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Agro-Ecological Perspective and Profitability of Betel Leaves Farming in Some Selected Sites of Purba Medinipur District

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Abstract: Betel leaves farming is a lucrative traditional cash crop in South-East Asia and India. Betel leaves popularly known as 'Pan', are produced in a closed shaded farm land called 'Boroj'. It is a means of livelihood of the small and marginal farmers and even landless people (lease-hold based cultivation). In India, states like West Bengal, Odissa, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra etc. with alluvial tracts, receiving a rainfall regime of more than 150 cm per annum are more favourable for betel leaves cultivation. West Bengal is the leading state in India for cultivation and production of betel leaves. This is a sensitive cash crop with some specific agro-ecological conditions. It favours alluvial soil mainly silty-clay loam, clay loam and sandy-clay loam. Soil pH 5 to 7 is more suitable for such cultivation practices. Annual rainfall of 150 cm spread out over 12 months is required for such a cash crop. Vine temperature must be within 10-25^{0}C. Considering this agro-ecological perspective, alluvial tracts of West Bengal produce huge betel leaves. The study revealed BCR in the first and second years was below one and optimum in fifth year (1.644098) means in the initial years cost of production is high compared to revenue. As time is required for the betel leaves plant to get matured to produce optimum number of leaves. The betel vine cultivation was profitable in the study areas. The BCR at 12%, 15% and 20% rate of interest were 2.09, 2.08 and 2.05 respectively.IRR was arrived in the study areas 103%, IRR 83% was found by 10% decrease in return, 94% by 10% increase in variable cost, and 91% by 10% increase in total cost. The status of financial feasibility is very impressive in the study areas. As in the study areas mitha variety betel vine was cultivated along with bangle variety and mitha variety is more profitable than bangle variety so its impact reflected in the analysis.

Present study opts to analyse agro-ecological condition and profitability analysis of betel vine cultivation in Purba Medinipur District. It is a quantitative analysis enriched with agro-ecological parameters and temporal trend of profitability. Ecological function, profitability perspective and sustainability are the thrust areas of this inquiry.

Key Words: **Betel vine, Cash Crop, Agro-Ecology, Profitability, BCR, IRR, NPV.**

Introduction

Betel leaf (Piper betle L.), locally known as 'Pan', is a perennial, evergreen, dioeciously creeper masticator having important socio-cultural and ceremonial uses in the most tropical and sun-tropical countries, significant medicinal properties and nutritional values. The vine is native to Southeast Asia including India which is thought to be one of the legends of earliest agriculture.

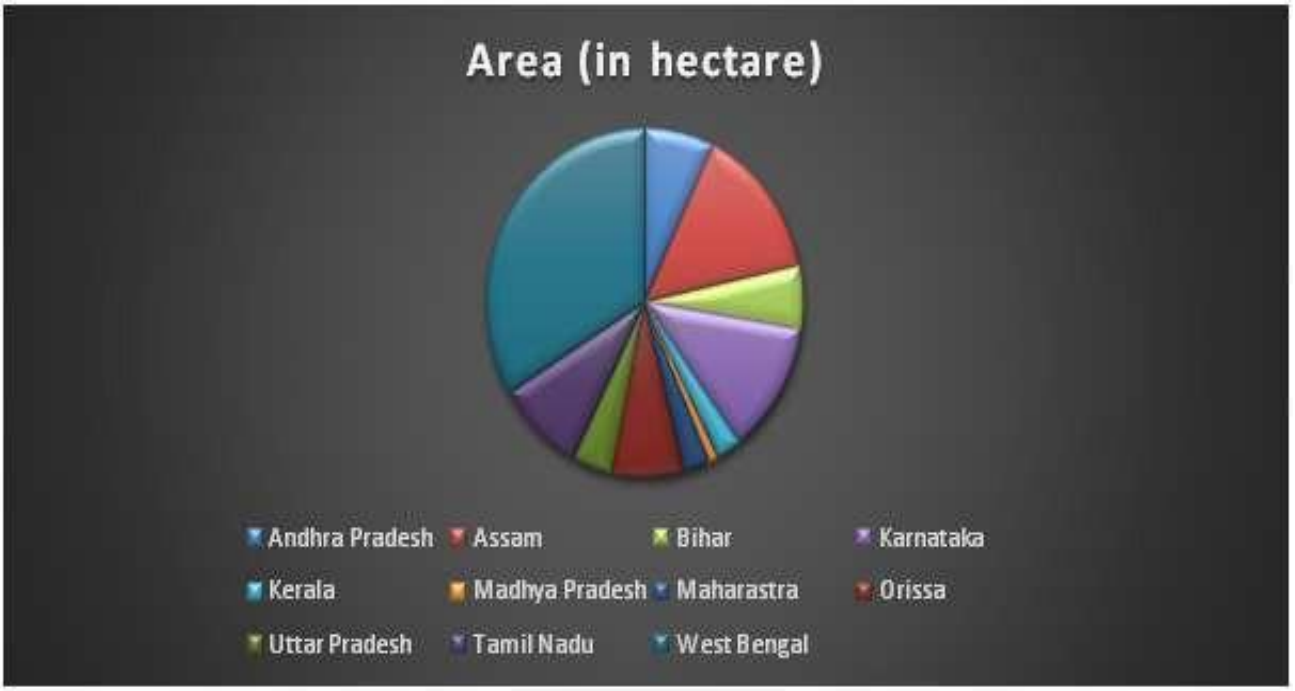
In fact, these edible leaves have achieved an esteemed position in human society right from the dawn of civilization, particularly in countries like Bangladesh, Burma, China, India, Indonesia, Malaysia, Nepal, Pakistan, Philippines, South Africa, Sri Lanka, Thailand etc. (Jana, 1996; Khoshoo, 1981; Samanta, 1994; Sharma et al., 1996), where leaves are traditionally used for chewing in their natural raw condition along with many other ingredients like sliced areca nut, slaked lime, coriander, aniseed, clove, cardamom, sweetener, coconut scrapings, ashes of diamond, pearl, gold and silver (Ayurvedic preparation), jelly, peppermint, flavouring agents, fruit pulp etc. (CSIR, 1969). It also has a sharp taste and good smell. Betel leaves are the age-old traditional cash crop of India as well as West Bengal concentrated mainly in the alluvial tract of this country with higher concentration in Andhra Pradesh, Assam, Bihar, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Uttar Pradesh, Tamil Nadu, West Bengal and other States. Area under Betel vine cultivation is as under-

