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Vol XXXVII
No. 1

ISSN 0019-5014

JANUARY-
MARCH
1982

INDIAN JOURNAL OF AGRICULTURAL ECONOMICS



INDIAN SOCIETY OF
AGRICULTURAL ECONOMICS,
BOMBAY

RESEARCH NOTES

ECONOMIC EVALUATION OF COORG MANDARIN (ORANGE) IN KARNATAKA

The importance of fruits and vegetables for improving the nutritive value of the diet needs no emphasis. Besides their nutritive value, these crops are labour intensive and help to generate additional employment.¹

Mandarin oranges are very good source of vitamin C and are good for fresh consumption and processing purposes. There are two important varieties of Mandarin oranges commercially grown South of Vindhyaçal, *viz.*, Nagpur Santra and Coorg Mandarin. The Nagpur Santra is commercially grown as a pure crop under irrigated conditions on black soils around Nagpur. The Coorg Mandarin is confined to Coorg region in Karnataka State and unlike Nagpur Santra it is grown as mixed crop in coffee plantations mainly for shade purpose and is raised as unirrigated crop because of heavy rains and light soils. Because of these differences in cultivation practices, there is a large difference in terms of costs and returns from these two varieties of Mandarin oranges.

The paper presents the results of a study on the economics of Mandarin oranges as it is the most important and popular inter-crop in Coorg district, occupying 48,078 acres out of a total of 64,337 acres under citrus crop during 1975-76 in Karnataka. The main objectives of the paper are to study (i) the costs and returns from Coorg Mandarin oranges, (ii) to determine the profitability of Coorg Mandarin oranges through different investment appraisal methods and (iii) to suggest the best method for evaluating the orchards.

DATA

The data for this study were collected from two taluks in Coorg district, *viz.*, Somwarpet and Virajpet, which together account for more than 90 per cent of the area under Mandarin in the district, under an ICAR financed scheme: "Comprehensive Scheme to Study the Economics of Production and Marketing of Fruits and Vegetables." From each taluk one *Hobli* (group of villages) having highest area was selected and a random sample of 30 orchardists was selected from each *Hobli*. Thus the total sample consisted of 60 orchardists. The required information was collected from the selected orchardists through personal interviews with the help of a designed questionnaire by the economic investigators recruited for the scheme. Information was collected on the total area of plantation, number of Mandarin trees in the plantation, year of planting, establishment costs, maintenance costs and returns for the year 1979-80.

As our sample consisted of Mandarin orchards of ages ranging from below one year to 40 years, the costs and returns data for different age groups of plants upto the age of 40 years could be compiled from 1979-80 data it-

1. K. V. Subrahmanyam, "Employment Potential of Horticultural Industry", Contribution No. 826 of Indian Institute of Horticultural Research, Bangalore.

elf.² The orchards were divided into four age groups, namely, upto 7 years, 8-14 years, 15-30 years and above 30 years representing approximately the establishment, increasing yield, constant yield and decreasing yield periods respectively for the purpose of analysis. The sample distribution in different age groups is shown in Table I. However, a preliminary statistical analysis revealed that there exists no significant difference between costs and returns among the three yielding age groups.³

TABLE I—DISTRIBUTION OF COORG MANDARIN GROWERS ACCORDING TO AGE GROUP

Age group	Number of growers
Below 3 years	10
4-7 years	8
8-14 years	18
15-30 years	31
Above 30 years	6
Total	73*

* The total is more than the sample size as some growers are having orchards of different age groups.

METHODOLOGY

The per acre costs were obtained by using the quantity of inputs used per plant at an average plant density of 99 plants per acre. The inputs were valued at 1979-80 prices. The returns reflected the contract price received by the orchardists. For the purpose of our analysis we have considered 40 years as the life of the Mandarin orchard, though they may be expected to yield even after 40 years, as we have noticed a single case of 44 years' orchard in our sample.

For studying the economic viability, we have used the project evaluation techniques. Besides the present value summation method commonly used (*i.e.*, net present value, benefit-cost ratio, internal rate of return),⁴ the annual amortization method which is used for working out the repayment plants is also used for the purpose of making a comparison of these two methods. The amortization formula used is

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

2. Here it should be pointed out that the sample for a single age group is small and in a few cases, the sample for a single age group was not available. In such cases the gap was filled by taking the average costs and returns of preceding and following age groups.

3. The effect of the size of plantation on the costs and returns could not be studied due to lack of sufficient sample in different size-groups distributed over age groups.

