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A STUDY ON CAPITAL PRODUCTIVITY ANALYSIS OF MANGO CULTIVATION WITH SPECIAL REFERENCE TO MADURAI DISTRICT

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Abstract

Capital Productivity in growing mango orchard is analysed in different ways compared to annual crops. The present study has been designed to investigate cost of production and returns per acre over the life time of mango trees. A sample of 300 mango growing farmers was taken from various villages of Madurai District of Tamil Nadu. The objective was to work out Pay Back Period, Benefit Cost Ratio and Net Present Worth of growing mango orchard. The Pay Back Period was computed on the basis of Undiscounted Cumulative Value for the investment made in mango cultivation over a period of 3.54 years, indicating that the growers can recover the initial investment made in mango orchard in 3.54 years. The cut off year at 15 per cent cost of capital is 6.67 years and the calculated Pay Back Period is less than that of the cut off year. Hence it may be calculated that the investment in mango cultivation is a viable one. Net Present Worth, at Rs. 32238.62 per acre, was estimated for the sampled respondents. This indicates that mango cultivation fetches higher returns whereas Benefit Cost Ratio was reasonably high at 1.45, implying that investing one rupee in mango cultivation would return Rs. 1.45. These results indicate that investing in mango orchard would bring huge returns to the farmers on one hand and for the country in the form of foreign earnings on the other hand.

Key Words: Mango, Cost of Production, Returns, Pay Back Period, BCR, NPV, IRR, Madurai District.

1. Introduction

India is a country of peasants and agriculture provides sustenance to more than two-thirds of the Indian Population. Agriculture is the backbone of Indian Economy and no planning for economic growth can be complete without the development of agricultural sector. This Sector in India assumes special importance in

the context of the population explosion and it is required that agricultural planning should be so devised that agricultural productivity should keep pace with the growing population. Efficient Agricultural Management to ensure better productivity may make valuable contribution to the balanced growth of the Indian Economy. It contributes 29.4 per cent of GDP, employing 64

per cent of the work force of the country. There are a number of sub-fields in the Agricultural Sector like Sericulture, Floriculture, and Horticulture. Among those fields, Horticulture has played a dominant role in the agricultural output throughout India.

Mango is the National Fruit and deemed to be the king among the fruits in India. In the production of horticultural crops in India, production of mango is about 60 per cent. Mango is one of the highly loved fruits in the country. It contains various nutrients, namely, B. carotene, carbohydrates, vitamin 'C' fibre and energy. It is one of the cheapest fruits in India, which can be eaten even by the poorest of the poor. Mango Cultivation is seasonal and therefore during the off-season, the growers are compelled to search for alternative employment. The study area, namely, Madurai District is very famous for mango cultivation. Especially the Blocks around the Madurai District contribute the maximum quantity of mangoes to the Madurai Market. Madurai District is world famous for a farmer oriented festival, namely Jallikkattu, in which young men face death or injury trying to tame a ferocious bull. The city is also called the Temple City of Tamil Nadu. The entire production of mangoes had been sent earlier to the Madurai Market, which involved high amount of work cost. But at present, the mango growers themselves organize a Local Mango Market at the production place itself. Since a large number of farmers are involving themselves in this field in Madurai District, it is very much essential to undertake the Capital Productivity Analysis of Mango Cultivation and hence the present study.

Need of the Study

Production of fruit orchards like mango, citrus and the like is distinguished from annual crops by the long gestation period, an extended period of output flow, and varying stages of productivity over the lifetime (Chand, 1994). Hence, it is more complex to determine economics of growing mango as compared to annual crops. A large variety of factors influence the economics of growing mango. These include yields, prices and cost of production. These factors are influenced by other variables like soil, climate, market conditions and the like. Having sufficient awareness regarding profitability of any enterprise is needed to make rational decisions at the farm level during various production stages. Economics of various crop enterprises have been estimated at different points of time by various organizations (APCom) and individuals (Ahmad et al., 1992, 1994, 2003). The producers would like to know the results of economic activity by working out a detailed cost benefit analysis of the investment in the project (Akçay & Uzunoğlu, 2005). Unfortunately, the farmers and other individuals concerned know very little about the economics of growing mango. The farmers need information regarding investment and returns from fruit gardening business. Keeping in view the importance of mango in terms of area, production and foreign earnings from exporting mango, the present study has undertaken the Capital Productivity Analysis of Mango Cultivation and Profitability of growing mango orchard.

