



# Economics of Paddy Cultivation in Thamirabarani River Basin of Tamil Nadu, India

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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## ABSTRACT

The study was designed with the main objective of estimating the costs involved in Rice cultivation and returns from Rice production in selected villages of Thoothukudi district, Tamil Nadu. A multistage random sampling technique was employed to obtain primary data from the study area. Out of the 14 blocks in the Thoothukudi district, Karungulam block was selected, wherein two villages namely Vasavapuram and Vallanadu were selected purposively considering the area of Rice cultivation. From each of the selected villages, 40 farmers were selected randomly. For the

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study, a total of 80 farmers were chosen. The CACP (Commission on Agricultural Costs and Prices) cost concept has been used for the analysis. The major findings of this study revealed that per hectare, the cost of cultivation of paddy was calculated as Rs. 77,394.05. The major variables of cost were Human labour (26.11 per cent), the rental value of owned land (17.73 per cent), fertiliser (16.17) followed by Machine labour (15.74). The percentage of cost A and cost B in the total cost of cultivation was 85.47 and 89.13 per cent, respectively. The net return realized from paddy cultivation was Rs.48,320.84. The benefit-cost ratio was 1.62 indicating rice cultivation is economically profitable in the study area.

*Keywords: Economics; paddy; river basin; Thoothukudi.*

## 1. INTRODUCTION

The agriculture sector in Tamil Nadu contributes 13 % of the revenue to the state [1]. It has a net cultivated area of 4.74 million hectares, with various irrigation sources irrigating almost 57% of the land in the State [2]. The climate is the primary determinant of agricultural productivity and it has a direct impact on food production across the globe [3]. Climate change is causing significant disruptions to rainfall patterns, profoundly impacting agricultural practices and productivity [4,5]. Irrigation is an essential input for agriculture and one of the most crucial factors for crop production, especially in regions with limited rainfall [6]. For irrigation, River Basin is a valuable resource and provides a continuous water source for crop growth even during dry periods [7]. Tamil Nadu has 17 major river basins in which the agricultural sector consumes about 75% of the water resources [8]. Thamirabarani river basin is one of the 17 river basins of Tamil Nadu and is located in Tirunelveli and Thoothukudi districts [9]. It is a perennial river that serves as a major source of water for agricultural, drinking purposes, and power generation. Thamirabarani River basin is vital for agriculture in the southern districts of Tamil Nadu and it supports extensive cultivation of crops like paddy, sugarcane, cotton, and fruits due to its water resources. In Tamil Nadu, rice is the major food crop with an area of 22.17 lakh hectares with a production of 79.06 lakh tonnes.

In Thoothukudi district, rice is the most widely planted crop, accounting for 8.7% of the total cultivated area, respectively. Rice is the dominant crop, with an area of 16452 hectares and a production of 60172 tons. Rice is the staple food crop that is consumed both domestically and exported to other parts of India and the world [10,11]. Rice is a water-intensive crop that requires a lot of water to grow [12,13]. Additionally, Thoothukudi district has a reliable water supply from the Thamirabarani River,

which ensures that Rice has a consistent supply of water throughout the growing season [14]. Hence, Rice is the predominant crop in Thoothukudi district. The specific objective of the study is to work out the costs and returns for Rice growing farmers in the Thamirabarani river basin of Tamil Nadu

### 1.1 Selection of Study Area

In the selection of the study area, a multistage purposive sampling method was followed. Thoothukudi district was purposively selected at the first stage because of the high area of Rice cultivation. It is located in the extreme south-eastern corner of Tamil Nadu State. It is situated between latitude 8° 49' 0" N and longitude 78° 8' 0" with an area of 4,621 sq. km. In the second stage among the 14 blocks in Thoothukudi district, Thoothukudi blocks were purposively selected. In the third stage further in the selected block the villages namely Vasavapuram and Vallanadu, were selected, since area-wise these villages occupy the first two places in Rice cultivation in Thoothukudi block. From each of the selected villages, 40 farmers were selected at random. Hence, in total 80 farmers were selected and interviewed through personal interview method from June 2023 to August 2023.

## 2. METHODOLOGY

### 2.1 Conventional Analysis

Conventional analysis involving the calculation of percentages and averages was carried out to interpret the data related to cost and returns in the study area.

### 2.2 Cost of Cultivation (CACP approach)

The cost concepts used by the Commission on Agricultural Costs and Prices (CACP) of the Government of India (GOI), were utilized for the

research study. Information was acquired on some physical indicators; irrigation, human labour, animal labour, machine labour, the value of seeds, insecticides and fungicides, manure, fertilizers, human, animal and machine labour, land revenue, rent paid for leased land or rental value of own land, interest on working capital, land revenue, depreciation of machinery and miscellaneous expenses. These concepts help to understand the costs involved in rice cultivation [15].

