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Cost of Production and Cost-Benefit Analysis of Smallholder Plantation Crops

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Cost of Production and Cost-Benefit Analysis of Smallholder Plantation Crops Under Ideal Management

INTRODUCTION

The smallholder plantation crops, namely, coconut, arecanut, cashewnut, black pepper and cardamom today occupy nearly 2 million ha of plantation area in India. Their contribution to the Gross National Product at the current market price comes to about Rs. 16,000 million and to the export earnings nearly Rs. 2000 million per annum. These five economically important crops together provide employment opportunity to some 15 million people every year.

Although, India is the largest producer of arecanut, cashewnut and cardamom, and third largest producer of coconut and black pepper in the world; they are, by and large, grown under sheer neglect with very little or no application of fertilizers and plant protection chemicals. The productivity of these crops in this country per unit area is therefore, one of the lowest in the world. The era of extensive cultivation with cheap labour force no more exists here as the plantation lands have become scarce and unsuitable due to erosion and constant exploitation of soil without replenishment, while the labour has become very expensive. The low productivity ultimately has resulted in high cost of production for these export oriented crops and commodities; hence India is put to a serious disadvantageous position in the highly competitive international markets.

If India is to re-establish her pre-eminent position in the world trade of coir and coir products, cashew kernels, and spices as was in the 1950s and 1960s; the only way is to provide the required cultural energy to the plantations and realise higher productivity. This is the only practical approach to reduce the cost of production and thereby ensure a remunerative price to growers without sacrificing the interest of the consumers within the country as well as overseas.

OBJECTIVES

Many significant advances have been made in crop production technology during the recent past by the Central Plantation Crops Research Institute and the Agricultural Universities in the regions where these crops are grown. Eventhough, owing to several constraints the transfer of the technology has not so far been very effective, an attempt has been made here to test the

economic viability of scientific management practices to get an insight into the economic potential of these crops. More precisely the objectives of this study are: (1) to estimate the cost of production and (2) to work out the Benefit - Cost Ratio (BCR), Net Present Worth (NPW) and Internal Rate of Return (IRR) in respect of the five crops under reference.

METHODOLOGY

The plantation crops covered in this study are of perennial nature with a long pre-bearing period followed by several phases of bearing period namely, (1) steady yield increasing phase, (2) stabilised yield phase, (3) yield declining phase and (4) senile and uneconomic phase. The flow of costs and returns in these crops spreads over a number of years with varying magnitude. The expenditure during the pre-bearing stage constitute the investment on the crop, while the full benefits take quite sometime to accrue regularly. The estimation of cost of production and the cost-benefit analysis in these crops, unlike annuals or seasonals, therefore, pose some problems normally associated with the measurement of costs and benefits and the problem of choosing an appropriate discount rate to compare different streams of costs and benefits over a period of time. Studies of this nature carried out under certain assumptions due to obvious reasons.

Technical coefficients

In this study, the technical coefficients namely, inputs and corresponding expected outputs are based on recommended package of practices for respective crops. In order to determine the labour requirement, a consensus approach was taken, obtaining information from a few sources as it was not possible to adopt "time and motion" approach for the purpose. However, for avoiding the influence of wide fluctuations in yields, they have been considered at moderate levels than their potential under given situation.

Factor costs

For computing the factor costs barring labour wages, the 1984-85 market prices have been taken into account. Since the operational wage rates vary widely from region to region, between seasons and among the categories of agricultural labour, the shadow price for this input was used. Land was not taken into consideration as an item of the investment, since it is not a wasting asset when proper nutrition is provided to this resource for its exploitation.

Product price

As regards the valuation of returns from different crops, the average farmgate prices of the last five years (1980-84) were used as the unit values. In the case of coconut it was Rs. 1.58/nut, whereas for other produces per kg, the unit values considered were Rs. 18 for arecanut, Rs. 8 for cashew,

Rs. 12 for pepper and Rs. 150 for cardamom. Since in the case of coconut and arecanut, one could expect a fairly good return from well planned inter and mixed crops, the net benefits expected from them have been added to the returns to the concerned main crop. Besides this, the estimated revenues from the timber, firewood and other by-products anticipated during the life cycle of the plantation also have been added to the flow of benefits to the systems.

Cost of production

At the first stage, the total investment (pre-bearing establishment cost) and the compound interest thereon were reduced to an annuity bearing 14 per cent interest, being the rate at which credit could be available. The annuity was calculated by using the formula:

$$A = \frac{P}{\sum_{i=1}^{n} \frac{1}{(1+r)^n}}$$

Where A = annuity value;
P = total investment;
r = rate of interest; and
n = life of the plantation

The annuity value thus obtained was added to the annual maintenance cost to arrive at the total annual cost per unit area. From this amount, the income from the by-products and net income from the inter and mixed crops were deducted and the net cost then divided by the average annual production to arrive at the cost of production.

