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Economic Feasibility of Coconut Cultivation in Tamil Nadu State of India

Gokula Kannan K.[1], Auindrila Biswas[2], and Soumitra Chatterjee[3]

ABSTRACT

The current study assessed the economic viability of copra production in Tamil Nadu for the 2023-24 period, based on data collected from 100 farm households with coconut plantations of varying age groups. Initial establishment cost formed one-fifth of the maintenance cost, while material and labour cost contributed one-fifth and one-fourth of the establishment cost, respectively. On an average, 13,000 mature nuts per hectare yielded about 30 quintals of copra, resulting in net returns of approximately Rs.1,00,000 per hectare. Financial indicators, such as Net Present Value (NPV), Internal Rate of Return (IRR), and Benefit-Cost Ratio (BCR) confirmed profitability, where 41–50 years old plantations performed best.

Keywords: Coconut, Copra, Financial Feasibility, NPV, IRR, BCR, Payback Period

JEL Code: Q12, Q14, D24, Q13, R11

I
INTRODUCTION

Coconut is documented as the key plantation crop in India and is applauded to be a smallholders' crop since three thousand years ago (Lathika and Kumar, 2005). The fruit has an enormous popularity as tender and one of the most natural drinks with high nutritional value (Paul and Lakhsmi, 2015). Around 92 countries in the world have practiced coconut plantation with a mammoth 60.00 million metric tons of production since 2007, which has gone up to 61.44 million metric tons of production in 2014-15. Currently, the production has a further upsurge of 66.67 million metric tons with acreage of 12.25 million hectares and productivity of 5440 nuts per hectare (2021-22). India is the largest producer of coconut in the world with a 20.74 million metric tonnes of production of nuts though it has secured third in acreage (2.20 million hectares) after the Philippines and Indonesia and second highest in productivity (9430 nuts per hectare) after Jamaica in 2021-22 (Coconut Statistical Year Book, 2021).

India plays a prominent role in global coconut supply, where export of coconut from India grew at a CAGR of 13 per cent in between 2015-16 to 2021-22. Currently, India has crossed Rs.3236.83 crore (US$ 393 million) mark in world export 2021-22 surpassing the previous year with an increase of 41.0 per cent (Indian Trade Portal, 2022).

However, the state Tamil Nadu has a bulk share in both acreage (20.75 per cent) and production (26.40 per cent) of coconut in the country after Kerala and Karnataka (Ministry of Agriculture and Farmers Welfare, Government of India, 2023). The

[1]Bidhan Chandra Krishi Viswavidyalaya (B.C.K.V.), West Bengal- 741252
[2]School of Agriculture and Development, Central University of South Bihar, Bihar-824236
[3]Palli Siksha Bhavana (Institute of Agriculture), Visva Bharati, West Bengal- 731236

importance of coconut cultivation in Tamil Nadu is enormous as it is inseparably embedded in the social heritage and cultural identity as well. It is being eulogized as "*Kalpavriksha*" or the Tree of Heaven (Palaniselvam *et al*., 2018). The people living in this region are predominantly exercising coconut oil as their prime cooking material.

Keeping this view in mind, the present study attempts to evaluate critically the financial status and economic feasibility of coconut orchard particularly in the state of Tamil Nadu with detailed cost-return structure and scenario over last seven years (2017-18 to 2023-24) of observation. The study comprises of socio-economic status of 100 sample coconut cultivators of varied operational holding (50 marginal farmers with holding size less than 1.0 hectare; 33 small farmers having holding size between 1.0 to 2.0 hectare; 11 semi-medium farmers with holding size between 2.0 to 4.0 hectare, 3 medium farmers having holding size between 4.0 to 10.0 hectare and 3 large farmers with more than 10.0 hectares of land). Data has been collected from different villages in three preferred blocks namely Pattukkotai, Peravurani and Sethubhavachatram of Thanjavur district where coconut production has secured the third highest position in the state.

II
DATA AND METHODOLOGY

100 coconut cultivators having different age group of plants have been categorized (Group I: 1-10 years; Group II: 11-20 years; Group III: 21-30 years; Group IV: 31-40 years and Group V: 41-50 years) from three blocks of Thanjavur district and interviewed following simple random sampling method with well-structured and pre-tested schedules. The primary data related to initial investment, maintenance cost at different stages of plant (gestation and bearing), annual break-up cost of production, returns obtained after sixth year were collected, compiled and analyzed subsequently from 2017-18 to 2023-24. Tabular analysis tools like percentages, averages and financial feasibility tools like Net Present Value (NPV), Benefit-Cost Ratio (BCR), Payback Period (PBP) and Internal Rate of Return (IRR) were used to analyze the overall sustainability of coconut farms in this region.

2.1 Amortization Cost

The amortization cost for establishment of coconut plantation is considered to represent the annual fixed cost component of plantation maintenance. The capital investment made in first 7 years for establishment was divided into equal annual installments starting from seventh year till the economic life of coconut plantation.

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

Where,

A= Annual amortization cost in rupees

P= Initial capital investment in rupees

i = Discount rate (12.0 per cent)
n = Expected life of the orchard (60 years).