2. Focus of the Study

Madurai District is one of the important Districts in Tamil Nadu and agriculture forms

the backbone of the District Economy. It is one of the major mango producing Districts of Tamil Nadu. Mango is an important commercial crop which plays a vital role in the Agricultural Economy of Madurai District. Besides, mango is grown under irrigated and unirrigated conditions. Several thousands of people get employment directly as well as indirectly. Mango is the most popular fruit in Madurai District. It is liked equally by both the rich and the poor. The District has the sixth place in mango cultivation in Tamil Nadu. In this District, a large number of farmers are engaged in mango cultivation. Presently, in Madurai District, mango is cultivated in various blocks like Alanganallur, Vadippatti, Melur, Kottampatti, Sedapatti, Madurai West and Thirumangalam. Hence, the Researchers selected the entire District for the study. The study was mainly conducted on behalf of the mango growers. It does not include other persons who are directly or indirectly connected with the mango cultivation. Keeping the above in mind, Researchers applied the Capital Productivity Analysis of mango cultivation on behalf of the mango growers and the details are given in this paper.

3. Objective of the Study

The objective of the study is to understand the Capital Productivity Analysis of mango cultivation, with special reference to Madurai District.

4. Methodology and Data Collection

The present study was based on both Primary and Secondary Data. The Primary Data were collected from mango growers of Madurai District with the help of an interview

schedule. The Secondary Data were collected from the various journals, books and the like.

5. Sampling Design

The Researchers have adopted for the present study multi-stage random sampling with Madurai District as the universe, the taluk as the stratum, the village as the primary unit of sampling and the mango growers as the ultimate unit.

Madurai District consists of 7 Taluks, namely, Vadippatti, Melur, Madurai South, Madurai North, Usilampatti, Peraiyur and Thirumangalam. There are thirteen Revenue Blocks. Each Taluk consists of two Revenue Blocks except Madurai South. There are two blocks in Melur (Melur and Kottampatti), two in Vadippatti, (Vadippatti and Alangaallure), two in Madurai North (Madurai East and Madurai West), two in Usilampatti (Usilampatti and Chellampatti), two in Peraiyur (T.Kallupatti and Sedapatti), two in Thirumangalam (Thirumangalam and Kalligudi) and one block in Madurai South, namely, Thirupparamkundram.

On enquiry with the Office of the Assistant Director of Horticulture of Madurai, it is understood that there are around 2500 growers actively engaged in mango cultivation in the District. Out of the 2500 growers that constitute the total population, 12 per cent, numbering 300 respondents, were considered an ideal sample size. Melur Taluk covers 35 per cent of area, Vadippatti 25 per cent, Madurai North 14 per cent, Madurai South and Usilampatti Taluks individually cover 8 per cent of mango cultivating area. Peraiyur and Thirumangalam Taluks each separately covers five per cent of mango

cultivating area. Twelve Villages were selected from Melur at random, Eight from Vadippatti, Four from Madurai North, two each from Madurai South and Usilampatti and one village each from Peraiyur and Thirumangalam Taluks.

One hundred and five growers were selected at random from all the 12 villages from Melur Taluk, 75 growers from the villages of Vadippatti, 42 growers from Madurai North, 24 growers were selected each from Madurai South and Usilampatti and 15 each from two villages of Peraiyur and Thirumangalam. **Table-1** explains the sample selection of the study area.

It is clear from **Table-1** that out of the total 300 respondents identified in the study, 150 were small growers and the remaining 150 were large growers. The growers having up to 5 acres were grouped as Small Size Growers and the growers having more than 5 acres were grouped as Large Size Growers.

6. Capital Productivity Analysis

Capital Productivity is the reciprocal of the Capital-Output Ratio. It has fluctuated over the years because it is simultaneously influenced by a variety of factors. Mango is a perennial crop. Its life span extends from 60 to 80 years or even more (A. K. Sacheti), but in the study area, the mango growers cut the tree and re-plant them after 50 to 60 years. The Researchers calculated the mango yield from its commercial production from the 6th year onwards. Therefore,

considerable investment was made over several years before the crop starts to yield. Hence it is necessary to know the present value of the expected future income to justify the investments made. A Resonance Appraisal Technique was used to measure the economic worth of the investment in mango orchard.

7. Analytical Framework

In the present study, the following Capital Budgeting Techniques (S.N. Maheswari) were used to measure the economic worth of investment in mango production.

8.1. Pay Back Period

Pay-Back Period measures the number of years required to recover the original cash outlay invested in the project. The maximum acceptable Pay Back Period was fixed by taking into account the reciprocal of the cost of capital. This can be termed as Cut Off Point. Generally, a project having a Pay Back Period of more than Cut Off Point is not entertained.