Cost-Benefit analysis

From the practical standpoint, the *ex-ante* concept of cost-benefit analysis was adopted here instead of *ex-post* concept. The scope of this study is however, confined to the direct costs and benefits and the social cost-benefit aspect has not been accounted for due to lack of adequate information. The costs and returns were discounted at 14 per cent rate of interest.

To test the worthiness of the investment in these crop productions, three common indicators of the financial analysis as already stated earlier were subjected to scrutiny. The methods applied for the evaluation of the indicators are as follows:

(i) *Benefit-Cost Ratio* (BCR):

$$\frac{\sum_{i=1}^{n} \frac{B_n}{(1+i)^n}}{\sum_{i=1}^{n} \frac{C_n}{(1+i)^n}}$$

(ii) *Net Present Worth* (NPW):

$$\sum_{i=1}^{n} \frac{B_n - C_n}{(1+i)^n}$$

(iii) *Internal Rate of Return* (IRR):

$$\sum_{i=1}^{n} \frac{B_n - C_n}{(1+i)^n} = 0$$

Where B_n = Benefits in each year;
C_n = Costs in each year;
n = number of years; and
i = discount rate

RESULTS AND DISCUSSION

Table 1 shows the cost of production of smallholder plantation crops for the period 1984–85. The details of the estimates are presented in Annexures 1 and 2.

TABLE 1. *Cost of Production of Smallholder Plantation Crops*

Crop	Variety/cultivar	Situation	Unit	Rs.
Coconut	West Coast Tall	Rainfed	Nut	1.05
,,	,,	Irrigated	Nut	0.90
,,	D × T hybrid	,,	Nut	0.60
Arecanut	Vittal Local	Rainfed	Kg.	13.40
,,	,,	Irrigated	Kg.	12.65
,,	Mangala	,,	Kg.	7.70
Cashewnut	High yielding types	Rainfed	Kg.	6.30
Pepper	,,	Rainfed	Kg.	13.40
Cardamom	Mysore/Malabar	Rainfed	Kg.	113.00

Table 2 presents the summary statement of the financial analysis in respect of each crop. The details of cash flows and their discounted values are given in the Annexures 3 to 11.

According to this study, the BCR in all the cases comes to greater than unity. In other words, the investments under the investigation are found to be profitable propositions. Similarly, the IRR in all the cases studied is higher than the interest rate of 14 per cent charged by the Commercial Banks. This also indicates that the returns from these crops are highly competitive. Further, the conclusion that emerges from these analyses is that the components such as irrigation and high yielding cultivars provide much higher benefits over the comparable factors.

TABLE 2. *Estimated Values of the Indicators of the Financial Analysis in respect of Smallholder Plantation Crops*

Crop	Variety	Situation	BCR (at 14% DF)	NPW	IRR
Coconut	West Coast Tall	Rainfed	1.30	11,500	18
,,	,,	Irrigated	1.75	40,900	22
,,	D×T hybrid	,,	2.08	60,000	35
Arecanut	Vittal local	Rainfed	1.30	21,000	20
,,	,,	Irrigated	1.46	50,800	22
,,	Mangala	,,	1.91	1,09,000	24
Cashewnut	High yielding types	Rainfed	1.29	4,900	18
Pepper	,,	,,	1.28	13,400	25
Cardamom	Mysore/Malabar	,,	1.42	13,700	25

This study could have been more useful if we had information on the input-output flows under average farmers' situation for measuring the impact of technology on plantation crops and for framing the policy measures. Detailed investigations under different agro-climatic and socio-economic conditions involving several alternative technologies should therefore, be undertaken to address to some of the policy issues.

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ANNEXURE 1

Cost of investments and maintenance in smallholder plantation crops (Rs/ha)