2.2 Discounted Payback Period (PBP)

Pay-back period refers to the length of time period required for an investment to generate the net cash income to be equal to the original investment.

$$\sum_{t=0}^{t^*} C_t = \sum_{t=0}^{t^*} R_t$$

Where,
R_t = Return in period t
C_t = Cost in period t

2.3 Net Present Value (NPV)

It represents the discounted value of the net cash flows of the project.

$$NPV = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+d)^t}$$

Where,
B_t = Benefits in rupees in each year
C_t = Costs in rupees in each year
d = Discounted rate (14 per cent)
n = Economic life of the plantation in years

2.4 Benefit-Cost Ratio

The benefit cost ratio was worked out by dividing discounting benefits by discounted cost during the life period of the coconut plantation. It was calculated using the formula:

$$BCR = \frac{\sum_{t=1}^{n} B_t / (1+d)^t}{\sum_{t=1}^{n} C_t / (1+d)^t}$$

Where,

B_t = Benefits in rupees in each year

C_t = Cost in rupees in each year

d = Discount rate (14 per cent)

n = Economic life of the plantation in years

The present study attempts to estimate the cost of production of coconut plantations across different age groups up to the sixth year, a period during which only

input costs were incurred and no economic returns were realized. Returns from the plantation started from the seventh year onwards. The authors have further considered an additional ten years of plantation life of coconut by computing projected cost and return from the seventh year onwards. Compounding method has been applied to work out the NPV and IRR based on the current BCR observed in the seventh year.

2.5 Internal Rate of Return (IRR)

It is that discount rate which makes the net present worth of cash flow equal to zero. It represents the average earning power of money used in the project over the project life. The formula used is

$$\begin{pmatrix}\text{Internal rate}\\ \text{of return}\end{pmatrix} = \begin{pmatrix}\text{Lower}\\ \text{discount}\\ \text{rate}\end{pmatrix} + \begin{pmatrix}\text{Difference}\\ \text{between two}\\ \text{discount rate}\end{pmatrix} \begin{pmatrix}\text{Present worth of the}\\ \text{cash flow at the}\\ \underline{\text{lower discount rate}}\\ \text{Absolute difference}\\ \text{between present}\\ \text{worth's of cash flow}\\ \text{at two discount rates}\end{pmatrix}$$

However, IRR is computed in MS-Excel formulas and not manually where only lower discounted rate was required to calculate IRR. The interest rate closer to opportunity cost of 14.0 per cent was chosen as discounted rate in case of coconut plantation.

Table 1 represents the socio-economic descriptive statistics of coconut cultivators and their farm-families. Farmers aged between 25 and 62 years, with basic education up to the primary level and an average operational holding of 1.0 to 2.0 hectares of land with moderate valuation (> Rs.1.5 lakh), have been considered and subsequently categorized according to various age groups of plants. The total non-farm income of the farm-families across groups varied from Rs. 75,000 per annum to Rs.81,500 per annum. However, due to the perennial nature of the crop, there is no off season or lean period in coconut cultivation. Apart from cultivation practices, farmers also engage in daily wage labour in hotels, supermarkets, loading and unloading activities and driving motor cars and tractors on a hire basis to meet their basic livelihood needs. Most cultivators are highly focused on coconut cultivation, although around 20.0 per cent of farm-families have also engaged in agriculture and allied activities such as livestock, fishery and poultry. The mean return from various farming activities ranges from Rs. 2,33,000 to a maximum of Rs. 3,42,333 per annum, while the total consumption expenditure of different groups of farm-families ranges between Rs. 2,07,000 and Rs. 2,31,000 per annum.

TABLE 1. SOCIO-ECONOMIC DESCRIPTIVE STATISTICS OF SAMPLE COCONUT FARM HOUSEHOLDS ACCORDING TO DIFFERENT AGE GROUPS OF PLANT IN TAMIL NADU INDIA

Parameters	Units	Group I (n=7) 1-10 years		Group II (n=38) 11-20 years		Group III (n=27) 21-30 years		Group IV (n=20) 31-40 years		Group V (n=8) 41-50 years	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Farmer's age	Years	25.43	1.51	31.79	5.67	46.07	6.03	55.00	4.30	61.50	3.93
Sex/Gender	Code	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
Education	Code	1.00	0.79	2.00	1.13	2.00	1.22	2.00	1.12	2.00	0.82
Religion	Code	1.14	0.38	1.26	0.45	1.19	0.40	1.45	0.51	1.43	0.52
Caste	Code	1.86	0.38	1.87	0.66	1.89	0.64	2.20	0.62	2.00	0.53
Distance to town	Code	1.14	0.38	1.32	0.66	1.37	0.69	1.25	0.64	1.38	0.74
Leased in land	Hectare	-	-	-	-	-	-	-	-	-	-
Leased out land	Hectare	-	-	-	-	-	-	-	-	-	-
Total operational holding	Hectare	1.03	0.75	1.68	2.27	2.10	2.23	1.56	2.43	1.30	1.16
Non-farm income	₹annum^{-1}	75000.00	8736.89	79105.26	33995.06	81592.59	33728.85	71800.00	14192.66	75250.00	11170.75
Total valuation of assets	₹annum^{-1}	212142.86	191873.59	217702.70	120569.22	238148.15	223276.08	204750.00	117310.60	163750.00	50124.84
Gross return from crops + animals	₹annum^{-1}	299285.71	63273.78	341710.53	193276.43	342333.33	178149.89	314250.00	164598.99	233125.00	70808.47
Total consumption expenditure	₹annum^{-1}	227714.29	25620.40	222657.89	21240.73	231277.78	23931.12	222350.00	20939.83	207625.00	20703.26

