas. Sensitivity analysis also indicates that the betel leaf farmers can earn profit under changing situation. Cultivation cost of betel leaf is very high mostly due to more use of labour and high price of boroj materials. Farmers faced various constraints like, leaf rot disease, high price of boroj materials, non-availability of modern variety, low price of betel leaf, high price of oilcake, vine mortality, lack of capital etc.

Pathologist may conduct research on betel leaf for controlling diseases. It is also imperative to carry out more research on developing high yielding varieties of betel leaf and to develop appropriate production technologies for maximizing the yield as well as profit. Strengthening to popularize the BARI released varieties of betel leaf and to expand the cultivation area.

## References

Ahmed, A.U. 1985 Disease Problems of Betel Leaf Vine in Kushtia Area, Plant Pathology Division, BARI, Joydebpur, Gazipur.

BBS (Bangladesh Bureau of Statistics). 2013. Yearbook of Agricultural Statistics of Bangldesh. Statistical Division, Ministry of Planning. GOB. P. 114.

Gittinger, J.P. 1977. Economic Analysis of Agricultural Project. A World Bank Publication.]

Islam, M.N. and S.M. Elias. 1991. Production and Marketing of Betel leaf in selected areas of Bangladesh, Research Report No. 16, Agricultural Economics Division, BARI, Joydebpur, Gazipur.

Moniruzzaman, M.S. Rahman, M.A Hossain and Q.M. Alam. 2008. Betel Leaf Production and Its Market Potential on National and International Market. Annual Research Report, Agricultural Economics Division, BARI, Joydebpur, Gazipur.