8.2. Benefit-Cost Ratio

Benefit-Cost Ratio is the ratio of present value of returns, at the required rate of return, to the present value of costs. When the Benefit Cost Ratio exceeds one, the investment is considered feasible at the required rate of return.

$$\text{Benefit-Cost Ratio} = \frac{\text{Present Value of Returns}}{\text{Present Value of Costs}}$$

Symbolically,

$$B-C = \frac{\sum_{t=1}^n \frac{B_t}{(1+i)^t}}{\sum_{t=1}^n \frac{C_t}{(1+i)^t}}$$

where,

n = Life Period of the project in years

B_t = Returns in the year 't',

C_t = Costs in the year 't'

i = Discount rate.

8.3. Net Present Value

Net Present Value is determined by subtracting present value of cost from the present value of returns. A project, whose net present value is greater or equal to zero, is considered as worthy of investment.

Net Present Value = Present Value of Returns – Present Value of Cost. Symbolically,

$$NPV = \sum_{t=1}^n \frac{B_t - C_t}{(1+i)^t} = 0$$

Where the symbols used are the same as in the case of Benefit-Cost Ratio.

8.4. Internal Rate of Return

Internal Rate of Return is the rate of discount at which NPV is zero. If the IRR exceeds cut off rate (opportunity cost of capital), the investment is economically viable.

Symbolically,

$$IRR = \frac{\sum_{t=1}^n (B_t/C_t)}{(1+i)^t} = 0.$$

Where the symbols used are the same as in the case of Benefit-Cost Ratio.

National Bank for Agricultural and Rural Development (NABARD) considers an agricultural project, which yields a return of 15 per cent and above, as an Economically Viable Project. (S. Shanmugaiah) Hence in this study, the required rate of return is taken as 15 per cent. To compute the Pay Back Period, Net Present Value, Benefit-Cost Ratio and Internal Rate of Return for mango cultivation, incremental cost, present value of cost and return at 15 per cent discount factor were calculated and they are presented in **Table-2**.

8.5. Pay Back Period

The Pay Back Period, computed on the basis of undiscounted cumulative value for the investment made in mango cultivation, was 3.54 years, indicating that the growers can recover the initial investment made in mango orchard in 3.54 years. The cut off year, at 15 per cent cost of capital, is 6.67 years and the calculated pay back period is less than the cut off year. Hence it may be inferred that the investment in mango cultivation is a viable one.

8.6. Benefit-Cost Ratio

Benefit-Cost Ratio, computed on the basis of discounted cost and returns for the investment in mango cultivation, is presented in **Table-3**.

Table-3 explains that at the discounted rate of 15 per cent, the Benefit-Cost Ratio was 1.45, which indicates that on an average, for one rupee invested in mango cultivation, the benefit received would be 1.45. Since the ratio is larger than unity, the investment in mango cultivation at the specified rate of discount is worthwhile.

8.7. Net Present Value

It is the most valid technique for evaluating an investment project. It is generally consistent with the objective of maximising wealth. The net present value of mango production was computed on the basis of estimates in **Table-4** and the results are presented in **Table-4**.

It is found from the Table 4 that the net present value was Rs.32238.62 at 15 per cent discount rate. Since the net present value is positive and large, it is inferred that the capacity to generate more wealth is high in mango orchards. Therefore, investment in mango cultivation is economically beneficial.

8.8. Internal Rate of Return

Internal Rate of Return is the rate at which the sum of discounted cash inflows equals the sum of discounted cash outflows. It is the maximum rate of interest, which an organisation can afford to pay, on the capital invested in a project. The computed value of Internal Rate of Return was 19 per cent for the samples. As compared to the opportunity cost of capital (cut off rate) which was taken as 15 per cent, the rate of return on investment made in mango cultivation is very high. It indicates the economic viability of investment in mango cultivation.

8. Findings of the Study

On the basis of results of the study, following findings could be arrived at.

i. The Pay Back Period, computed on the basis of undiscounted cumulative value for the investment made in mango cultivation, is 3.54 years, indicating that the growers can recover the initial investment made in mango orchard in 3.54 years. The Cut Off Year at 15 per cent cost of capital is 6.67 years and the calculated Pay Back Period is less than the cut off year. Hence it may be calculated that the investment in mango cultivation is a viable one.

ii. At the discounted rate of 15 per cent, the Benefit-Cost Ratio was 1.45, which indicates that on an average, for one rupee invested in mango cultivation, the benefit received would be 1.45. Since the ratio is larger than unity, the investment in mango cultivation at the specified rate of discount is worthwhile.