Crop variety situation	Labour @ Rs 20	Fencing shading standards	Irrigation acces-sories	Planting material	FYM/ compost	Fertilizer	Plant protection chemicals	Harvest-ing & pro-cessing	Contin-gencies	Total
COST OF INVESTMENT										
Coconut WCT Rainfed	15,120	—	—	1220	2700	6300	1560	—	4500	31,400
Coconut WCT Irrigated	15,900	—	15,000	1220	2700	6300	1780	—	6000	48,900
Coconut Hybrid Irrigated	13,380	—	15,000	2150	2600	5040	1250	—	5400	44,820
Arecanut Local Irrigated	44,700	—	15,000	1050	7200	5040	1100	—	2500	76,590
Arecanut Local Rainfed	35,200	—	—	1050	7200	5040	1100	—	500	50,090
Arecanut Mangala Irrigated	36,300	—	15,000	2000	4000	7560	1200	—	3000	69,060
Cashewnut High yielding Rainfed	7,200	2000	—	170	—	1356	774	—	1000	12,500
Pepper High yielding Rainfed	11,640	4400	—	220	4400	3460	2080	500	400	27,100
Cardamom Mysore/Malabar Rainfed	11,800	2000	—	3800	—	1649	351	1,000	800	21,400
MAINTENANCE COST										
Coconut WCT Rainfed	2,200	—	—	—	450	1260	400	—	750	5,060
Coconut WCT Irrigated	2,700	—	—	—	450	1260	390	—	1000	5,800
Coconut Hybrid Irrigated	2,700	—	—	—	450	1260	390	—	1000	5,800
Arecanut Local Rainfed	6,600	—	—	—	1440	1260	300	—	100	9,700
Arecanut Local Irrigated	11,200	—	—	—	1440	1260	300	—	500	14,700
Arecanut Mangala Irrigated	12,000	—	—	—	1440	2520	300	—	500	16,760
Cashewnut High Yielding Rainfed	1,700	—	—	—	—	340	190	—	170	2,400
Pepper High Yielding Rainfed	2,260	—	—	—	1100	1155	930	3,000	155	8,600
Cardamom Mysore/Malabar Rainfed	2,640	800	—	100	—	620	200	1,500	340	6,200

ANNEXURE 2

Estimated cost of production of smallholder plantation crops during 1984–85

Sr. No.	Item	Coconut			Arecanut			Cashew	Pepper	Cardamom
		WCT Rainfed	WCT Irrigated	D×T Irrigated	Local Rainfed	Local Irrigated	Mangala Irrigated	Local Rainfed	Local Rainfed	Malabar/ Mysore Rainfed
1	Investment during establishment (Rs '000/ha)	31.4	48.9	44.8	50.0	76.5	69.0	12.5	27.1	21.40
2	Compound interest on investment @ 14% (Rs '000/ha)	21.4	40.7	29.7	28.4	46.2	32.8	7.5	12.2	10.2
3	Total investment (Sl. No. 1+2) (Rs '000/ha)	52.8	89.6	74.5	78.5	122.8	109.9	20.0	39.3	31.6
4	Annuity value @ 14% (Rs '000/ha)	7.4	12.5	10.4	11.0	17.3	14.3	2.9	6.4	5.6
5	Annual maintenance cost (Rs '000/ha)	5.0	5.8	5.8	9.7	14.7	16.7	2.4	8.6	6.2
6	Total cost per year (Rs '000/ha)	12.4	18.3	16.2	20.7	32.0	31.1	5.3	15.0	11.8
7	Average revenue from									
	(i) by-product/shade tree/live standard (Rs '000/ha)	0.9	0.9	0.9	1.2	1.2	1.2	0.6	0.2	0.5
	(ii) Inter/mixed crops (Rs '000/ha)	0.6	3.5	3.5	0.8	3.0	3.0	–	–	–
8	Net cost of production/ha/yr (Sl. No. 6–7) (Rs '000/ha)	10.9	13.9	11.8	18.7	27.8	26.9	4.7	14.7	11.3
9	Average production of main produce	10500 Nuts	15700 Nuts	21000 Nuts	1.4 tons	2.2 tons	3.5 tons	0.75 tons	1.1 tons	0.1 tons
10	Cost of production/Kg (Sl. No. 8÷9) (Rs) (In case of coconut per nut)	1.05	0.90	0.60	13.40	12.65	7.70	6.30	13.4	11.3
	Assumption :									
	(A) Establishment period (years)	6	6	5	5	5	4	5	4	4
	(B) No. of years considered for computing annuity value :	60	60	60	40	40	40	25	15	12

