R. P. F. III

(13)

FINAL REPORT

1. Institute Code No: Zoon. I.2(443):

2. I. C. A. R. Code No: P_1-78|10-IC1-E10|2710

3. Name and Address of Research Institute/Centre: G.P.C.R.I, Research Centre, Kohitnagar Dt. Jalpaiguri-735101, West Bengal.

4. Project Title: Succession of Inter and mixed cropping in garden land-Arecanut gardens.

5. Name and Designation of Project Leader
R. K. Singh, Scientist- S

6. Name (s) and Designation(s) of Project Associates including Project Leader and work to be done:

Sl. No.	Name and Designation	Time spent	work done
1.	R. K. Singh, Scientist- S	24 months.	Collection, tabulation and analysis of data.

7. Location of Research Project with complete address (Division/Section/Sub-Centre)
G.P.C.R.I. Research Centre, Kohitnagar, District. Jalpaiguri-735101 West Bengal.

8. Date of start

July, 1978.

9. Date of termination

January,1982.

10. (a) Objectives (Not more than 150 words)

i) To estimate the cost of production and measures of farm profits based on different cost concepts in the farmers field.

ii) To select the inter/mixed crop which can be grown most economically in arecanut garden and to find out the scope for extension for different size of holdings.

iii) To study the land use pattern of areca growers.

iv) To determine the replacement time of arecanut tree.

(b) Practical Utility including background information (Not more than 150 words)

Inspite of the importance of arecanut crop in our economy the efficiency of arecanut production in the country is still very low and inspite of its significance as a cash crop, micro-studies on arecanut economics have attracted very little attention from the researchers in this country. The efforts to raise the level of efficiency of production of arecanut necessiate investigations in to the various aspects of economics of arecanut cultivation. The present study is an attempt in this direction.

CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
KASARAGOD-670 124, KERALA

RPF III
Project No. Econ.I.2(443)
Date of Start: July 1978

11. Technical Programme: and Method

(1) Collection of data by survey method from sampled arecanut growers in Jalpaiguri district.

(2) Preparation of proforma to collect desired data from different agencies such Block, Traders, Farmers etc.

(3) Tabulation, analysis and interpretation of data.

Jalpaiguri district has purposively been selected for the purpose. Stratified Random Sampling method was used for the selection of blocks, gram panchayats and arecanut growers for the purpose of study. There are 13 blocks in Jalpaiguri district fifty percent of these blocks were i.e. 7 blocks were selected at random. There were 74 panchayats in these seven selected blocks. Out of these fifty percent of the panchayats with a minimum of 3 from each block were selected at random for the study. A list of arecanut growers from these 37 panchayats was prepared in ascending order of the size of their own holding and stratified into 3 strata viz. 2 hectares and below, above 2 hectares to 4 hectares and above 4 hectares. The first group being designated as small farmers, second group as medium farmers and third group as large farmers. Twenty five percent of the arecanut growers from each of these 3 strata were then selected at random. Thus 190 arecanut growers 50 small, 67 medium and 73 large were selected for the study from 37 panchayats of 7 blocks of Jalpaiguri district.

The information on costs and returns, cropping pattern, irrigation, size of holdings, family composition and marketing etc. were collected from the randomly selected farmers by personal interviews in a proforma designed for the purpose. The direct as well as indirect costs involved for a period of 3 years (1977 (1978, 1979 and 1980) in arecanut cultivation including inter and mixed crops, alongwith its yield and marketing were collected. The survey year was 1979 and 1980.

CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
KASARAGOD-670 124, KERALA

RPF III
Project No. Rcom.I.2(443)
2. Final Report 1978 —1982 Date of Start: July 1978

ANALYTICAL TOOLS:

Since the gestation period for arecanut is much longer than that for other crops and since its economic life is greater than 30 years (out of which the pre-bearing stage or the period of first 7 years after plantation usually involves costs and does not yield any returns), the time element in the calculation of cost and return was taken care of by evaluating the profitability of arecanut gardens with the help of the 4 major techniques. These are:

i) Pay back period (PBP)

ii) Net present value (NPV)

iii) Internal rate of return (IRR)

iv) Benefit cost ratio (BCR)

ESTIMATES OF VARIOUS COSTS IN ARECANUT AND INTERCROPS:

Estimates of various costs in arecanut and other crops presented in table-1 indicated that "Cost A_1 exhibited positive relation with the size of farm while cost B and C did not indicate such trend in arecanut. Among the intercrops only in banana and pineapple all the three types of costs indicated positive relation with the size of farm. Betelvine exhibited highest cost C per hectare followed by ginger, turmeric, banana and pineapple", same trend was observed in case of cost A_1. In case of cost betelvine exhibited highest cost followed by turmeric, ginger, banana and pineapple.