iii. It is found from the analysis that the net present value was Rs.32238.62 at 15 per cent discount rate. Since the net present value is positive and large, it is inferred that the capacity to generate more wealth is high in mango orchards. Therefore, investment in mango cultivation is economically sustainable.

iv. Internal Rate of Return is the rate at which the sum of discounted cash inflows equals the sum of discounted cash outflows. It is the maximum rate of interest, which an organisation can afford to pay, on the capital invested in a project. The computed value of Internal Rate of Return was 19 per cent for the samples. As

compared to the opportunity cost of capital (cut-off rate), which was taken as 15 per cent, the rate of return on investment made in mango cultivation is very high. It indicates the economic viability of investment in mango cultivation.

9. Suggestions

Results of the study highlight the net returns to be positive. It is expected that under the prevailing technology, prices of inputs and outputs, use of various inputs, and the acreage under mango farming, will increase. On the basis of the findings of the study, the following suggestions are made to shorten the yield potential of mango.

A. Mango Cultivation could increase if recommended package of practices of mango based on scientific data are readily available to the farmers. Role of Agricultural Extension Department should be strengthened to boost up mango cultivation and production in the Madurai District.

B. The mango fruits are perishable in nature and they require proper packaging, storing and transporting facilities. But such facilities are not available to the farmers of Madurai District. If these facilities are made available to the farmers at their door steps, the mango cultivation would increase to a great extent.

C. There is lack of research in mango industry. Prospects of mango cultivation require increased research facilities, research personnel, training to researchers and improved communication between researchers and mango growers. Especially small growers need more attention from the researchers.

D. Mangoes should be processed into juices, nectars and other value added products. In this way, demand for mangoes would increase and this increased demand would result in higher income for mango growers. For this purpose, setting up processing industries in mango growing areas will be a decision in the right direction.

10. Conclusion

Mango, the world's most luscious fruit, has been recognized as the "king of fruits" long back. It is highly tasty and a luscious table fruit for Indians. To meet the ever-growing demand for the mangoes, a larger area of Indian Soil should be used for mango cultivation. The mango cultivation provides employment opportunities to many people and also helps the mango growers for improving their economic status. Cultivation of fruits contributes to the health, happiness and prosperity of people. The standard of living of the people can be judged by the production and consumption of fruits per capita. The area and production of fruits in general and mango in particular, have increased many times during the last fifteen years. From the Capital Productivity Analysis, it is inferred that mango cultivation is an economically viable one. The investment in mango cultivation can be preferred to other alternatives that yield less than the 19 per cent Internal Rate of Return.

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Table-1
Sample Framework in Madurai District

Sl. No	Taluk	Block	Sample Size of growers
1	Melur	Melur Kottampatti	105
2	Vadippati	Vadippati Alanganallure	75
3	Madurai North	Maduari East Maduari West	42
4	Madurai South	Thiruparankundram	24
5	Usilampatti	Usilampatti Chellampatti	24
6	Peraiyur	T. Kallupatti Sedapatti	15
7	Thirumangalam	Thirumangalam Kalligudi	15
Total sample			300

Table-2
Computation of Pay Back Period, Benefit Cost Ratio, Net Present Value and
Internal Rate of Return for Mango