Note: Group I: 1-10 years age of plants Group II: 11-20 years age of plants Group III: 21-30 years age of plants Group IV: 31-40 years age of plants Group V: 41-50 years age of plants, n: Number of farmers
Sex code: 1- Male 2- Female Education code: 1- Illiterate 2- Primary(educated) Religion code: 1- Hindu 2- Christian Caste code: 1- General 2-OBC 3-Others Distance to town code: 1- >5Km
2- <5Km.

One striking observation is that, despite considering various age groups of plants, the mean return and expenditure of farm-families was highest for Group III, representing 21-30 years of farming experience in coconut plantations. This pattern can be explained by the biological life cycle of the coconut tree, as the age span of 21-40 years corresponds to its full bearing stage, during which the number of nuts per plant is at its peak. Beyond 40 years, the fruit bearing ability of the plant gradually declines, leading to a reduction in overall yield.

III

RESULTS AND DISCUSSION

3.1 Cost Structure of Coconut Plantations

The initial investment cost incurred for coconut plantations refers to the expenditure required to establish the plantation until returns begin from the seventh year onwards. The initial investment in coconut plantations worked out to be slightly greater than Rs. 1, 00,000 per hectare per annum, ranging from a minimum of Rs.1,01,863 (Group IV: 31-40 years of plantation) to a maximum of Rs.1,08,750 (Group I: 1-10 years of plantation) per hectare per annum. This accounts for only around 18.0 per cent of the total establishment cost incurred up to the sixth year across all plant age groups. Activities like land preparation, digging, filling and planting, fencing were the major contributors towards labour costs, accounting for 7-8 per cent of the initial investment across all age groups. Total labour cost starting from land preparation to harvesting, handling and de-husking contitutes around 20.0 per cent of the initial investment cost of coconut plantations. These findings are consistent with earlier studies by Kishore and Murthy (2017) on coconut plantations in Karnataka, as well as Goswami and Challa (2007) on the computation of initial investment cost in rubber plantation. Total maintenance cost is the major part of cost incurred for establishment of coconut plantation, contributing approximately 80.0 per cent. Within maintenance cost, almost equal contribution came from cost incurred for variable and fixed inputs (around 50.0 per cent each). Variable cost includes material cost like planting materials, manures and fertilizers, plant protection chemicals, irrigation and miscellaneous uses, total labour cost (both hired and owned) and interest on working capital @12.5 per cent per annum, while fixed cost includes rental value of land, depreciation of own machineries, land revenue cess taxes and interest on fixed capital @10.0 per cent per annum. Planting material accounts for 9.0 per cent of total material cost in the first year, while the cost of manures and fertilizers shares around 60.0 per cent of the total material cost from first year onwards. Irrigation contributes around 34.0 per cent of the labour cost across all plantation age groups. Opportunity cost of land shares around 86.0 per cent of the total fixed cost in coconut plantations up to the sixth year of investment (Chinniah and Suresh, 2013). The cost of production in seventh year was estimated at around Rs. 2, 00,000 per hectare per annum for coconut and around Rs. 2, 20,000 per hectare per annum for copra. Total variable cost shares

TABLE 2. MAINTENANCE COST OF COCONUT PLANTATION DURING GESTATION AND BEARING PERIOD FOR AGE GROUP 1-10 YEARS IN TAMIL NADU INDIA

(Rs. per hectare)