Table-1. Area under Betel vine Cultivation in India

Sl. No.	States	Area (in hectare)
01	Andhra Pradesh	3865
02	Assam	7850
03	Bihar	3166
04	Karnataka	6682
05	Kerala	1280
06	Madhya Pradesh	600
07	Maharashtra	1419
08	Orissa	4007
09	Uttar Pradesh	2214
10	Tamil Nadu	4795
11	West Bengal	18203
12	Other States	600
	Total	**53140**

Source: QRT Report on AICRIP on Betel vine (1996)

Picture-1: Area under Betel vine Cultivation in India



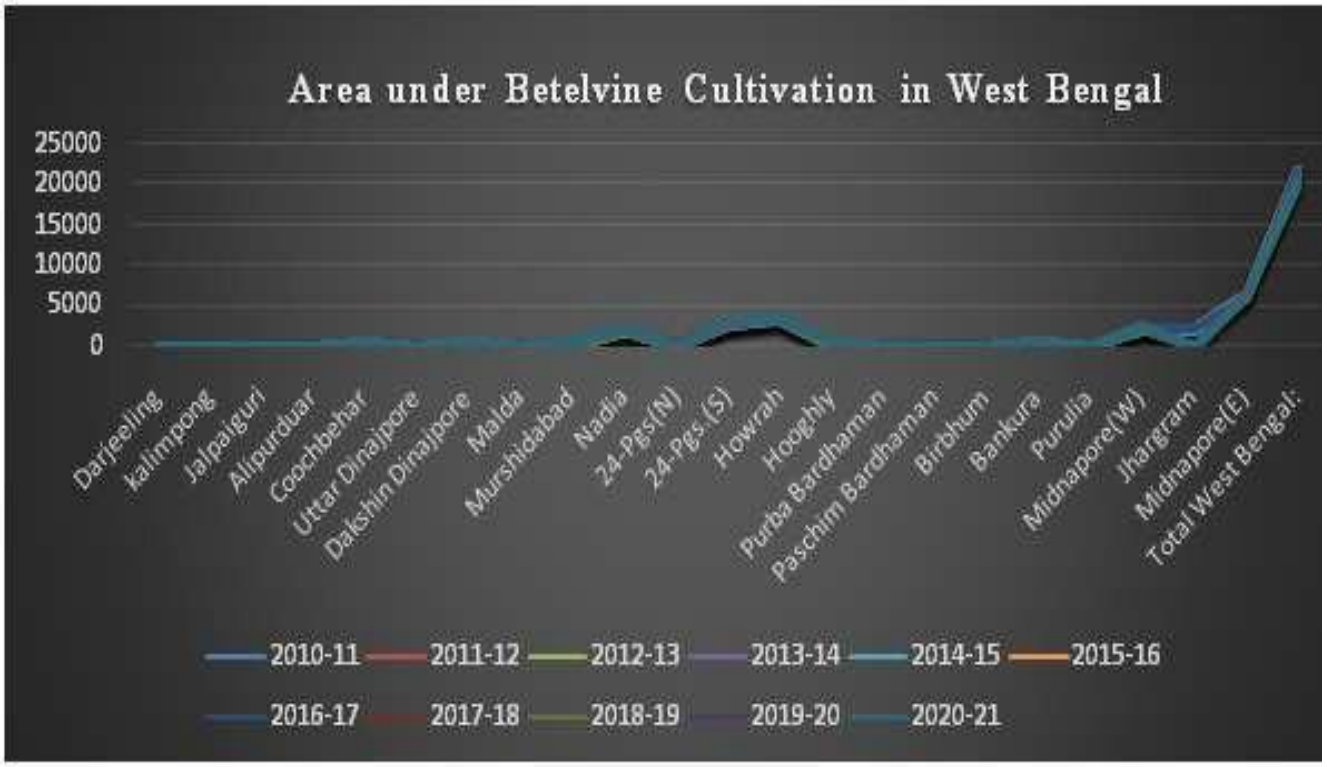
Source: QRT Report on AICRIP on Betel vine (1996)