Cost of production per quintal for arecanut worked out to be Rs.174.44 for small farmers, Rs.194.75 for medium farmers, Rs.205.35 for large farmers and Rs.190.59 for all farmers.

YIELD IN ARECANUT AND INTERCROPS:

Details of yield in arecanut and intercrops presented in table-2 indicated negative relation between yield per hectare and size of farm. Same trend was observed for betelvine, however, for pineapple and banana opposite trend was observed and for ginger and turmeric no specific trend was observed.

MEASURES OF FARM PROFIT:

Various measures of farm profits such as family labour income (FLI), farm business income (FBI), farm investment income (FII), gross income (GI), net income (NI) as well as output-input ratio (O/I) in arecanut and intercrops presented in table-3 indicated that "all these measures except for output input ratio exhibited positive relation with the size of farm in arecanut". Output-input ration was highest on large farms followed by small farms and medium farms. "Among the intercrops in pineapple all the measures of farm profits exhibited positive relation with the size of farm while in betelvine opposite trend was observed". In banana all the measures except output input ration exhibited positive relation with the size of farm. In ginger and turmeric no specific trends were observed.

DISCOUNTED MEASURES OF PROFITABILITY IN ARECANUT:

The above analysis of costs and returns for arecanut and inter-crops is based on crude measures which did not take in to consideration time element. However, as explained in analytical tools in chapter I, profitability in arecanut crop with

relation with the size of farm while cost B and C did not indicate such trend in arecanut. Among the intercrops only in banana and pineapple all the three types of costs indicated positive relation with the size of farm. Betelvine exhibited highest cost C per hectare followed by ginger, turmeric, banana and pineapple", same trend was observed in case of cost A_1. In case of cost betelvine exhibited highest cost followed by turmeric, ginger, banana and pineapple.

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DISCOUNTED MEASURES OF PROFITABILITY IN ARECANUT:

The above analysis of costs and returns for arecanut and inter-crops is based on crude measures which did not take in to consideration time element. However, as explained in analytical tools in chapter I, profitability in arecanut crop with a longer gestation period has to be studied after taking into consideration the time element by discounting the costs and returns. Analysis of such discounted measures is attempted in following paragraphs.

The four measures of profitability namely pay back period, NPV, IRR and BCR presented in table-4 give the following results:

Pay back period: It is a crude measure and to judge the profitability one has to obtain information on the maximum pay back period desired by arecanut growers. In the present study information collected from the sample growers indicate that the maximum pay back period desired by the sample growers ranged from 10 to 12 years. The actual pay back period computed ranged from 8.77 years to 9.53 years. Thus the computed pay back period was less than the maximum pay back period desired by the sample growers. Hence, according to the criterion of pay back period arecanut cultivation was profitable.

Net Present Value (NPV): The NPV at 10 per cent discount rate ranged from Rs.47874 for medium farmers to Rs.54420 for large farmers. Even at higher discount rate of 12 percent NPV ranged from Rs.32507 in medium farmers to Rs.35052 in large farmers. These values of NPV were positive and quite high, hence, according to the criterion of NPV arecanut cultivation was profitable.

Internal Rate of Return (IRR): The IRR ranged from 24.48 percent in medium farmers to 24.87 percent in small farmers. It was much greater than the cost of borrowing the capital, which ranged from 9 to 14 percent, for borrowings from cooperatives and commercial banks in the region. Thus according to the criterion of IRR arecanut cultivation was profitable.

Benefit Cost Ratio (BCR): The Benefit Cost Ratio at 10 percent of discount rate ranged from 2.315 in medium farmers to 2.480 in large farmers. Even at higher rate of discount of 12 percent it ranged from 2.048 in medium farmers to 2.183 in small farmers. In all the size groups it was greater than unity hence according to the criterion of BCR also arecanut cultivation was profitable.