SL. No.	Particulars/Year (1)	1st year (2)	2nd year (3)	3rd year (4)	4th year (5)	5th year (6)	6th year (7)	Total (8)	Per cent (9)	7th year (10)
1	Land preparation	8721	0	0	0	0	0	8721	1.51	
2	Planting materials	11357	500	0	0	0	0	11857	2.05	
3	Manure	3800	4386	4900	5214	5857	5943	30100	5.20	6857
4	Fertilizers	6757	7643	7829	8143	8571	8629	47572	8.22	8252
5	Plant protection chemicals	431	571	603	617	671	671	3564	0.62	550
6	Irrigation	2399	2814	2857	3286	3286	3286	17928	3.10	2786
7	Miscellaneous	1643	1500	1500	1429	1429	1429	8930	1.54	1429
A	**Total material costs**	26388	17414	17689	18689	19814	19957	119951	20.74	19874
8	Gap filling	971	914	0	0	0	0	1885	0.33	
9	Fertilizers/solutions application	3300	3471	3500	3600	3743	3743	21357	3.69	4529
10	Manure application	5714	5714	5714	6214	7143	7143	37642	6.51	8071
11	Irrigation	7357	8000	8357	8714	8714	8857	49999	8.64	12200
12	Weeding	5671	5671	5671	5743	5743	5743	34242	5.92	12671
13	Harvesting, collection, handling and de-husking									15100
B	**Total labour cost**	31735	23771	23243	24271	25343	25486	153849	26.60	52571
14	Marketing cost									1829
15	Interest on working capital@12.5 per cent	2877	2971	2905	3034	3168	3186	18141	3.14	6571
I	**Total variable cost (A+B+14+15)**	61000	44157	43837	45994	48325	48629	291942	50.47	79016
16	Copra making charges									21250
17	Marketing charges									1829
18	Interest on working capital@12.5 per cent									9228
II	**Total variable cost of copra (A+B+16+17+18)**									104751
19	Amortized establishment cost									70589
20	Rental value	41076	41076	41076	41076	41076	41076	246456	42.61	41076
21	Land revenue	200	200	200	200	200	200	1200	0.21	200
22	Depreciation	2133	2133	2133	2133	2133	2133	12798	2.21	2170
23	Interest on fixed capital@10 per cent	4341	4341	4341	4341	4341	4341	26046	4.50	11404
III	**Total fixed cost (19+20+21+22)**	47750	47750	47750	47750	47750	47750	286500	49.53	125439
IV	**Total cost of coconut (I+III)**	108750	91907	91587	93744	96075	96379	578442	100.00	204456
V	**Total cost of copra (II+III)**									230190

TABLE 3. MAINTENANCE COST OF COCONUT PLANTATION DURING GESTATION AND BEARING PERIOD FOR AGE GROUP 11-20 YEARS IN TAMIL NADU INDIA

(Rs. per hectare)

SL. No.	Particulars/Year	1st year	2nd year	3rd year	4th year	5th year	6th year	Total	Per cent	7th year
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	Land preparation	8493	0	0	0	0	0	8493	1.50	
2	Planting materials	11075	500	0	0	0	0	11575	2.04	
3	Manure	3803	4184	4192	5026	5626	5747	28578	5.03	6790
4	Fertilizers	6632	7342	7345	7816	8171	8234	45540	8.02	8002
5	Plant protection chemicals	423	550	564	606	666	666	3475	0.61	553
6	Irrigation	2405	2661	2737	3105	3105	3211	17224	3.03	2697
7	Miscellaneous	1592	1447	1487	1461	1461	1461	8909	1.57	1395
A	**Total material costs**	25930	16684	16325	18014	19029	19318	115300	20.30	19436
8	Gap filling	1066	874		0	0	0	1940	0.34	
9	Fertilizers/solutions application	3355	3516	3553	3629	3753	3753	21559	3.80	4371
10	Manure application	5474	5474	5579	5987	6842	6842	36198	6.37	7711
11	Irrigation	6895	7500	7623	8434	8447	8500	47399	8.35	11758
12	Weeding	5521	5561	5600	5732	5732	5732	33878	5.97	12418
13	Harvesting, collection, handling and de-husking									15100
B	**Total labour cost**	30804	22924	22355	23782	24774	24826	149465	26.32	51358
14	Marketing cost									1758
15	Interest on working capital@12.5 per cent	2789	2865	2794	2973	3097	3103	17621	3.10	6420
I	**Total variable cost (A+B+14+15)**	59522	42473	41474	44768	46899	47248	282384	49.72	77214
16	Copra making charges									21250
17	Marketing charges									1758
18	Interest on working capital@12.5 per cent									9076
II	**Total variable cost of copra (A+B+16+17+18)**									102878
19	Amortized establishment cost									69448
20	Rental value	40978	40978	40978	40978	40978	40978	245868	43.29	40978
21	Land revenue	200	200	200	200	200	200	1200	0.21	200
22	Depreciation	2083	2083	2083	2083	2083	2083	12498	2.20	2089
23	Interest on fixed capital@10 per cent	4326	4326	4326	4326	4326	4326	25956	4.57	11272
III	**Total fixed cost (19+20+21+22)**	47587	47587	47587	47587	47587	47587	285522	50.28	123986
IV	**Total cost of coconut (I+III)**	107109	90061	89061	92356	94487	94835	567909	100.00	201200
V	**Total cost of copra (II+III)**									226864

TABLE 4. MAINTENANCE COST OF COCONUT PLANTATION DURING GESTATION AND BEARING PERIOD FOR AGE GROUP 21-30 YEARS IN TAMIL NADU INDIA

(Rs. per hectare)