ANNEXURE 3

Cash–flow analysis of rainfed coconut (WCT) production/ha

Year	Cost (Rs)	Discounted cost @ 14% (Rs)	Return (Rs)	Discounted return @ 14% (Rs)	Incremental benefit (Rs)	Discounted incremental benefit @ 14% D. F. (Rs)
1	7850	6884	1000	877	–6850	–6009
2	4600	3537	1000	769	–3600	–2770
3	5220	3523	1000	675	–4220	–2849
4	4500	2664	750	444	–3750	–2220
5	4600	2387	750	389	–3850	–2000
6	4600	2097	750	342	–3850	–1754
7	5060	2024	4265	1706	–795	–318
8	5060	1776	7030	2467	1970	691
9	5060	1558	11180	3443	6120	1882
10	5060	1366	13940	3763	8880	2395
11	5060	1199	15325	3632	10265	2429
12 to 50	5060	7944	18100	28417	13040	21920
51	5060	7	17540	22	12480	15
52	5060	6	16980	20	11920	13
53	5060	5	16430	18	11370	11
54	5060	4	15880	16	10820	10
55	5060	3	15325	11	10265	7
56	5060	2	14770	8	9710	6
57	5060	1	14220	7	9160	5
58	5060	1	13390	6	8330	4
59	5060	1	12560	5	7500	4
60	5060	1	21000	4	15940	6

ANNEXURE 4

Cash–flow analysis of irrigated coconut (WCT) production/ha

Year	Cost (Rs)	Discounted cost @ 14%	Return (Rs)	Discounted return @ 14% (Rs)	Incremental benefit (Rs)	Discounted incremental benefit @ 14% D. F. (Rs)
1	23100	20258	3500	3069	–19600	–17193
2	4900	3768	3500	2691	–1400	–1077
3	5600	3780	3500	2362	–2100	–1418
4	5100	3019	2000	1184	–3100	–1836
5	5100	2646	2000	1038	–3100	–1610
6	5100	2320	5665	2577	565	257
7	5300	2114	9810	3914	4510	1802
8	5500	1925	19490	6821	13990	4905
9	5700	1749	23640	7257	17940	5517
10 to 50	5800	12528	29300	63288	23500	51465
51	5800	7	27900	36	22100	27
52	5800	6	27900	30	22100	24
53	5800	5	26520	24	20720	21
54	5800	4	26520	21	20720	19
55	5800	3	25140	18	19340	14
56	5800	2	25140	15	19340	12
57	5800	1	22370	13	16570	10
58	5800	1	22370	11	16570	8
59	5800	1	20990	9	15190	8
60	5800	1	29740	7	23940	10

ANNEXURE 5

Cash–flow analysis of irrigated coconut (hybrid) production/ha

Year	Cost (Rs)	Discounted cost @ 14% (Rs)	Return (Rs)	Discounted return @ 14% (Rs)	Incremental benefit (Rs)	Discounted incremental benefit @ 14% D. F (Rs)
1	24000	21048	3500	3069	–20500	–17978
2	5000	3845	3500	2691	–1400	–1153
3	5600	3780	3500	2362	–2100	–1417
4	5100	3019	2000	1184	–3100	–1835
5	5100	2646	5525	2867	425	221
6	5100	2325	8150	3716	3050	1391
7	5300	2120	16725	6690	11425	4570
8	5500	1930	25020	8782	19520	6851
9	5700	1755	27785	8557	22085	6802
10 to 12	5800	4147	30550	21843	24750	17696
13 to 15	5800	2795	33315	16057	27515	13262
16 to 40	5800	5608	37580	36339	31780	30731
41 to 59	5800	238	23755	978	17955	739
60	5800	2	27255	10	21455	9

ANNEXURE 6

Cash–flow analysis of rainfed arecanut (Vittal) local production/ha

Year	Cost (Rs)	Discounted cost @ 14% (Rs)	Return (Rs)	Discounted return @ 14% (Rs)	Incremental benefit (Rs)	Discounted incremental benefit (Rs) @ 14% D. F. (Rs)
1	15160	13295	1000	877	–14160	–12421
2	9370	7205	1000	769	–8370	–6441
3	9460	6385	1000	675	–8460	–5711
4	7500	4440	1000	592	–6500	–3846
5	8600	4463	7400	3840	–1200	–623
6	9000	4095	12800	5824	3800	1731
7	9700	3870	16400	6543	6700	2677
8	9700	3395	20000	7000	10300	3611
9	9700	2977	23600	7245	13900	4274
10 to 35	9700	19303	27200	54128	17500	37240
36	9600	86	25400	228	15800	145
37	9550	76	23600	188	14050	115
38	9500	66	21800	152	12300	89
39	9450	56	20000	80	10550	65
40	9400	47	31400	157	22000	117