Replacement Period: The average annual returns help us in determining the replacement period of arecanut trees.

Arecanut has a productive life of about 60-70 years and the farmers cut down the trees when they become uneconomic and replace them by new plantations. In the whole period of growth of arecanut, the first 7 years involve only cost and no returns. From 7 to 10 years there is initial low bearing stage. From 10 to 20 years the yield goes on increasing. From 20 years onwards the yield goes on declining but after 30 years declines faster. Usually the farmers cutdown the trees after 50 years when the yields are so low that gardens become uneconomic. Thus the re-

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The average annual returns (AAR) can be computed by dividing the NPV by the present value of an annuity of rupee one over the life of the project. At a discount rate of 10 percent, the present value of rupee 1 received at the end of each period (years) for 40 periods (years) is Rs.9.779 and at 12 discount rate it is Rs.8.244. The formula for average annual return is as follows:

$$AAR = \frac{NPV}{\text{Present Value of annuity of Re.1 for 40 years.}}$$

The AARs computed at 10 and 12 percent discount rate presented in table-5 indicate that so long as Net Returns (Revenue - Cost) are greater than Rs.4240 for small farmers, Rs.3943 for medium farmers and Rs.4252 for large farmers, the arecanut palms should not be replanted. In other words old arecanut palms (trees) on small farms should not be replaced by new palms until net returns from old palms do not fall below Rs.4240 per hectare. Similarly old trees on medium and large farms should not be replaced by new trees until net returns from old trees do not fall below Rs.3943 per hectare on medium farms and below Rs.4252 per hectare on large farms. Thus on this basis no arecanut garden of the sample farmers needs to be replanted since none of the sample gardens reported net returns (upto 40 years of age) below the average annual returns computed above.

CROPPING PATTERN — ARECANUT AND INTERCROPS:

Average area under arecanut gardens per farm for the sample was 0.45 hectares and it increased with the size of farm as is evident from table-6. This area for large farmers was more than 3 times that of small farmers and more than 1½ times that of medium farmers. The main intercrops grown by sample farmers were pineapple, banana, turmeric, ginger and betelvine. Among the intercrops betelvine occupied maximum proportion of the total area under arecanut (5.62 percent) followed by banana (4.29 percent), pineapple (1.68 percent), ginger (1.47 percent) and turmeric (1.13 percent). Of the total area under arecanut all the five intercrops together accounted for only 14.19 percent while 85.81 percent of the area was without any intercrop. Proportion of area under banana declined with the increase in the size of farm while that under ginger exhibited opposite trend. Other intercrops did not exhibit any definite trend in relation to size of farm. Further, betelvine also accounted for the highest proportion of the gross area sown plus area under arecanut (0.48 percent), followed by

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Table-1: Estimates of various costs in arecanut and intercrops

(Rs./hectare)

Sl. No.	Size group		Arecanut	Banana	Pineapple	Betelvine	Ginger	Turmeric
1.	Small	A_1	1230.69	1108.45	1212.20	2309.37	2244.62	2306.34
		B	2523.86	1296.45	1399.70	2530.70	2436.93	2494.44
		C	3358.00	1720.00	1760.80	4064.00	2783.08	2782.90
2.	Medium	A_1	1503.42	1366.45	1395.60	2434.01	1994.57	1904.64
		B	2753.72	1523.45	1552.60	2593.07	2154.57	2061.71
		C	3642.00	1925.85	1956.10	4585.20	2483.14	2330.00
3.	Large	A_1	1549.91	1719.34	1474.60	2612.83	2210.50	2273.33
		B	2504.30	1797.34	1659.85	2685.95	2288.71	2351.33
		C	3415.00	2248.54	2022.15	4130.39	2679.74	2601.33
4.	All farms	A_1	1430.44	1464.38	1361.95	2518.38	2150.87	2126.34
		B	2569.71	1593.21	1484.90	2637.30	2263.57	2267.27
		C	3444.00	2022.37	1963.37	4240.21	2632.62	2535.31

Table-2: Yields per hectare of arecanut and intercrops.