### 2.3 Different Costs and their Components

The structure of different costs and their components were as follows:

- i. Cost A1 includes the value of human labour (casual and permanent), hired bullock power, owned bullock power, owned machine power, hired machine power, seeds (farm produced and purchased), manure (owned and purchased), fertilizer, plant protection chemicals, herbicides, irrigation charges, land tax (In India, landowners pay a tax to the government depending on the amount of land they possess. The land tax is paid to the village administration.) and other taxes, depreciation on farm implements and buildings, interest on working capital and miscellaneous expenses;
- ii. Cost A2 = Cost A1 + Rent paid for leased land;
- iii. Cost B1 = Cost A1 + Interest on the value of owned fixed capital assets (excluding land);
- iv. Cost B2 = Cost B1 + Rental value of owned land and rent paid for leased land;
- v. Cost C1 = Cost B1 + Imputed value of family labour;
- vi. Cost C2 = Cost B2 + Imputed value of family labour;
- vii. Cost C3 = Cost C2 + 10 per cent of cost C2

### 2.4 Returns Over Different Cost Concepts

- i. Gross returns = Value of main product + Value of by-product
- ii. Net returns = Gross income - Cost C3
- iii. Benefit-cost ratio

For executing a cost-benefit analysis, an indicator termed the benefit-cost ratio is computed by dividing the gross return by the entire cost of cultivation.

$$\text{Benefit-cost ratio} = \frac{\text{Gross return}}{\text{cost of cultivation}}$$

## 3. RESULTS AND DISCUSSION

### 3.1 Cost and Return from Paddy Cultivation

Rice is the main source of food for more than half of the world's population [16]. The profitability aspect of rice cultivation in the study area has been analysed by calculating per hectare cost and returns. Table 1. Shows the cost for the input pattern utilised by sample farmers when cultivating rice. The cost of cultivation is the total cost incurred on various inputs and wages for labour utilized in the cultivation of rice [17]. The components consist of variable costs, such as labour costs for carrying out various cultural practices and material input costs for seeds, FYM fertilizers, plant protection chemicals, etc. Depreciation on working assets, interest on fixed capital, rent on owned land, and land revenue are examples of fixed costs. The estimation of cost helps to know the profitability of rice cultivation.

From the Table 1, it is seen that cost A1 consists of all the expenses including the cost of human labour, cost of machine labour, cost of seeds, cost of fertilizers, cost of plant protection chemicals, depreciation on fixed capital, interest on working capital, land revenue etc. Interest on working capital was worked out at 7 per cent interest. Depreciation was calculated using the straight-line method. Cost A1 was Rs. 54640.49 per hectare in the conventional method of rice cultivation.

The major expenses involved in the cultivation of conventional rice are machine labour costs, human labour costs and expenditure on fertilizer. Among the variable costs, labour cost (both human and machine) was found to be high, among which the share of human labour cost (26.11 per cent) was higher than machine labour cost (15.74 per cent). Conventional rice cultivation requires more labourers for Transplanting and Weeding. The expenditure on fertilizer was the second major variable cost and it included expenditure on farmyard manure, and fertilizers such as nitrogenous (urea), phosphatic (di-ammonium phosphate) and potassic (murate of potash). The bio-fertilizers like azo spirillum, and phosphobacteria were also used by the farmers as a source of nutrients. Within the fertilizer cost, the major cost incurred for

phosphatic fertilizer *i.e.* DAP (acts as a source of plant nutrients such as N and P) and it is applied as both basal and foliar application in the nursery and main field [18]. Next to phosphatic fertilizers, the higher share was accounted for expenditure on potassic fertilizers.

The cost of plant protection chemicals (PPC) includes the expenditure on fungicides, weedicides and insecticides. Within the variable cost, the share of PPC cost was 2.40 per cent of the total cost under the conventional method of rice cultivation, respectively. Even though conventional farming involves the application of herbicides, hand weeding is practised by the farmers. The pay range of the men labourers ranged from Rs.450 to Rs.540 based on the operations done. Similarly, the wages obtained by women labourers ranged from Rs.180 to Rs.250 based on the operations performed. Human Labour was also a major contributor to the labour costs which was Rs. 20213.45 /ha, Whereas, machine labour costs about Rs.12186.97/ha. The farm machinery was extensively utilised for ploughing, planting, harvesting and transportation activities to reduce human drudgery. It required more hours of machine labour to perform the above operation and hence, resulted in a high machine manpower cost for field preparation and harvesting. The

machine labour cost incurred for field preparation was 4982.34, respectively. Next to field preparation, the calculated harvesting cost was ₹7204.63 for conventional rice cultivation.

Seed/planting material is the primary input in agriculture; hence selection of seed variety plays an important role. ASD 16, White Ponni and ADT 36 were some of the rice varieties cultivated in the study area, of which ADT 36 was the predominant variety which was used by more than 90 per cent of the farmers in the study area during the study period. So, farmers who cultivated ADT 36 were selected for this study. The average seed rate used in the sample farms was 33 kg/ha in the conventional method and the corresponding expenditure incurred was ₹2845.47/ha in a conventional method.