SL. No.	Particulars/Year	1st year	2nd year	3rd year	4th year	5th year	6th year	Total	Per cent	7th year
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	Land preparation	8419	0	0	0	0	0	8419	1.47	
2	Planting materials	11020	500	0	0	0	0	11520	2.00	
3	Manure	3689	4233	4704	4963	5589	5667	28845	5.02	6770
4	Fertilizers	6719	7407	7511	7815	8222	8259	45933	7.99	8028
5	Plant protection chemicals	421	559	589	604	659	659	3491	0.61	563
6	Irrigation	2341	2678	2741	3111	3111	3148	17130	2.98	2667
7	Miscellaneous	1574	1481	1537	1426	1426	1426	8870	1.54	1444
A	**Total material costs**	25765	16859	17082	17919	19007	19159	115791	20.15	19472
8	Gap filling	1037	911	0	0	0	0	1948	0.34	
9	Fertilizers/solutions application	3259	3426	3426	3559	3711	3711	21092	3.67	4430
10	Manure application	5481	5481	5611	5981	6815	6815	36184	6.30	7722
11	Irrigation	6944	7500	8019	8407	8407	8481	47758	8.31	12148
12	Weeding	5522	5541	5585	5715	5715	5715	33793	5.88	12500
13	Harvesting, collection, handling and de-husking									15100
B	**Total labour cost**	30663	22859	22641	23663	24648	24722	149196	25.97	51900
14	Marketing cost									1819
15	Interest on working capital@12.5 per cent	2781	2857	2830	2958	3081	3090	17597	3.06	6488
I	**Total variable cost (A+B+14+15)**	59209	42576	42553	44540	46737	46972	282587	49.18	77860
16	Copra making charges									21250
17	Marketing charges									1819
18	Interest on working capital@12.5 per cent									9144
II	**Total variable cost of copra (A+B+16+17+18)**									103585
19	Amortized establishment cost									70120
20	Rental value	41983	41983	41983	41983	41983	41983	251898	43.84	41983
21	Land revenue	200	200	200	200	200	200	1200	0.21	200
22	Depreciation	2060	2060	2060	2060	2060	2060	12360	2.15	2074
23	Interest on fixed capital@10 per cent	4424	4424	4424	4424	4424	4424	26544	4.62	11438
III	**Total fixed cost (19+20+21+22)**	48668	48668	48668	48668	48668	48668	292008	50.82	125814
IV	**Total cost of coconut (I+III)**	107876	91244	91220	93207	95404	95639	574590	100.00	203674
V	**Total cost of copra (II+III)**									229399

TABLE 5. MAINTENANCE COST OF COCONUT PLANTATION DURING GESTATION AND BEARING PERIOD FOR AGE GROUP 31-40 YEARS IN TAMIL NADU INDIA

(Rs. per hectare)

SL. No.	Particulars/Year	1st year	2nd year	3rd year	4th year	5th year	6th year	Total	Per cent	7th year
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	Land preparation	7983	0	0	0	0	0	7983	1.49	
2	Planting materials	10078	500	0	0	0	0	10578	1.97	
3	Manure	3445	3895	3897	4525	4575	5105	25442	4.74	6540
4	Fertilizers	6440	6875	6910	7225	7225	7545	42220	7.87	7430
5	Plant protection chemicals	413	510	515	580	598	630	3246	0.61	508
6	Irrigation	2230	2445	2460	2750	2750	2800	15435	2.88	2400
7	Miscellaneous	1400	1350	1265	1325	1325	1325	7990	1.49	1325
A	**Total material costs**	24004	15575	15047	16405	16473	17405	104909	19.56	18203
8	Gap filling	1090	880		0		0	1970	0.37	
9	Fertilizers/solutions application	3255	3400	2875	3520	3540	3590	20180	3.76	4210
10	Manure application	5050	5050	4900	5525	5534	6225	32284	6.02	7000
11	Irrigation	6700	7225	7226	8000	7800	8025	44976	8.39	10490
12	Weeding	4800	4800	4585	5170	5070	5170	29595	5.52	12035
13	Harvesting, collection, handling and de-husking									15100
B	**Total labour cost**	28878	21355	19586	22215	21944	23010	136988	25.55	48835
14	Marketing cost									1805
15	Interest on working capital@12.5 per cent	2612	2669	2448	2777	2743	2876	16125	3.01	6104
I	**Total variable cost (A+B+14+15)**	55494	39599	37081	41397	41160	43291	258022	48.12	73142
16	Copra making charges									21250
17	Marketing charges									1805
18	Interest on working capital@12.5 per cent									8761
II	**Total variable cost of copra (A+B+16+17+18)**									98854
19	Amortized establishment cost									65982
20	Rental value	39958	39958	39958	39958	39958	39958	239748	44.71	39958
21	Land revenue	200	200	200	200	200	200	1200	0.22	200
22	Depreciation	1996	1996	1996	1996	1996	1996	11976	2.23	2015
23	Interest on fixed capital@10 per cent	4215	4215	4215	4215	4215	4215	25290	4.72	10816
III	**Total fixed cost (19+20+21+22)**	46369	46369	46369	46369	46369	46369	278214	51.88	118970
IV	**Total cost of coconut (I+III)**	101863	85969	83451	87766	87529	89660	536238	100.00	192113
V	**Total cost of copra (II+III)**									217824

TABLE 6. MAINTENANCE COST OF COCONUT PLANTATION DURING GESTATION AND BEARING PERIOD FOR AGE GROUP 41-50 YEARS IN TAMIL NADU INDIA

(Rs. per hectare)