Quintals

Sl. No.	Size group	Arecanut	Pineapple	Banana	Ginger	Turmeric	Betelvine
1.	Small	19.25	40.00	34.00	26.15	40.38	20.35
2.	Medium	18.70	44.91	39.00	20.57	32.93	18.57
3.	Large	16.63	46.96	44.50	29.55	41.00	15.88
4.	All farms	18.07	45.28	40.30	26.70	37.42	17.28

Table-3: Measures of farm profit

Sl. No.	Size group	Arecanut	Pineapple	Banana	Ginger	Turmeric	Betelvine
1. Small	FLI	11284.14	1400.30	1253.55	1293.84	967.10	6033.30
	FBI	12577.31	1587.80	1441.55	1486.15	1155.20	6254.63
	FII	11743.17	1226.70	1018.00	1140.00	866.74	4721.33
	GI	13808.00	2800.00	2550.00	3730.77	3461.54	3564.00
	NI	10450.00	1039.20	830.00	947.69	678.64	4500.00
	O/I Ratio	4.11	1.59	1.48	1.34	1.24	2.11
2. Medium	FLI	11996.28	1725.83	1401.55	931.14	901.70	5322.68
	FBI	13246.58	1882.83	1558.55	1091.14	1358.77	5481.74
	FII	12358.30	1479.33	1156.15	762.57	790.48	3489.61
	GI	14750.00	3278.43	2925.00	3085.71	2963.41	7915.75
	NI	11108.00	1322.33	999.15	602.57	633.41	3330.55
	O/I Ratio	4.05	1.68	1.52	1.24	1.27	1.73
3. Large	FLI	13684.70	1862.15	1540.16	1980.52	1338.67	4442.01
	FBI	14639.09	2047.40	1618.16	2058.73	1416.67	4515.11
	FII	13728.39	1577.85	1166.96	1667.70	1166.67	3070.69
	GI	16189.00	3522.00	3337.50	4269.23	3690.00	7127.96
	NI	12774.00	1499.85	1088.96	1589.49	1088.67	2997.57
	O/I Ratio	4.74	1.74	1.48	1.59	1.42	1.73
4. All farms	FLI	12884.29	1870.38	1424.36	1221.35	1054.38	4922.58
	FBI	14023.56	1993.33	1553.19	1734.05	1195.31	5041.50
	FII	13149.27	1514.86	1084.03	1365.00	927.27	3438.59
	GI	15454.00	3355.28	3017.57	3884.92	3321.65	7559.88
	NI	12010.00	1391.91	955.20	1252.30	786.34	3319.67
	O/I Ratio	4.49	1.71	1.49	1.48	1.31	1.78

Table-4: Measures of profitability (investment worth) in arecanut

(n = 40)

Sl. No.	Particulars	size group			
		Small	Medium	Large	All farms
1.	Pay back period (years)	8.77(I)	9.53(III)	9.20(II)	9.38
2.	Net Present Value (NPV) Rs. 10%	50786(II)	47874(III)	54420(I)	51253
	12%	34956(II)	32507(III)	35052(I)	34599
3.	Internal Rate of Return (IRR) %	24.87(I)	24.48(III)	24.61(II)	24.74
4.	Benefit Cost Ratio (BCR) at 10%	2.465(II)	2.315(III)	2.480(I)	2.411
	12%	2.183(I)	2.048(III)	2.112(II)	2.110

Figures in parentheses indicate ranks.

Table-5: Average annual returns for arecanut

(Rs./hectare)

Sl. No.	Particulars	Size group			
		Small	Medium	Large	All farms
1.	Net Present Value (NPV)				
	A_1 at 10%	50786	47874	54420	51253
	A_2 at 12%	34956	32507	35052	34576
2.	Present value of annuity of rupee one for 40 years				
	B at 10%	9.779	9.779	9.779	9.779
	C at 12%	8.244	8.244	8.244	8.244
3.	Average annual return				
	(i) at 10%	$\frac{50786}{9.779}$	$\frac{47974}{9.779}$	$\frac{54420}{9.779}$	$\frac{51253}{9.779}$
	A_1/B =	5193.374	4895.592	5564.986	5241.128
	(ii) at 12%	$\frac{34956}{8.244}$	$\frac{32507}{8.244}$	$\frac{35052}{8.244}$	$\frac{34576}{8.244}$
	A_2/C =	4240.175	3943.110	4251.819	4194.080