4. For details, see J. Price Gittinger: Economic Analysis of Agricultural Projects, The Economic Development Institute, International Bank for Reconstruction and Development, Washington, D.C., U.S.A., 1974.

where P = represents the amount of annual payment,
 B = initial amount,
 n = number of years (life period of plantation),
 i = interest rate,

$\frac{1}{a_{\overline{n}|i}}$ = is annual total payment for one rupee borrowed for 'n' years with an annual interest rate of 'i', the values of which are readily available from worked out tables.⁵

Using the amortized establishment cost, one can work out the absolute profit that can be expected in an year from the plantation by deducting this cost along with maintenance cost from gross returns. Besides, the amortized establishment cost can be used as a guide for replanting.

The investment criteria like benefit-cost ratio (BC), and capital value (CV) of the orchard can be derived as follows:

$$(i) \text{ BC} = \frac{\text{GR}}{(\text{AEC} + \text{MC})}$$

where GR = gross returns/acre/year,
 AEC = amortized establishment cost/acre,
 MC = maintenance cost/acre.

$$(ii) \text{ CV} = [\text{GR} - (\text{AEC} + \text{MC})] (\text{DAPV})$$

where GR, AEC and MC are the same as in (i) above and DAPV = is deferred annuity present value of Re. 1 which is obtained by multiplying the present value of Re. 1 per annum for the (n-r) bearing years at an interest rate of 'i' by present value of Re. 1 for 'r' non-bearing years at an interest rate of 'i' where 'n' is total life period of the plantation.

RESULTS AND DISCUSSION

A. Costs and Returns from Coorg Mandarin Oranges

The agewise costs and returns data are presented in Table II. From the table it can be seen that for the first seven years the trees give no returns and the returns start from the eighth year and continue beyond 40 years, unlike Nagpur Santras which start giving returns from the fifth year and go upto 30 years.⁶ The reason for this is that in the case of Coorg Mandarin oranges seedlings are planted as against grafted plants in the case of Nagpur oranges. The total cost of establishment was found to be about Rs. 970 and amortized over 40 years at the rate of 11 per cent, the establishment cost per year worked out to be Rs. 108. The average cost of maintenance from the eighth year onwards was found to vary from Rs. 65 to Rs. 590 per acre with an average of Rs. 370. This maintenance cost was low as compared to the cost incurred on pure crop (Nagpur oranges) for which the operating cost was Rs. 542

5. A. G. Nelson, Warren F. Lee and William G. Murray: *Agricultural Finance*, Sixth Edition, Iowa State University Press, Ames, Iowa, 1973, Appendix Table 3.

6. G. S. Gupta and P. S. George, "Profitability of Nagpur Santra (Oranges) Cultivation", *Indian Journal of Agricultural Economics*, Vol. XXIX, No. 3, July-September 1974, p. 139.

TABLE II—COSTS AND RETURNS OF COORG MANDARIN ORANGES—AGEWISE

(Rs. per acre)

Age of the orchard (years)	Costs	Gross returns	Net returns
1	249.95	—	(—)249.95
2	60.35	—	(—) 60.35
3	77.43	—	(—) 77.43
4	135.74	—	(—)135.74
5	141.93	—	(—)141.93
6	148.11	—	(—)148.11
7	148.11	—	(—)148.11
8	141.56	752.51	610.95
9	500.92	1,217.04	716.12
10	63.84	600.00	536.16
11	450.60	906.71	456.11
12	382.50	1,666.67	1,284.17
13	216.65	777.78	561.13
14	389.80	1,029.29	639.49
15	249.96	1,092.28	842.32
16	168.79	1,200.00	1,031.21
17	122.09	218.75	96.66
18	359.10	3,000.00	2,640.90
19	226.32	514.10	287.78
20	304.18	1,211.97	907.79
21	123.21	218.75	95.54
22	277.23	509.38	232.15
23	431.25	800.00	368.75
24	370.35	933.33	562.98
25	482.34	1,011.70	529.26
26	517.50	697.28	179.78
27	498.69	954.89	456.20
28	489.29	1,083.70	594.41
29	479.88	1,212.50	732.62
30	465.77	588.24	122.47
31	425.31	788.17	362.86
32	405.07	888.14	483.07
33	394.96	938.12	543.16
34	389.90	963.11	568.15
35	384.84	988.10	603.26
36	485.91	991.08	505.17
37	586.98	994.05	407.07
38	433.44	997.03	563.59
39	356.72	998.52	641.80
40	279.90	1,000.00	720.10

at 1973-74 prices.⁷ The reason for this low maintenance cost in the case of Coorg Mandarin is that it is only an inter-crop and the major attention of the farmers is on the coffee plantation which is the main crop. Except for fertilization, virtually no other major cultural operations are done on Mandarin crop. The returns range was found to be high with as low as Rs. 219 to as high as Rs. 3,000 per acre and it was found that there was no significant correlation between the age of the orchard and income received. The reason for this may be that for each age we have considered different orchards whose fertility, management, etc., may be different. The average gross return per acre