SL. No.	Particulars/Year	1st year	2nd year	3rd year	4th year	5th year	6th year	Total	Per cent	7th year
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	Land preparation	8500	0	0	0	0	0	8500	1.49	
2	Planting materials	11250	500	0	0	0	0	11750	2.06	
3	Manure	3450	4125	4850	5125	5725	5725	29000	5.09	6900
4	Fertilizers	6625	7250	7500	7875	8250	8250	45750	8.02	6683
5	Plant protection chemicals	428	550	580	611	675	675	3519	0.62	550
6	Irrigation	2275	2475	2750	3125	3125	3375	17125	3.00	1850
7	Miscellaneous	1438	1438	1688	1750	1750	1750	9814	1.72	1375
A	**Total material costs**	25465	16338	17368	18486	19525	19775	116957	20.51	17358
8	Gap filling	1125	950	0	0	0	0	2075	0.36	
9	Fertilizers/solutions application	3313	3500	3500	3500	3788	3788	21389	3.75	4100
10	Manure application	5625	5625	5750	6063	6813	6813	36689	6.43	7750
11	Irrigation	6875	7500	8000	8438	8438	8438	47689	8.36	9500
12	Weeding	5338	5400	5438	5563	5563	5563	32865	5.76	11475
13	Harvesting, collection, handling and de-husking									15100
B	**Total labour cost**	30775	22975	22688	23563	24600	24600	149201	26.17	47925
14	Marketing cost									1575
15	Interest on working capital@12.5 per cent	2784	2872	2836	2945	3075	3075	17587	3.08	5991
I	**Total variable cost (A+B+14+15)**	59024	42184	42891	44994	47200	47450	283743	49.76	72848
16	Copra making charges									21250
17	Marketing charges									1475
18	Interest on working capital@12.5 per cent									6740
II	**Total variable cost of copra (A+B+16+17+18)**									93998
19	Amortized establishment cost									69579
20	Rental value	41133	41133	41133	41133	41133	41133	246798	43.28	41133
21	Land revenue	200	200	200	200	200	200	1200	0.21	200
22	Depreciation	2070	2070	2070	2070	2070	2070	12420	2.18	2093
23	Interest on fixed capital@10 per cent	4340	4340	4340	4340	4340	4340	26040	4.57	11301
III	**Total fixed cost (19+20+21+22)**	47744	47744	47744	47744	47744	47744	286464	50.24	124305
IV	**Total cost of coconut (I+III)**	106768	89928	90635	92738	94944	95194	570207	100.00	197154
V	**Total cost of copra (II+III)**									218304

around 38.0 per cent of the total cost for coconut and 45.0 per cent for copra across all aged groups, with the remaining share attributed to fixed cost. Copra-making charges contributed around 10.0 per cent to the total cost of copra production. Amortization cost after seven years accounts approximately 30.0 per cent of the total cost of copra production. Further, cost of manure and fertilizer constitutes the largest share of the total variable cost for copra production after the seventh year (76.0 per cent). Labour cost for copra making after the seventh year was estimated to be around 29.0 per cent of total labour cost. Among fixed cost components, amortized costs of copra production account for the highest share, contributing about 56.0 per cent of the total fixed cost.

3.2 Output Performance and Optimum Replacement Age of Coconut Plantations

While analysing the output and return from coconut plantations across different age groups, the return has been segregated into mature nuts, tender nuts and copra. The productivity of all age groups varied between 13,000 and 13,700 nuts per hectare, while plants aged 21-30 years with profuse bearing phase recorded highest yield (13,689 nuts per hectare), indicating that this stage corresponds to the peak productive phase. After this stage, the yield declined to 13,027.5 nuts per hectare in 31–40 years age group, suggesting the onset of biological ageing and gradual reduction in productivity. Therefore, the optimum age for replacement of coconut plantations may be considered between 31–40 years, when the yield begins to deteriorate.

The returns from selling mature nuts at Rs.18 per unit ranged from Rs.2,40,000 to Rs. 2,52,000 per hectare for all aged groups. Additional returns from husk and dry leaves were around Rs. 9000 per hectare. After deduction of total cost, net return from mature nuts ranged between Rs. 40,000 to Rs. 50,000 per hectare. Another striking feature is that due to lower maintenance cost, the net return from mature nuts was highest (Rs. 49,646 per hectare) for plantations aged 41-50 years. A similar trend was observed for tender nuts and copra, with net returns of Rs. 70,971 and Rs. 1,12,402 per hectare, respectively, in the same age group. Of all three major products from coconut plantations, copra registered the highest profit, with productivity of 28.0-30.0 quintals per hectare in this region.

3.3 Economic Feasibility of Coconut Plantation in Long-run

The authors have considered copra while analysing the financial feasibility of coconut plantations across different age groups of plants under study. Since return from copra are realized from the seventh year onwards, both return and cost have been projected for an additional ten years (up to sixteenth year of cultivation) from the current stage of each age group to assess the economic feasibility and viability of coconut plantations in Thanjavur district.