Table-2. Area under Betel vine Cultivation in West Bengal

Sl.No.	Name of the District	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
		Area in ha	Area in ha	Area in ha	Area in ha	Area in ha	Area in ha	Area in ha	Area in ha	Area in ha	Area in ha	Area in ha
1	Darjeeling	31	29	30	30	31	31	32	22	25	28	28
2	kalimpong	0	0	0	0	0	0	0	10	12	13	13
3	Jalpaiguri	182	183	198	199	70	71	72	73	92	105	105
4	Alipurduar	0	0	0	0	131	132	132	134	148	152	152
5	Coochbehar	439	440	435	432	434	436	438	443	475	487	487
6	Uttar Dinajpore	179	194	214	225	228	235	236	237	270	275	275
7	Dakshin Dinajpore	271	270	271	270	271	270	271	272	306	312	312
8	Malda	186	181	186	187	190	196	197	199	217	225	225
9	Murshidabad	341	344	345	380	381	400	402	404	425	428	428
10	Nadia	1938	1945	1957	1952	1959	1961	1963	1967	2025	2035	2035
11	24-Pgs(N)	248	225	230	225	225	210	211	213	262	265	265
12	24-Pgs.(S)	2560	2685	2718	2736	2750	2781	2782	2785	2835	2840	2840
13	Howrah	3419	3425	3427	3423	3426	3450	3452	3455	3482	3495	3495
14	Hooghly	361	362	365	383	385	380	381	383	418	422	422
15	Purba Bardhaman	0	0	0	0	0	0	0	91	120	125	125
16	Paschim Bardhaman	80	81	82	86	85	87	88	0	0	0	0
17	Birbhum	38	39	39	39	38	34	35	36	37	38	38
18	Bankura	451	455	465	467	469	470	471	473	475	478	478
19	Purulia	0	0	0	0	0	0	0	0	0	0	0
20	Midnapore(W)	2144	2185	2180	2186	2190	2192	2193	2197	2236	2247	2247
21	Jhargram	2144	2185	2180	2186	2190	2192	2193	6	8	8	8
22	Midnapore(E)	6150	6175	6178	6180	6192	6202	6204	6210	6252	6262	6262
Total		**21162**	**21403**	**21500**	**21586**	**21645**	**21730**	**21753**	**19610**	**20120**	**20240**	**20241**

Source: Department of Food Processing Industries and Horticulture, Govt. of West Bengal

Picture-2. Area under Betel vine Cultivation in West Bengal (in ha)



Source: Department of Food Processing Industries and Horticulture, Govt. of West Bengal

West Bengal is top most (3rd) betel leaves producing state in India. West Bengal produces about 1,39,18,300 mote betel leaves (1 mot = 10,000 betel leaves) (Source: Department of Food Processing Industries and Horticulture, Govt. of West Bengal). Cultivation of betel vines provide a continuous source of income to the farming family unlike the major crops which provide income only once in a year or so. That apart, most of the major crops require some sorts of post-harvest processing for making the produce marketable but the betel leaves do not require any such processing at all. Moreover, the leaves may also be retained on the basis for about six months without any visual signs and symptoms of deterioration Bhowmick, 1997).

Betel leaves have become a promising commodity with an increasing trend of export every year (Anonymous, 1984). The country may earn a high amount of foreign currency every year by exporting betel leaves in different countries. As per report of Directorate General of Commercial Intelligence & Statistics (DGCIS), Govt. of India, India exported betel leaves to the tune of 6517.369 tonnes and earned foreign income to the tune of 459.729227 million rupees in the year 2021-22. Betel leaf (or *pan*) is one of the most important horticultural cash crops in the country and is widely used in religious rituals, for medicinal benefits and as an addictive substance. It is mostly cultivated by smallholder farmers (Jana, 2016) and is exported to a large number of locations (Agricultural and Processed Food Development Authority, 2018), offering employment to about 20 million people in different aspects of the trade (Palaniappan et al., 2012).

Thus, the present study has been designed to investigate the economics of betel leaves cultivation considering intensive cultivated areas. This study provides useful information to the 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:

a) To identify the agronomic practices of betel leaves at growers level

b) To know the agro-ecology of betel vine cultivation

c) To assess the cost-volume-profit of betel leaves cultivation

d) To investigate physical productivity and returns to investment in betel leaves cultivation

Methodology

Study Area: West Bengal is the leading state in terms of production, trade and export of betel leaves though by consumption, states like Uttar Pradesh, Rajasthan, Delhi and North Eastern states surpass West Bengal. This is a traditional cash crop found to be concentrated in the alluvial tracts of the states. Considering its overwhelming importance in production, marketing and trade within the nation, broadly the whole state is the study area. However considering its concentration of production the leading districts are Purba Medinipur (1), Howrah (2), Paschim Medinipur (3), S-24 Parganas (4), Nadia (5), Koch behar (6), Hoogly (7), Bankura (8), Dakshin Dinajpur (9), Uttar Dinajpur (10), N-24 Parganas (11), Murshidabad (12), Malda (13). The intensive study of this investigation concentrates on Purba Medinipur District.

Sampling Design and Sample Size: Diverse array of sampling design has been adopted for the forgoing research work. Multi-stage sampling technique was followed. Considering the agro-ecological variability and betel leaves variety, three agro-ecological zones are selected from Purba Medinipur District. Nandigram- II block is taken from silty clay zone with mitha and bangla (kali variety), Moyna block from clay zone with bangla (bargai variety) and Ramnagar-I block from sandy clay zone with bangla (birkuli and halud variety). Thus a total of 3x34=102 samples were randomly selected for study.

Data Collection and Period of Study: Researcher collected data and information using pre-tested inter- view schedule. Data and soil were collected during the period of April to March 2021-22.

Analytical Technique: (a) Graphical method was used to present results of soil test regarding soil texture, organic and inorganic matter present in the soil of betel vine cultivation study area. (b) Tabular method of analysis using descriptive statistics was followed in presenting the result of the study. Data were categorised according to the age of betel vine boroj. The age of the betel vine boroj were classified like 1st year, 2nd year, 3rd year, 4th year, 5th year, (6-10)th year, (11-15)th year and (16 and above)th year. As both cost and yield vary year to year. Collected data were edited, summarised, tabulated and analysed to fulfill the objectives of the study. (c) To calculate the return to investment of betel vine cultivation project appraisal technique was used.