ANNEXURE 7

Cash-flow analysis of irrigated arecanut (Vittal) local production/ha

Year	Cost (Rs)	Discounted cost @ 14% (Rs)	Return (Rs)	Discounted return @ 14% (Rs)	Incremental benefit (Rs)	Discounted incremental benefit at 14% D. F (Rs)
1	30560	26801	3500	3069	–27060	–23737
2	10770	8282	3500	2691	–7270	–5594
3	10860	7330	3500	2362	–7360	–4968
4	11500	6808	3500	2072	–8000	–4737
5	12900	6695	13200	6851	300	156
6	13900	6338	22200	10123	8300	3781
7	14700	5880	31200	12480	16500	7517
8	14700	5160	36600	12847	21900	7678
9	14700	4528	40200	12382	25500	7841
10 to 35	14700	31252	43800	93119	29100	61925
36	14500	130	42000	378	27500	253
37	14300	114	40200	322	25900	212
38	14100	99	36600	256	22500	162
39	13900	83	34800	209	20900	130
40	13700	68	48000	240	34300	182

ANNEXURE 8

Cash-flow analysis of irrigated arecanut (Mangala) production/ha

Year	Cost (Rs)	Discounted cost @ 14% (Rs)	Return (Rs)	Discounted return @ 14% (Rs)	Incremental benefit (Rs)	Discounted incremental benefit @ 14% D. F. (Rs)
1	31405	27542	3500	3069	–27905	–24473
2	11710	9005	3500	2691	–8210	–6313
3	12195	8232	3500	2362	–8695	–5869
4	13760	8146	13300	7874	–460	–272
5	14560	7557	18700	9705	4140	2149
6	15360	7004	22300	10169	6940	3165
7	16760	6704	36700	14680	19940	7976
8	16760	5883	49300	17304	32540	11421
9	16760	5162	58300	17956	41540	12794
10 to 35	16760	35632	67300	143079	50540	107448
36	16560	149	61900	415	45340	408
37	16160	129	58300	342	42140	337
38	15960	112	51100	250	35140	246
39	15760	94	43900	172	28140	169
40	15560	78	55300	202	39740	199

ANNEXURE 9

Cash-flow analysis of rainfed cashewnut (high yielding type) production/ha

Year	Cost (Rs)	Discounted cost @ 14% (Rs)	Return (Rs)	Discounted return @ 14% (Rs)	Incremental benefit (Rs)	Discounted incremental benefit @ 14% D. F (Rs)
1	4890	4288	–	–	–4890	–4288
2	1744	1341	–	–	–1744	–1349
3	2000	1350	–	–	–2000	–1350
4	1830	1083	2400	1420	570	337
5	2030	1053	3000	1557	970	503
6	2230	1016	3600	1641	1370	625
7	2330	932	4800	1920	2470	988
8 to 20	2430	5564	6000	13740	3570	8318
21	2000	128	4800	307	2800	179
22	2000	112	4800	268	2800	156
23	1900	93	3600	176	1700	83
24	1900	82	18600	799	16700	718

ANNEXURE 10

Cash-flow analysis of rainfed pepper (High yielding types) production/ha

Year	Cost (Rs)	Discounted cost @ 14% (Rs)	Return (Rs)	Discounted return @ 14% (Rs)	Incremental benefit (Rs)	Discounted incremental benefit @ 14% D. F. (Rs)
1	10619	9312	–	–	–10619	–9312
2	4761	3661	–	–	–4761	–3661
3	5683	3836	3960	2673	–1723	–1163
4	6051	3582	9900	5860	3844	2275
5	8656	4492	16500	8563	7844	4071
6	8656	3947	16500	7524	7844	3576
7	8656	3462	16500	6600	7844	3137
8	8656	3038	19800	6949	11144	3911
9	8656	2666	19800	6098	11144	3432
10	8656	2337	19800	5346	11144	3008
11	8656	2051	16500	3910	7844	1859
12	8500	1768	13200	2745	4700	977
13	8400	1528	11880	2162	3480	633
14	8400	1344	10560	1689	2160	345
15	8400	1176	10560	1478	2160	302

ANNEXURE 11

Cash-flow analysis of rainfed cardamom (Mysore/Malabar) production/ha

Year	Cost (Rs)	Discounted cost @14% (Rs)	Return (Rs)	Discounted return @ 14% (Rs)	Incremental benefit (Rs)	Discounted incremental benefit @14% D. F. (Rs)
1	9960	8734	–	–	–9960	–8784
2	3432	2639	–	–	–3432	–2639
3	3752	2532	4500	3037	748	504
4	4252	2517	6000	3552	1748	1034
5	5157	2676	10500	5449	5343	2773
6	5900	2690	13500	6156	7600	3465
7	6000	2400	18000	7200	12000	4800
8	6157	2161	18000	6318	11843	4156
9	6157	1896	18000	5544	11843	3647
10	5900	1593	15000	4050	9100	2457
11	5660	1341	10500	2488	4840	1147
12	5400	1123	11000	2288	5600	1164