Net present value of copra has been computed at 14.0 per cent discounted rate for all age group plants, with values ranging from Rs.9,76,000 to Rs.17,90,000 per hectare. Notably, 41-50 years age group plants have registered highest NPV (Rs.17,90,703 per hectare). Internal rate of return (IRR) of copra has been estimated

TABLE 7. OUTPUT AND RETURN FROM COCONUT PLANTATION FOR DIFFERENT AGE GROUPS OF PLANT IN TAMIL NADU INDIA

Sl. No.	Particulars	Unit	Average Yield and return per hectare					
			Group I (1-10 years)	Group II (11-20 years)	Group III (21-30 years)	Group IV (31-40 years)	Group V (41-50 years)	Overall
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Total yield (nuts)	No.	13392.9	13363.2	13688.9	13027.5	13443.8	13383.3
2	Domestic consumption	No.	207.1	210.5	207.4	205.0	231.3	212.3
3	Nuts available for selling or copra making	No.	13185.7	13152.6	13481.5	12822.5	13212.5	13171.0
I	**Yield of mature nuts**	No.	13185.7	13152.6	13481.5	12822.5	13212.5	13171.0
4	Average price per nut	Rs.	18.0	18.0	18.0	18.0	18.0	18.0
5	Returns realized	Rs.	237342.9	236747.4	242666.7	230805.0	237825.0	237077.4
6	Husk	Rs.	5614.3	5579.6	5657.4	5370.0	5475.0	5539.3
7	Dry leaves	Rs.	3500.0	3539.5	3574.1	3575.0	3500.0	3537.7
8	Total returns	Rs.	246457.1	245866.4	251898.1	239750.0	246800.0	246154.3
9	Total cost	Rs.	204455.5	201200.1	203674.3	192112.7	197153.5	199719.2
10	Net returns from mature coconut	Rs.	42001.7	44666.3	48223.9	47637.3	49646.5	46435.1
II	**Yield of tender nuts**	No.	13185.7	13152.6	13481.5	12822.5	13212.5	13171.0
11	Average price per unit	Rs.	20.0	20.0	20.0	20.0	20.0	20.0
12	Returns realized	Rs.	263714.3	263052.6	269629.6	256450.0	264250.0	263419.3
13	Dry leaves	Rs.	3928.6	3868.4	3870.4	3750.0	3875.0	3858.5
14	Total returns	Rs.	267642.9	266921.1	273500.0	260200.0	268125.0	267277.8
15	Total cost	Rs.	204455.5	201200.1	203674.3	192112.7	197153.5	199719.2
16	Net returns from tender nuts	Rs.	63187.4	65720.9	69825.7	68087.3	70971.5	67558.6
III	**Yield of copra**	Quintals	29.3	29.2	30.0	28.5	29.4	29.3
17	Average price per quintal	Rs.	10860.0	10860.0	10860.0	10860.0	10860.0	10860.0
18	Returns realized	Rs.	318215.2	317416.8	325353.1	309449.7	318861.7	317859.3
19	Dry leaves	Rs.	2000.0	2210.5	2203.7	2625.0	2187.5	2245.3
20	Husk	Rs.	4500.0	4500.0	4500.0	4500.0	4500.0	4500.0
21	Shell	Rs.	5164.3	5155.3	5155.6	5137.5	5156.3	5153.8
22	Total returns	Rs.	329879.5	329282.6	337212.3	321712.2	330705.4	329758.4
23	Total cost (including copra making and marketing costs)	Rs.	230190.3	226864.3	229399.0	217824.0	218303.5	224516.2
24	Net returns from copra	Rs.	99689.2	102418.4	107813.3	103888.2	112402.0	105242.2

Note: Group I: 1-10 years age of plants Group II: 11-20 years age of plants Group III: 21-30 years age of plants Group IV: 31-40 years age of plants Group V: 41-50 years age of plants.

TABLE 8. FINANCIAL FEASIBILITY OF COCONUT PLANTATION IN TAMIL NADU ACCORDING TO DIFFERENT YEARS OF FARMING EXPERIENCE

(Rs. per hectare)