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

Cost Benefit Ratio = $\frac{\sum_{t=1}^{t=n} \frac{C_t}{(1+i)^t}}{\sum_{t=1}^{t=n} \frac{B_t}{(1+i)^t}}$

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

Results and Discussion

(a) Agronomic Practices of Betel vine Cultivation

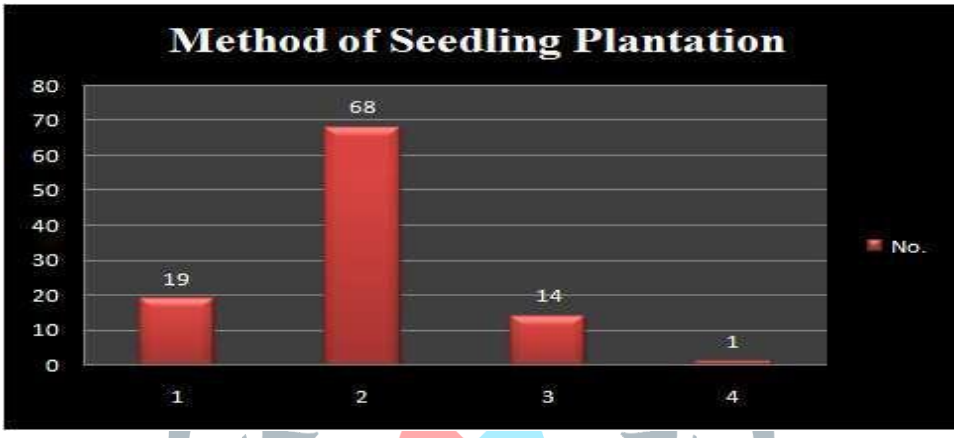
Farmers did plough their land for betevine cultivation. The appropriate planting time of the betel vine is during the winter season mostly from February to April. Majority of the respondent farmers used betel vine as seeds from outside sources which were mostly local variety from boroj of best quality betel plant. Four methods of seedling plantation were followed in the study area. 66% respondent growers choose two nodes seeds for plantation (i.e. method-2), followed by 19% respondent choose one node seed for plantation (i.e.method- 1), 14% choose five to seven nodes (i.e. method-3) and 1% choose full plant (i.e.method-4). The information is given below:

Table-3. Method of Seedling Plantation in Study Area

Method of Seedling Plantation	No. of Respondent
1	19
2	68
3	14
4	1
Total	10 2

Source: Field Survey

Picture-3. Method of Seedling Plantation in Study Area



Within local varieties, farmers mainly cultivated Banglapan(Kali) and Mithapan in Nandigram-II Block, Banglapan(Bargai) in Moyna and Banglapan(Birkuli and Halud) in Ramnagar-I Block. Modern Varieties of betel vine seeds are not available in the study areas. The Average number of betel vine plants was found to be 133520 numbers per hectare. Average plant to plant distance was found 9.38 cm and line to line spacing of betel vine plant row 53.34 cm. The average number of earthing up, fertiliser application, insecticides use and irrigation per year were 4.33, 8.41, 17.32, and 68.96 respectively.

Table-4. Agronomic Practices of Betel vine Cultivation in Study Areas

A gronomic Practic es	**All Areas**
N o. of Sample	102
M onth of Plantation (%)	
February	14.70588
March	7.843137
A pril	22.54902
Ma y	11.76471
June	18.62745
July	16.66667
A ugust	6.862745
September	0.980392
Earthing of soil (no./year)	4
Fertiliser Application (no./year)	8
Fungicide/Insecticide Application (no./year)	17
Irrigation(no./year)	69
N o. of Vines per ha	133519
Plant Distance (cm)	9.382353

Source: Field Survey

Table-5. Details of Sample in Study Areas

Size of Boroj	No.
Small	22
Medium	50
Large	30
Total	102
Variety of Betel Leaves	
Bangla	82
Mitha	20
Total	102

(b) Agro-ecology

The forgoing study incorporates the integrative perspective of betel vine agro-economy based industry of West Bengal. From such an integrative perspective, the linkage is the most important factors that include natural ecology, pedo-ecology, agro-ecology of production, transport and trade etc. Pedo-ecology and agro- ecology is the key factor for any type of agricultural production. While pedo-ecology considers soil texture, soil p^H, EC and soil nutrients especially, the agro-ecology considers climate, climatic variability along with soil characteristics. This study crops up the regional perspective of betel vine production under different pedo-ecological and agro-ecological zones. This is a sensitive cash crop with some specific agro-ecological conditions. It favours alluvial soil mainly silty-clay loam, clay loam and sandy-clay loam. Soil pH 5 to 7 is more suitable for such cultivation practices. Annual rainfall of 150 cm spread out over 12 months is required for such a cash crop. Vine temperature must be within 10-25°C. Considering this agro-ecological perspective, alluvial tracts of Purba Medinipur produce huge betel leaves. Status of agro-ecology of Purba Medinipur is as under.

Soil Characteristics

Three soil samples from each block were collected, resulting in twenty seven samples in total. The result soil tests are given below:

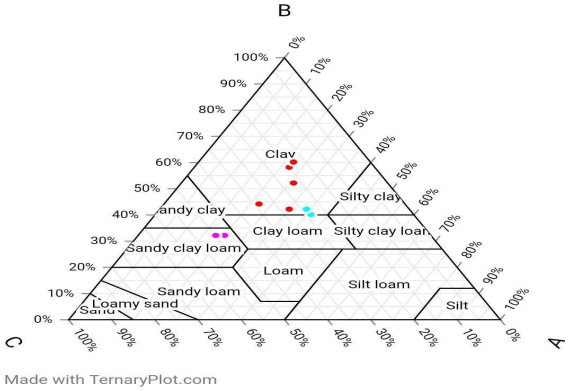
Table-6. Result of Soil Tests in Study Areas