7. Gupta and George, *op. cit.* Though we are comparing costs and subsequently returns of two different periods, nonetheless, it would approximately give us a fair comparison of the two types of oranges grown in South India.

was found to be Rs. 992 as against Rs. 1,900 in the case of Nagpur Santra. The gross returns in the case of Coorg Mandarin oranges represent the contract price, as they are mostly sold to contractors unlike Nagpur Santras which are mostly sold by auction in the market. Of course, the Nagpur farmers have to incur an expenditure of Rs. 364 towards transportation and marketing charges.⁸

The per acre gross returns, costs and net returns are presented in Table III. It could be seen that the net return over maintenance cost was Rs. 620 and over total cost it was Rs. 514. Some of the fixed costs like rental value of land, interest on working capital and depreciation costs are not included in the costs as it is mainly an inter-crop and, as pointed out earlier, not many cultural operations are done for this crop and the amount incurred is small compared to the amount spent for maintaining the coffee plantation.

TABLE III—AVERAGE COSTS AND RETURNS FROM COORG MANDARIN ORANGES

Sr. No.	Item	(Rs. per acre)	
		Amount	
1.	Establishment cost (amortized over 40 years at 11% interest) per year		107.41
2.	Average maintenance cost per year		370.46
3.	Total cost per year		477.87
4.	Average gross income per year		991.97
5.	Net income per year		514.10

The return to maintenance cost ratio was worked out to be about 2.67 for Coorg Mandarin as compared to 3.61 of Nagpur Santra. At first sight, it may appear that the rate of return on pure crop is higher but considering the fact that the Nagpur farmers had to incur additional cost on transportation, and if that also was considered, the rate of return was worked out to be 2.10.⁹ This reveals that inter-cropped Mandarins fare better than pure oranges.

B. Economic Evaluation of Coorg Mandarin Oranges

As stated earlier, the profitability of Coorg Mandarin oranges was evaluated with the help of different investment appraisal methods. The benefit-cost ratio, net present value and minimum income required for taking the replanting decision based on the present value summation method and annual amortization method along with pay back period and internal rate of return are presented in Table IV. We have discounted and amortized the values at 11 per

TABLE IV—COMPARISON OF TWO METHODS OF MEASURES OF INVESTMENT WORTH PER ACRE OF COORG MANDARIN ORANGES

Sr. No.	Measures of investment	Present value method	Amortization method
1.	Benefit-cost ratio	2.14	2.07
2.	Net present value (Rs.)	2,225	2,174
3.	Minimum net income required before replacement (Rs.)	>249	>108
4.	Internal rate of return (%)	29.68	—
5.	Pay back period (years)	9	—

8. P. S. George: Nagpur Oranges: A Micro Study on Agri-business System, CMA Monograph No. 46, Indian Institute of Management, Ahmedabad, 1974.

9. Computed from figures given in George, *op. cit.*, and Gupta and George, *op. cit.*

cent as this is the interest rate at which Land Development Banks advance loans for the plantation crop.

From the table it can be seen that the pay back period is nine years. Though this seems to be high as compared to Nagpur Santra (seven years), yet it is compensated by more than 40 years of productive life. The net present value was worked out to be Rs. 2,225, the benefit-cost ratio 2.14 and the internal rate of return 29.68 per cent under the present value method. Under amortization method also, the net present value and benefit-cost ratio were more or less the same. All these measures clearly reveal that Coorg Mandarin oranges as inter-crop are profitable. Since this is the major inter-crop in coffee plantations and most of the coffee planters prefer Mandarin to other inter-crops like pepper because of least attention needed by the crop, and very few inter-crops providing shade for coffee plants which are economically important are available, the need for a comparison of the economics of different inter-crops in coffee plantation does not arise.