Year	DF @ 14 per cent	Group-I (1-10 years)			Group-II (11-20 years)			Group-III (21-30 years)			Group-IV (31-40 years)			Group-V (41-50 years)		
		DTC	DTR	DNR	DTC	DTR	DNR	DTC	DTR	DNR	DTC	DTR	DNR	DTC	DTR	DNR
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1	0.877	95395	0	-95395	93955	0	-93955	94628	0	-94628	89354	0	-89354	93656	0	-93656
2	0.769	70719	0	-70719	69299	0	-69299	70209	0	-70209	66150	0	-66150	69197	0	-69197
3	0.674	61819	0	-61819	60114	0	-60114	61571	0	-61571	56327	0	-56327	61176	0	-61176
4	0.592	55504	0	-55504	54682	0	-54682	55186	0	-55186	51965	0	-51965	54908	0	-54908
5	0.519	49898	0	-49898	49074	0	-49074	49550	0	-49550	45460	0	-45460	49311	0	-49311
6	0.455	43909	0	-43909	43206	0	-43206	43572	0	-43572	40848	0	-40848	43369	0	-43369
7	0.399	91993	131832	39840	90663	131594	40930	91676	134763	43086	87051	128568	41518	87242	132162	44920
8	0.350	115394	165369	49975	115317	167378	52061	118214	173773	55558	113013	166913	53900	115557	175057	59499
9	0.307	144749	207436	62687	146676	212893	66218	152434	224075	71641	146719	216694	69975	153063	231873	78811
10	0.269	181571	260205	78634	186561	270785	84224	196560	288939	92379	190477	281322	90845	202741	307131	104389
11	0.236	227760	326397	98638	237293	344420	107127	253459	372580	119121	247286	365225	117939	268543	406813	138270
12	0.207	285699	409428	123730	301820	438078	136258	326829	480432	153603	321038	474152	153114	355702	538849	183147
13	0.182	358377	513581	155205	383893	557204	173311	421437	619504	198067	416786	615566	198780	471149	713739	242590
14	0.159	449543	644229	194687	488285	708724	220439	543432	798834	255402	541090	799156	258065	624066	945391	321325
15	0.140	563900	808112	244212	621065	901448	280383	700741	1030075	329334	702468	1037500	335032	826614	1252228	425615
16	0.122	707348	1013684	306336	789951	1146578	356628	903587	1328255	424668	911976	1346930	434954	1094900	1658653	563753
		3503576	4480274	976698	3731853	4879102	1147249	4083084	5451228	1368144	4028007	5432026	1404020	4571195	6361897	1790703
NPV				**976698**			**1147249**			**1368144**			**1404020**			**1790703**
IRR				**29.70**			**31.34**			**32.88**			**33.78**			**35.56**
BCR				**1.28**			**1.31**			**1.34**			**1.35**			**1.40**
PBP				**11.38**			**11.14**			**10.94**			**10.79**			**10.60**

Note: Group I: 1-10 years age of plants Group II: 11-20 years age of plants Group III: 21-30 years age of plants Group IV: 31-40 years age of plants Group V: 41-50 years age of plants DF: Discounted factor DTC: Discounted total cost DTR: Discounted total return DNR: Discounted net return NPV: Net present value IRR: Internal rate of return BCR: Benefit cost ratio PBP: Pay-back period.

between 30.0 to 36.0 per cent, which is significantly higher than the discounted rate (14.0 per cent), indicating strong economic viability and sustainability of coconut plantations across all age groups in the long run. Among the different age groups, 41-50 years old plants have marked the highest IRR (35.56 per cent). Furthermore, the projected values revealed a discounted cost-benefit ratio between 1.3 and 1.4 across all age groups, reflecting a satisfactory and stable returns from future plantations. The highest ratio (1.4) was again observed for the 41–50 years age group.

Another important indicator of financial feasibility is the break-even point, which represents the stage at which the cumulative returns from the plantation become equal to the total investment cost incurred. In the present study, the break-even point was evaluated through the discounted pay-back period, since both concepts essentially indicate the time required to recover the initial investment from the net cash flows of the project. The results revealed that coconut plantations recover their initial investment within 10–11 years of cultivation, depending on the age group of plants. Plantations aged 41–50 years recorded the shortest discounted pay-back period of about 10.60 years, whereas the longest pay-back period (11.38 years) was observed for plantations in the 1–10 years age group. Thus, coconut plantations are capable of reaching their break-even point within a decade of establishment, after which the plantation continues to generate positive net returns over its productive life. These findings highlight the long-term economic sustainability of coconut cultivation in the Thanjavur district.

However, the entire study was an honest attempt to work out the economic feasibility of copra production in Tamil Nadu, wherein the authors have classified plantations into five distinct age groups and collected cost-return information up to seventh year of plantation. For financial feasibility computation, the authors further projected costs and returns for an additional ten years, thereby extending the economic life of the plantations up to sixteen years. A striking feature of this entire study is that the IRR (~30 per cent) was substantially higher than the existing discounted rate of 14 per cent for all age group plants, registering a steady and sustained growth in coconut plantation in this region. These findings are similar with those reported by Sulochana (2009). Regarding payback period, initial investment is recovered within 10-11 years for all age group plants. However, this result contrasts with the findings of Ramachandra (2006), who reported a comparatively longer payback period, while it aligns with the observations of Dusang et al. (2023) in their assessment of the economic feasibility of coconut cultivation in Maharashtra.

IV

CONCLUSIONS

The study concludes that the total maintenance cost of coconut plantations after six years ranges between Rs.5,30,000 to Rs.5,80,000, depending on the age of plants. The initial establishment cost accounts for approximately 18.0 per cent of the total

maintenance cost. The contribution of fixed and variable input costs were found to be more or less equal (~50 per cent) to total cost where material cost shares around 20.0 per cent and labour cost has contributed around 27.0 per cent to total establishment cost of copra production. In terms of output, the production of copra (~30.0 quintals) is derived from around 13,000 numbers of mature nuts per hectare. However, net return from copra was estimated at about Rs.1, 00,000 per hectare. Regarding financial feasibility over sixteen years of economic life, the plantations were feasible for all age group plants where highest NPV (Rs.17,90,703) was registered for 41-50 years aged plants with higher IRR (35.56 per cent) and BCR (1.4) with lower pay back period of ten years and six months of time. Financial incentives, enhanced coconut-specific schemes, infrastructural development, improved marketing and value-addition support from the Government and local bodies are essential to promote and sustain coconut cultivation in Thanjavur.

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