Sample ID	Texture (%)			pH	EC (mS/cm)	Org. C (%)	Avl. N (kg/ha)	Avl. P_2O_5 (kg/ha)	Avl. K_2O (kg/ha)
	Sand	Silt	Clay						
S1	27.8	30.0	42.2	4.66	1.65	1.12	1134.2	577.8	512.7
S2	23.8	36.0	40.2	4.22	1.21	0.93	1568.0	584.7	632.5
S3	23.8	34.0	42.2	4.27	1.46	0.89	1693.4	647.5	573.6
S4	47.8	20.0	32.2	5.84	0.28	1.04	1066.2	257.7	764.3
S5	33.8	22.0	44.2	6.12	0.14	0.81	1254.4	80.8	499.4
S6	49.8	18.0	32.2	7.05	0.41	0.97	878.1	247.1	299.8
S7	21.8	26.0	52.2	5.86	1.25	1.16	1191.7	756.1	1634.6
S8	19.8	22.0	58.2	5.00	0.60	0.81	1254.4	712.7	420.7
S9	17.8	22.0	60.2	5.97	0.42	1.00	1129.0	778.7	317.2

Source: Field Survey

From the above table the texture of the study area represented in a Ternary Plot-

Soil Texture of the Study Area (Purba Medinipur)



Source: Field Survey

From the above Ternary Plot of Soil Texture it reveals most of the study areas are under clay and some parts are sandy clay loam to clay loam. As mentioned, betel vines grow best under shaded conditions, in diffused sunlight. Clay loams are ideal for good growth (Reddy, 2015), which are well-drained and having pH values between 5.6–8.2 (Guha, 2006), with suitable organic carbon content (Kalaivanan et al., 2019). Annual rainfall between 2250–4750 mm in a tropical humid regime is ideal for vine growth (Beura, 2017), while irrigation can sustain the crop in drier areas (Herath, 2015). The range of clay is 30-43%, silt is 20-40% and sand is 15-24% in the study area. So the area is suitable for good betel vine cultivation from the view point of soil texture. Another soil characteristics of the study areas reveals, p^H level 5-7 holds 63% plots of study area, EC level (0.4-0.8) holds 74% of plots of study area, Org.C level (>0.8) holds 63% plots of study area, 100% of plots of study area are above (400-600 kg/ha) Avl.N requirement, 100% of plots of study area are above (200-300 kg/ha) Avl.P_2O_5 requirement and 100% of plots of study area are above (200-500 kg/ha) Avl.K_2O requirement which are all favourable for betel vine cultivation (Maity, 1989;1997; Guha and Jain, 1997 and Jana, 1995). It flourishes well in areas with and annual rainfall of 225-475 cm and temperature ranging from 15-40ºC (Jana, 2006). The average annual rainfall is 1752.6 mm (175.26 cm) and average temperatures range from 25.5–38.6 °C. Under shaded condition average temperature ranges from 10-25ºC. Both the climatic conditions are suitable for betel vine cultivation with the proper arrangement of irrigation in the study areas.

(c) Cost-Volume-Profit Analysis

Cost

The cost of production includes fertiliser, micronutrients, manures, vitamin, fungicide, and maintenance of structure, labour charges, and cost of soil, irrigation charges, and rent of lease land, interest on loan, carriage inward, cost of marketing, depreciation on fixed assets and imputed cost. The details of cost of cultivation are shown in table below:

Table-7. Per hectare Cost (Rs./ha) of Betel vine Cultivation in the Study Areas

	Particulars	Per hectare Cost (Rs./ha) of Betelvine Cultivation in the Study Areas Period of Cultivation (Year)										
		*1	*2	*3	*4	*5	*6 - 10	*11 - 15	*16 & Above	All		(%)
	Observations	5	5	5	3	14	46	20	4	102		
	Production of Betel Leaves (in one ha)	308	743	1092	944	1009	915	798	690	855		
	Man-days per ha	2736	3022	2957	2859	3127	3307	2470	2120	2897		
	Baroj Size (in ha)	1	1	1	1	1	1	1	1	1	1	
VARIABLE COST	Fertiliser -Organic	206986	182752	209320	185458	261793	340864	101259	39375	218602		
	Fertiliser -Inorganic	95692	67310	85172	85324	117743	162445	38197	20000	98850	317452	7.23
	Micronutrients	72803	44668	65723	59246	97005	106623	13722	18500	65354	65354	1.49
	Manures	8957	13066	18891	13690	10379	8971	16153	17670	12600	12600	0.28
	Vitamin Cost	17250	20022	23047	19986	23797	24910	15886	14000	20675	20675	0.47
	Bio Fungicide	50385	12743	22500	25352	38905	57285	5212	0	31369		
	Inorganic Fungicide	49668	52770	58902	51915	69782	78008	55050	62500	65582	96951	2.21
	Bambo	4808	61283	69141	74296	92701	88997	78392	50500	77797		
	Coir & Fiber	481	4425	5469	7042	6452	7697	7187	5050	6667		
	Rope	481	5973	6445	6338	7626	7722	6697	5050	6769		
	Stick	9615	87168	94922	91549	106033	108700	91875	75750	95292		
	Straw	962	8407	8398	8451	9113	9997	12086	7575	9773		
	Net	0	13274	13672	14085	10172	8207	18681	25250	13002		
	Paper	481	5832	7813	10563	9873	12298	7972	5050	9250	218550	4.98
	Hired Skilled Labour	138462	184956	342969	238028	267668	300223	188948	195000	1856254		
	Hired Unskilled Labour	63462	80310	51563	130141	128920	121307	127172	0	107807		
	Family Labour	606779	735796	662266	646408	666479	735152	542057	571375	649059	2613120	59.5
	Irrigation Charges	112500	112500	112500	112500	112501	112501	112501	112500	112501	112501	2.56
	Interest on Loan	31250	33186	34766	31690	35681	37872	27564	23750	32861	32861	0.75
	Carriage Inward	24519	23894	25781	25352	28638	28723	25147	20000	26451	26451	0.6
	Packing	26442	36726	40234	35915	39906	39463	36643	35000	37705		
	Transport	40865	52212	53906	49296	58842	57447	43958	35000	50856		
	Commission	141202	191712	352609	308451	415834	455489	94489	0	282046		
	Others	10096	13274	11328	14789	12207	12563	8752	6250	10900	381507	8.69
	Total Variable Cost (Rs./ha)	1714146	2044259	2377337	2245865	2628050	2923464	1675600	1345145	3898022	3898022	
FIXED COST	Contractual Payment	0	124115	0	0	0	17224	33410	0	21057		
	Depreciation	95625	91115	91426	85507	82599	74928	34054	10258	61934		
	Rent of Own Land	132212	113717	130859	130282	131534	126165	124722	125000	126349		
	Interest on Own Capital	192269	205593	207797	189028	173155	153059	74447	30770	131244		
	Cost of Soil (Own)	157212	135841	155859	155282	158412	150747	148579	150000	150972	491556	11.2
	Total Fixed Cost (Rs./ha)	577318	670381	585941	560099	545700	522123	415212	316028	491556	491556	
	TOTAL COST (Normal)	2291464	2714640	2963278	2805964	3173750	3445587	2090812	1661173	4389578	4389578	100
	CASH TOTAL COST	2195839	2623525	2871852	2720457	3091151	3370659	2056758	1650915	4327644	4327644	