Table-6: Arecanut and intercrops

(Area in hectares)

Sl. No.	Size group	Arecanut	Pineapple	Banana	Ginger	Turmeric	Betelvine	Total area with intercrops	Area without intercrops
1.	Small	0.22	0.0003	0.02	0.0002	0.005	0.02	0.05	0.17
			(1.60)	(7.58)	(1.16)	(2.32)	(6.68)	(19.34)	(80.66)
			(0.19)	(0.88)	(0.13)	(2.27)	(0.78)	(2.25)	(9.39)
2.	Medium	0.36	0.01	0.02	0.004	0.006	0.02	0.06	0.03
			(2.36)	(4.86)	(1.44)	(1.69)	(5.23)	(15.58)	(84.42)
			(0.22)	(0.45)	(0.18)	(0.64)	(0.48)	(1.43)	(7.76)
3.	Large	0.69	0.008	0.02	0.01	0.002	0.04	0.08	0.61
			(1.37)	(3.27)	(1.56)	(0.60)	(5.57)	(12.37)	(87.63)
			(0.14)	(0.25)	(0.12)	(0.05)	(0.43)	(0.95)	(6.76)
4.	All farms	0.45	0.009	0.02	0.006	0.005	0.03	0.07	0.38
			(1.68)	(4.29)	(1.47)	(1.13)	(5.62)	(14.19)	(85.81)
			(0.14)	(0.36)	(0.12)	(0.10)	(0.48)	(1.20)	(7.20)

Figures in upper parentheses indicate the percentage to area under arecanut and in lower parentheses percentage to gross area sown + area under arecanut.

13. Approximate expenditure incurred in the Project: (Give reasons for variation, if any, from original estimated cost)

Rs. 35,000/-

14. Publications and material (one copy each to be supplied with this proforma)

a) Research papers

(1). "Economics of Export oriented Plantation crops- A case sample study of Arecanut" (R.K.Singh,R.A.Singh& V.P.Tyagi) IJAE, Vol.xxxvii No.3 Page-352. 1982. **

b) Popular articles

(1) "Intercropping in Areca gardens in North Bengal" (R.K.Singh, H.Y.Kumar, K.N.Ray Barman & A.C.Roy), Indian Farming, XXX-II No.9, pp-13-15, 1982.

c) Report

Thesis "Economics of Arecanut Cultivation in Jalpaiguri District, West Bengal", Submitted to Institute of Agril. Sciences, Banaras ++

d) Seminars and Workshops (Relevant to the Project) in which the Scientists have participated:

1. SIJAR- 1982 held at CPCRI, Regional Station, Vittal during December,12-14,1982.

2. Fifth Annual Symposium on Plantation Crops held at CPCRI, Kasaragod during December,15-18,1982.

++ Hindu University, as Ph.D. Thesis.

e) Material developed such as new varieties of crops or breeds of farm animals, implements, products, etc.)

**

(2) "Productivity of Arecanut cultivation -- A sample study" (M.M. Khalerao, R.K.Singh and Ramaswamy Singh) SIJAR-1982.

(3) "A study of Marketing of Arecanut in Jalpaiguri District, West Bengal" (R.K.Singh, Khalerao) - SIJAR-1982.

(4) "Some Methodological problems in estimating the cost of production of plantation crops" (R.K.Singh, M.M.Khalerao and P.K. Das) - PLACROSIM-V, 1982.

15. Details (Nos. etc.) of Field/Laboratory Note books and final material and their location,

Schedules, Questionnaires, Tabulation sheets are maintained at the Research Centre, Mohitnagar, West Bengal.

16. Comments/suggestions of Project leader regarding possible future line of work that may be taken up arising of this project:

Similar studies should be undertaken in the neighbouring arecanut growing state Assam.

17. Signatures with name of Project Leader and Associates:

(R. K. Singh.)

18. Signature (with comments, if any) of Head of Division/Section/Station :

(P. K. Das)

19. Signature (with comments, if any) of Director :

(K.V.A.Bavappa)