Age	Cost Rs/acre	Returns Rs/acre	Income Benefit	Disc.15%	Present value of Cost	Present Value of Return
1	23,085.83	0.00	-23,085.83	0.8696	20074.63	0.00
2	12,595.50	0.00	-12,595.50	0.7561	9524.01	0.00
3	10,932.30	0.00	-10,932.30	0.6575	7188.16	0.00
4	9,542.50	0.00	-9,542.50	0.5718	5455.96	0.00
5	8,885.65	9,848.43	962.78	0.4323	3841.51	4257.75
6	7,496.37	15,895.17	8,398.80	0.4972	3727.02	7902.71
7	6,633.25	19,654.29	13,021.04	0.4323	2867.74	8497.09
8	6,236.95	23,362.73	17,125.78	0.3759	2344.70	8782.92
9	6,092.69	25,965.72	19,873.03	0.3269	1991.71	8488.24
10	5,917.45	27,857.18	21,939.73	0.2843	1682.11	7918.75
11	6,289.53	23,294.28	17,004.75	0.2472	1554.68	5757.99
12	6,255.72	25,574.00	19,318.28	0.2149	1344.62	5496.96
13	6,200.12	26,975.27	20,775.15	0.1869	1158.85	5041.87
14	6,193.00	27,356.49	21,163.49	0.1625	1006.54	4446.19
15	6,150.74	28,958.49	22,807.75	0.1413	869.28	4092.66
16	6,939.91	30,579.64	23,639.73	0.1229	852.88	3758.07
17	6,119.15	31,489.46	25,370.31	0.1069	653.92	3365.11
18	6,215.63	34,948.00	28,732.37	0.0929	577.59	3247.57
19	6,486.54	33,756.84	27,270.30	0.0808	524.15	2727.73
20	6,734.12	37,497.32	30,763.20	0.0703	473.18	2634.76
21	6,890.84	34,548.51	27,657.67	0.0611	421.03	2110.92
22	6,967.48	35,655.91	28,688.43	0.0531	370.19	1894.42
23	7,010.52	34,783.49	27,772.97	0.0462	323.89	1607.02
24	7,059.36	36,987.14	29,927.78	0.0402	283.61	1485.94
25	7,011.52	37,458.71	30,447.19	0.0349	244.94	1308.59
26	7,028.45	37,546.24	30,517.79	0.0304	213.51	1140.57
27	7,050.35	38,853.21	31,802.86	0.0264	186.24	1026.32
28	7,095.46	38,416.33	31,320.87	0.0230	162.98	882.42
29	7,078.64	39,714.12	32,635.48	0.0200	141.39	793.24
30	7,065.81	39,947.46	32,881.65	0.0174	122.72	693.83
31	9,458.84	34,947.43	25,488.59	0.0151	142.86	527.81
32	9,659.48	38,257.19	28,597.71	0.0131	126.86	502.44
33	9,894.36	32,487.48	22,593.12	0.0114	112.99	371.01
34	9,859.28	36,721.46	26,862.18	0.0099	97.91	364.66

Table-2 Contd.

Age	Cost Rs/acre	Returns Rs/acre	Income Benefit	Disc.15%	Present value of Cost	Present Value of Return
35	9,718.86	35,124.54	25,405.68	0.0086	83.92	303.31
36	9,523.40	36,254.14	26,730.74	0.0075	71.51	272.23
37	8,492.66	35,146.74	26,654.08	0.0065	55.45	229.49
38	8,366.26	36,741.87	28,375.61	0.0057	47.50	208.61
39	8,412.96	37,241.82	28,828.86	0.0049	41.54	183.87
40	8,352.27	34,855.27	26,503.00	0.0043	35.86	149.64
41	8,297.15	38,421.94	30,124.79	0.0037	30.98	143.44
42	8,258.17	40,512.89	32,254.72	0.0032	26.81	131.52
43	8,235.40	44,215.59	35,980.19	0.0028	23.25	124.81
44	8,214.23	38,125.00	29,910.77	0.0025	20.16	93.58
45	8,246.51	36,249.16	28,002.65	0.0021	17.60	77.37
46	8,242.71	34,879.45	26,636.74	0.0019	15.30	64.74
47	8,260.35	36,458.49	28,198.14	0.0016	13.33	58.84
48	8,237.53	33,645.28	25,407.75	0.0014	11.56	47.22
49	8,218.19	33,588.28	25,370.09	0.0012	10.03	40.99
50	8,219.18	32,846.48	24,627.30	0.0011	8.72	34.86
51	7,198.64	33,468.27	26,269.63	0.0009	6.64	30.88
52	7,947.15	32,468.99	24,521.84	0.0008	6.38	26.05
53	7,814.99	31,577.47	23,762.48	0.0007	5.45	22.03
54	6,758.00	30,846.48	24,088.48	0.0006	4.10	18.72
55	6,654.96	30,394.58	23,739.62	0.0005	3.51	16.04
56	6,577.47	29,451.67	22,874.20	0.0005	3.02	13.51
57	7,450.32	28,641.93	21,191.61	0.0004	2.97	11.43
58	5,524.15	27,487.24	21,963.09	0.0003	1.92	9.54
59	4,364.81	26,789.74	22,424.93	0.0003	1.32	8.08
60	3,214.53	23,851.29	20,636.76	0.0003	0.84	6.26
					71214.01	103452.63

Table-3 : Benefit-Cost Ratio of Mango Cultivation

Present Value of Return (Rs. per acre)	Present Value of Cost (Rs. per acre)	Benefit-Cost Ratio	Nature of Benefit-Cost Ratio
103452.63	71214.01	1.45	>1

Source: Computed data.

Table-4 : Net Present Value of Mango Cultivation

Present Value of Return (Rs. per acre)	Present Value of Cost (Rs. per acre)	Net Present Value (Rs. in acre)	Nature of Net Present Value
103452.63	71214.01	32238.62	Positive

Source: Computed data.