Source: Field Survey

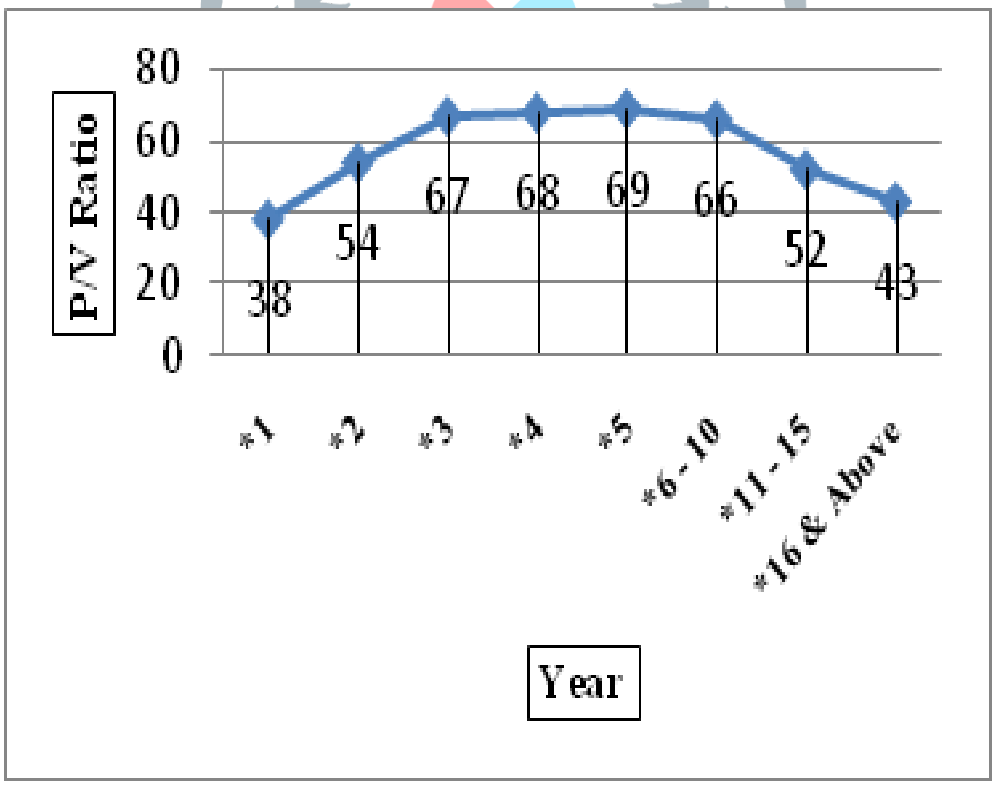
From table-7 (Per hectare Cost (Rs./ha) of Betel vine Cultivation in the Study Areas) it reveals that total variable cost per ha for 1st, 2nd, 3rd, 4th, 5th, (6-10)th, (11-15)th and (16 & Above)th years are Rs.1714146, Rs.2044259, Rs.2377337, Rs.2245865, Rs.2628050, Rs. 2923464, Rs.1675600 and Rs.1345145 respectively. Total fixed cost per ha for 1st, 2nd, 3rd, 4th, 5th, (6-10)th, (11-15)th and (16 & Above)th years are Rs.577378, Rs.670381, Rs.585941, Rs.560099, Rs.545700, Rs.522123, Rs.415212 and Rs.316028 respectively. Labour cost incurred is highest (59.5%) of total cost, followed by

cost of soil (own) is (11.2%) of total cost, marketing cost is (8.69%) of total cost, fertiliser cost is (7.23%) of total cost, maintenance cost is (4.98%) of total cost and other costs are not so remarkable. Variable cost to fixed cost ratio is 7.93:1. Total variable cost to total cost is 88.80%. Total fixed cost to total cost is 11.20%. As variable cost percentage is more, so, by good management of cost element under variable group can basically minimise cost of cultivation of betel vine. At the same time as different variety of betel vine cultivation has different character and effect of different agro- ecological and marketing conditions are different so critical analysis and linkages of those items can boost up production of betel leaves with minimum cost with quality leaves. Cost issue is not the sole consideration of successful cultivation quality of leaves should be taken care of.