C. Comparison of the Two Investment Appraisal Methods

As for the comparison of the results obtained from the two methods, though the amortization method seems to slightly under-estimate both benefit-cost ratio and present (capital) value of the orchard, the differences, however, are small. But with respect to the income required over maintenance cost for taking the replanting decision they differ widely. The amortization method suggests an income of more than Rs. 108 over maintenance cost for retaining the plantation as this income will be enough to meet the amortized establishment cost. On the other hand, the method suggested by Gupta and George based on net present value¹⁰ requires an income of more than Rs. 250 for retaining the plantation. The former (Rs. 108) seems to be more realistic as there are Coorg Mandarin plants retained as inter-crop with as low an income as Rs. 100 over maintenance cost (Table II). In view of this and the fact that the long life of the plantations (more than 40 years) makes it difficult to get costs and returns data for all the bearing years as required by present value summation method, the amortization method seems to be convenient. The annual amortization establishment cost can be treated like fixed cost in the case of field crops to know the net income during any year of plantation. Of course, in both the methods the establishment costs upto first bearing have to be collected.

CONCLUSIONS

The study shows that the costs and returns of inter-cropped Coorg Mandarins differ largely from that of pure Nagpur Santras. The performance of inter-cropped Mandarins in terms of rate of return was found to be better than pure oranges. The Coorg Mandarin orange seems to be an ideal inter-crop in coffee plantations from the economics point of view also, besides meeting the shade requirement of coffee. It is profitable with a good rate of return of nearly 30 per cent and benefit-cost ratio of more than 2. The pay back

10. Gupta and George, *op. cit.*, p. 141.

period of nine years though slightly high is however compensated by more than 40 years of productive life. The study also shows that the plants are worth retaining as long as they give an income of Rs. 108 over maintenance cost which is quite low. Regarding the method of economic appraisal, the annual amortization method seems to be preferable to the present value summation method because of its simplicity, equal efficiency and close to real situation results.

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RELATIVE EFFICIENCY, FARM SIZE AND PEASANT
PROPRIETORSHIP—A CASE STUDY OF
RANCHI DISTRICT (BIHAR)†

In recent years relative economic efficiency of small versus large farms and peasant versus capitalist farms has been a subject of lively debate particularly in Indian agriculture. While some of the findings of the early fifties would point to the higher relative efficiency of small farms and farms based on peasant proprietorship,¹ those relating to the late sixties and early seventies would focus on the equal relative efficiency of small and large farms.² The explanations of the early batch of researchers were that the small sized farms, by and large, were characterized by the predominance of family labour whose contribution to the raising of crops was significant. The managerial ability of small farms and the greater care and attention paid by the peasant family labour would enable them to raise greater per acre yield of crops and thus put them in a better position vis-a-vis the large farms. The findings of the late sixties have their major explanations in terms of technological changes, which might have, to a large extent, brought about economies of large scale production, thus reducing the relative gains of small sized farms.

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† The present paper is based on the author's Ph.D. thesis, Resource Use Efficiency and the Size of Farms—A Case Study of Ranchi District, Ranchi University, Bihar, 1980.

1. A. K. Sen, "An Aspect of Indian Agriculture", *The Economic Weekly*, Vol. XIV, Nos. 4, 5 and 6, Annual Number, February 1962, "Size of Holdings and Productivity", *The Economic Weekly*, Vol. XVI, Nos. 5, 6 and 7, Annual Number, February 1964, and "Peasants and Dualism With or Without Surplus Labour", *Journal of Political Economy*, Vol. LXXIV, No. 5, October 1966; D. Mazumdar, "On the Economics of Relative Efficiency of Small Farmers", *The Economic Weekly*, Vol. XV, Nos. 28, 29 and 30, Special Number, July 1963; L. J. Lau and P. A. Yotopoulos, "A Test for Relative Efficiency and Application to Indian Agriculture", *The American Economic Review*, Vol. LXI, No. 1, March 1971, and "Profit, Supply and Factor Demand Functions", *American Journal of Agricultural Economics*, Vol. 54, No. 1, February 1972; and P. A. Yotopoulos and L. J. Lau, "A Test for Relative Economic Efficiency: Some Further Results", *The American Economic Review*, Vol. LXIII, No. 1, March 1973.

2. S. S. Sidhu, "Relative Efficiency in Wheat Production in Indian Punjab", *The American Economic Review*, Vol. LXIV, No. 4, September 1974 and M. H. Khan and D. R. Maki, "Effects of Farm Size on Economic Efficiency: A Case Study of Pakistan", *American Journal of Agricultural Economics*, Vol. 61, No. 1, February 1979. The study by Khan and Maki relates to Punjab and Sind Provinces of Pakistan, during 1974.