The cost A2 was the addition of cost A1 and rent paid for leased land. The estimated cost A2 was ₹66146.74, respectively. Cost B1 is a sum of Cost A1 and the interest on the value of owned fixed capital without including the value of the land which was Rs. 54264.48 in a conventional method of rice cultivation. Cost B2 is the sum of Cost B1 and the rental value of owned land and rent paid for leased-in land which was Rs. 68983.23 per hectare respectively.

**Table 1. Cost of Cultivation of Rice According to CACP Concepts (Rs./ha.)**

Particulars	Value in Rs ha	Percentage
<b>Cost A1</b>		
Seeds	2845.47	3.68
Human labour	20213.45	26.11
Machine labour	12186.97	15.74
Fertilizer	12516.02	16.17
Plant protection chemicals	1854.69	2.40
Transport and packaging cost	2414.69	3.12
Depreciation on fixed capital	713.13	0.92
Interest in working capital	1821.09	2.35
Land revenue	75.00	0.10
Total (A1)	54640.49	70.60
Rent paid for leased in land	11506.25	14.87
Cost A2	66146.74	85.47
Interest on owned capital (excluding land)	623.99	0.81
<b>Cost B1</b>	55264.48	71.41
Rental value of owned land per season	13718.75	17.73
<b>Cost B2</b>	68983.23	89.13
Imputed value of family labour	1375.00	1.78
<b>Cost C1</b>	56639.48	73.18
<b>Cost C2</b>	70358.23	90.91
<b>Cost C3</b>	77394.05	100.00

**Table 2. Returns from rice cultivation and the benefit-cost ratio**

S. No	Particulars	Amount (Rs./ha.)
1	Yield of rice (Kg/ha)	5495.62
2	Yield of straw (rolls/ ha)	92.93
3	Price of rice (Rs/kg)	21.22
4	Price of straw (Rs/Roll)	97.9
5	Gross returns	125714.89
A	Rice (Main product)	116617.05
B	Straw (By-Product)	9097.847
6	Net returns	48320.84
7	Benefit-cost ratio	1.62

A breakup of cost, cost concept-wise income over different average costs C1 and cost C2 was worked out to Rs. 56639.48, and Rs. 70358.23 per hectare respectively. The cost C3 was Rs. 77394.05 per hectare under conventional methods of rice cultivation, respectively.

### 3.2 Returns from Rice Cultivation

It is important to know about the returns obtained from cultivating paddy under conventional methods to understand the benefits associated with the money spent on cultivation and to make decisions about cultivating the crop in future [19]. The details on the returns received from cultivating paddy under conventional and organic methods are furnished in Table 2.

The average yield obtained by cultivating rice under the conventional method was 5 tonnes per hectare. The average price received per kg of paddy under the conventional method of Rice cultivation is Rs. 21. Rice cultivation yields straw as a by-product. From the cultivation of paddy in one hectare, an average of 92 rolls of straw was obtained. Each roll weighed around 40 kg and obtained a price of Rs. 97 per roll. The average income obtained from the rolls of straw was Rs. 9097 per hectare, respectively.

The gross return realized under conventional methods of paddy cultivation was Rs.125714.89 per hectare respectively. Moreover, cost C3 was deducted from gross income to determine the net return. The net return was Rs. 48,320 per hectare, respectively. The estimated benefit-cost ratio for the conventional methods of rice cultivation was 1.62, respectively. This means that for every rupee invested, it would generate a gross income of Rs. 1.62 under paddy cultivation. This shows that paddy cultivation was profitable in the Thamirabarani River basin.

### 4. CONCLUSION

From the analysis, the total cost of cultivation of rice is Rs. 77394.05 per hectare and from variable costs human labour accounted for more cost followed by the rental value of owned land and fertilizer. The cost and returns based on cost concept in the production of paddy on cost A1, cost A2, cost B1, cost B2, cost C1, cost C2 and cost C3 were worked out to Rs. 54640.49, Rs. 66146.74, Rs. 55264.48, Rs. 68983.23, Rs. 56639.48, Rs. 70358.23 and Rs.77394.05 per hectare respectively on the sample farms. The per hectare net returns received by the farmers was Rs.48320.84. The Benefit-cost ratio of the total cost is 1.05. It indicates rice cultivation is profitable in the study area. The findings showed that in the selected study area farmers had to pay a significant amount of money for paddy cultivation by way of heavy expenditures on Human labour and fertilizer application. Encouraging mechanization such as paddy transplanters helps to reduce the labour cost for transplanting. Fertiliser application costs are also high due to an increase in fertilizer prices. Thus, farmers can switch to using organic manure instead of synthetic or fertilizer prices can be lowered by government subsidies, which will lower the cost of paddy cultivation.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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