Volume and Profit

Data was collected from the surveyed areas on the basis of local unit like goj, pon, tala, guchhi, etc. After that yield data is converted into mote per hectare. One mote is equal to 10000 betel leaves. Prices of betel leaves are also collected from the surveyed areas of farmers for different sizes and also for different varieties for different seasons. At the same time prices were collected from different markets for different sizes and also for different varieties for different seasons. Thereafter average prices were computed according to the sizes and varieties. The data were tabulated in Table-8 (Profitability of Betel vine Cultivation in the Study Areas). Cost- volume-profit means analysis of three variables viz., cost, volume, and profit. Such an analysis explores the relationship existing amongst cost, revenue, activity levels and the resulting profit. The P/V ratio is considered to be the indicator of the profitability of economic activity. P/V Ratio = (Contribution/Sales Value) 100. P/ V ratios of betel vine cultivation of 1st, 2nd, 3rd, 4th, 5th, (6-10)th, (11-15)th and (16 & above)th years are 38, 54, 67, 68, 69, 66, 52 and 43% respectively. The highest P/V ratio is 69% in the 5th year and lowest 38% in 1st year in the study areas. So, life cycle of betel vine cultivation from the view point of P/V ratios is given in picture below:

Picture-5. Life Cycle of Betel vine Cultivation in the Study Areas



Source: Field Survey

Table-8. Profitability of Betel vine Cultivation in the Study Areas

Particulars	Profitability of Betel vine Cultivation in the Study Areas								
	Period of Cultivation (Year)								
	*1	*2	*3	*4	*5	*6 - 10	*11 - 15	*16 & Above	All
Observations	5	5	5	3	14	46	20	4	102
Production of Betel Leaves (mote/ha)	308	743	1092	944	1009	915	798	690	855
Man-days per ha	2736	3022	2957	2859	3127	3307	2470	2120	2897
Baroj Size (in ha)	1	1	1	1	1	1	1	1	1
Sales (Rs./ha	2747885	4466372	7351953	6947183	8391706	8522723	3497018	2359800	6126036
Variable Cost (Rs./ha)	1714146	2044259	2377337	2245865	2628050	2923464	1675600	1345145	3898022
Contribution	1033739	2422113	4974616	4701318	5763656	5599259	1821418	1014655	2228014
Fixed Cost (Rs./ha)	577318	670381	585941	560099	545700	522123	415212	316028	491556
Profit (Rs./ha)	456421	1751732	4388675	4141219	5217956	5077136	1406206	698627	1736458
BCR to Total Cost	1.199183	1.645291	2.48102	2.475863	2.644098	2.473518	1.672565	1.420562458	1.395587
BCR to Total Cash Cost	1.251405	1.702432	2.560004	2.553682	2.714751	2.528503	1.700257	1.429389157	1.415559
Return to labour (Rs./man-days)	167	580	1484	1448	1669	1535	569	330	599
Total Cash Cost	2195839	2623525	2871852	2720457	3091151	3370659	2056758	1650915	4327644

Source: Field Survey

Table-9. Cost Benefit Analysis of Betel vine Cultivation in Study Areas (Cash only)

		Cash Cost Benefit Analysis of Betel vine Cultivation in Study Areas									
Year of Boroj	Total Cost (Rs./ha)	Discount Factor (DF)			Discounted Total Cost at			Sales (Rs./ha)	Discounted Benefit at		
		12%	15%	20%	12%	15%	20%		12%	15%	20%
0	-1195546										
1	2195839	0.892857	0.869565	0.833333	1960571	1909425	1829866	2747885	2453469	2389465	2289904
2	2623525	0.797194	0.756144	0.694444	2091458	1983762	1821892	4466372	3560564	3377219	3101647
3	2871852	0.71178	0.657516	0.578704	2044128	1888289	1661951	7351953	5232975	4834028	4254602
4	2720457	0.635518	0.571753	0.482253	1728900	1555430	1311949	6947183	4415060	3972074	3350300
5	3091151	0.567427	0.497177	0.401878	1754002	1536848	1242264	8391706	4761679	4172161	3372438
6-10	3370659	0.506631	0.432328	0.334898	1707681	1457229	1128827	8522723	4317877	3684608	2854243
11-15	2056758	0.287476	0.214943	0.134588	591269	442086	276815	3497018	1005309	751660	470657
16 & Above	1650915	0.163122	0.106865	0.054088	269300	176425	89295	2359800	384934	252179	127637
Total	20581156				12147309	10949494	9362859	44284640	26131867	23433394	19821428

Source: Field Survey

On review of the table -8, it is observed that the production of betel leaves is highest in 3rd year (1092 mote/ha), followed by 5th year (1009 mote/ha), lowest in 1st year (308 mote/ha) and lastly 690/ha in (16 & Above)th year. In the 1st year the betel vine plant took time to produce and as a result most of the cases production is lowest in 1st year. Sale value (Rs./ha) is highest in (6-10)th year (Rs.8522723) and lowest in (16 & Above)th year (Rs.2359800). It means prices of different years produced leaves have different quality and earn different prices and the resultant figure similarly also differ with the production level. To know the optimum utilisation of capacity of production BEP (Break-Even Point) is another tool for judgment. BEP = Fixed Expenses/PV Ratio. As per table-8 overall Fixed Cost is Rs.491556/ha and PVRatio is 36.37%. So, BEP = 491556/36.37% = 1351542.48 or Rs.1351542. So, at the point of Sales of Rs.1351542 there is no profit and no loss, thereafter full contribution is profit. Here as a betel vine boroj turns BEP in 1st year so the remaining life cycle of betel vine boroj farmers can utilise input resources for cultivation optimum upto to the end of life. As the life of betel vine boroj near about 16 and above years, so by proper management of input resources betel vine growers safely cultivate betel vine for longtime. But there arises uncertainty due to natural calamities, pest attract, quality issue, future costs, different uses, temporal trend in demand and prices. Otherwise betel vine cultivation is a profitable crop to marginal, small and medium farmers in the study areas.

Returns on Investment

The best discount rate to use is the 'Opportunity Cost" of Capital. In most developing countries it is assumed to be somewhere between 10-12% (Gittinger, 1977). To calculate BCR, NPV and IRR, the costs and returns were discounted at 12%, 15% and 20% rate of interest. Dividing the present worth of gross benefits by present worth of gross costs which were discounted at 12%, 15% and 20% the Benefit Cost Ratio (BCR) are 2.15, 2.14 and 2.12 respectively. Differences of discounted value of gross benefits and worth of gross costs are the Net Present Value (NPV). NPV at 12%, 15% and 20% discounting levels are Rs. 13984558, Rs. 12483900 and Rs. 10458569 respectively. Discounted values are shown in table-9. It signifies that betel vine cultivation in the study areas is profitable.

Tabel-10. Rates of Returns on Investment in Betel vine Cultivation in the Study area

Discount Factor (DF)			
Item	@12%	@15%	@20%
BCR	2.15	2.14	2.12
NPV (Rs.)	13984558	12483900	10458569
IRR	107%	102%	94%

Source: Field Survey

The IRR is that discount rate which nullifies the present worth of cash inflows and outflows. It represents the average earning power of the money used in the project over the project life. IRR is 107% at 12% discount rate, 102% at 15% discount rate and 94% at 20% discount rate in table 10. It is acceptable; it is much higher than the opportunity cost of capital.

Sensitivity Analysis

To establish a valid judgment it was necessary to conduct sensitivity analysis. This opportunity has been reworked separately to see what happens on the profitability of betel vine cultivation under varying conditions (Islam et al., 2015). The cost of betel vine cultivation was considered constant, while sales decreased at the rate of 10% or if sales of the betel vine cultivation remained constant but all costs increased at the rate of 10% then what would be the outcome. This is a tool for valid generalisation about a phenomenon. This test has been done separately to see what happens to the profitability of betel vine cultivation under varying conditions. This test is popular where proper records of economic activities are not properly maintained. As betel vine farmers are not familiar with the record keeping of their economic activities, so it is important to test sensitivity analysis from another view point to generalise the valid policy making.

Table-11. Results of Sensitivity Analysis of Betel vine Cultivation in the Study Areas

Results of Sensitivity Analysis of Betel vine Cultivation in Study Area			
Stutation	BCR at 12%	NVP at 12%	IRR at 12%
Base Parameter	2.15	13984558	107%
Decrease in Return: @ 10%	1.94	11371373	88%
Increase in Variable Cost: @ 10%	1.99	12989254	98%
Increase in Total Cost: @ 10%	1.96	12769827	96%

Source: Field Survey

The results of sensitivity analysis presented in table-11. It was evident from table-10 that BCR of betel vine cultivation is greater than 1(one), NPV is positive at 12% discount rate and IRR is also higher than the opportunity cost of capital. This implies that if the sales decrease by 10% and the cost of betel vine cultivation remains constant, investment in betel vine cultivation is profitable from the viewpoint of farmers. Again, BCR to betel vine cultivation is greater than 1 (one), NPV is positive and IRR is higher than the opportunity cost of capital, if variable cost increases by 10% and the sales remain the same, investment in betel vine cultivation is profitable from the viewpoint of farmers. This is also for if total cost increases by 10% and sales remains same then investment in betel vine cultivation is profitable from the view point of farmers. This means that the owner, the farmer of the betel vine boroj can also make profit if all costs slightly increase in the near future. The result of the study indicates that the farmers of betel vine boroj can earn profits under changing situations.

Conclusion and Recommendation

The study has reported the agronomic practices, agro-ecology, climatic conditions, cost-volume-profit analysis and profitability, returns of investment and sensitivity analysis of betel vine cultivation in the study areas at farm level. The P/V ratio, Break-even Point, Benefit Cost Ratio (BCR), Return to Labour (Rs./man-day), Net Present Value (NPV) and Internal Rate of Return (IRR) indicate that the betel vine cultivation is profitable. Sensitivity analysis also indicates that the farmers of betel vine boroj can earn profit under changing situations. Betel vine cultivation requires special care and specific knowledge. The creation of 'Boroj', planting of vines, maintenance of optimum temperature and humidity inside the boroj, requirement of nutrients according to the soil characteristics, proper steps for climatic zone of the particular area, management of fungicide for safeguard of vines, knowledge of plucking and processing and knowledge of temporal trend of prices and market dynamics are very much important for betel vine cultivation. All of these activities are done by humans and therefore providing huge employment opportunities to the rural areas which develop the regional economic base. Betel leaves are the most important cash crop, being cultivated in many states by which India earns considerable foreign exchange each year. Although betel vine cultivation is profitable,

farmers faced various problems and due to this many betel vine farmers stopped betel vine cultivation in some areas under study. At the same time new betel vine cultivation started. As whole acreages of betel vine cultivation is going down and if it is continued then in near future employability opportunities will hamper in rural areas and their livelihood also. So, Government intervention into the system of betel vine cultivation and marketing of betel leaves is an urgent phenomenon. Total marketing system is under the control of middlemen. As betel leaf is a perishable commodity so farmers have no scope to escape from exploitation of middlemen. Export policy of betel leaves is not properly linked with the betel leaves market. So, scope of export of betel leaves is not properly reached to the growers. There is no crop insurance for betel vine cultivation. As a huge number of families are engaged directly and indirectly in such industry, betel leaves should be included under crop insurance and should be listed under agricultural crops. Extension works with publicity need to be strengthened to popularize the quality cultivation of betel vine not the quantity in order to expand its cultivation areas.

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