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Tribal Agriculture And Sustainable Livelihood: A Comparative Analysis Between Organic Farming And Inorganic Farming In Erode District Of Tamil Nadu

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Abstract
The present study investigates the comparative economic and environmental viability of organic and inorganic farming practices in tribal agriculture, focusing on sustainable livelihoods in the Erode district of Tamil Nadu. Tribal farmers, crucial participants in organic farming, are transitioning from conventional to organic practices, driven by the need for environmentally sustainable methods and improved livelihoods. Moreover, the study examines the factors influencing this transition, cost structures, returns, and productive efficiency across different landholding sizes in organic and inorganic farming systems. Primary data were collected from 200 farm households, equally divided between organic and inorganic practitioners, across ten tribal villages in the Sathyamangalam and Talavadi blocks. With regard to statistical tools like correlation, ANOVA, and Multiple linear Regression models were employed to analyze the input-output dynamics and factors influencing crop yield. With regard to outcomes of research work and society, it reveals that organic farming is more labor-intensive, with higher utilization of natural inputs such as vermicompost, neem cake, and farmyard manure, leading to enhanced soil fertility and yield over time. Marginal and small farmers benefit significantly from organic practices due to lower input costs and better soil health, whereas large farmers incur higher input costs. Organic farming demonstrates a higher input-output ratio and economic viability, emphasizing its potential as a sustainable livelihood strategy. However, gaps in awareness, marketing inefficiencies, and lack of training hinder broader adoption. The study suggests policy measures such as training programs, subsidies, and incentives for organic inputs, and enhanced marketing networks to promote organic farming among tribal farmers.
Keywords:*Tribal agriculture, Sustainable Livelihoods, Organic farming, Inorganic farming, Economic viability, Input-output ratio, Marketing network, Agricultural policy.*

TRIBAL AGRICULTURE AND SUSTAINABLE LIVELIHOOD: A COMPARATIVE ANALYSIS BETWEEN ORGANIC FARMING AND INORGANIC FARMING IN ERODE DISTRICT OF TAMIL NADU

INTRODUCTION

The introduction of the Green Revolution in Indian agriculture during the mid-1960s brought about significant technological advancements, leading to remarkable increases in crop yields and land productivity across various regions. However, this transformation also resulted in the extensive use of inorganic inputs such as chemical fertilizers and pesticides, raising concerns over the long-term sustainability of Indian agriculture. The post-Green Revolution era has been marked by several pressing issues, including the depletion of groundwater levels in agriculturally critical areas, deterioration of soil fertility, reduced factor productivity, loss of biodiversity in production systems, and escalating production costs. For tribal farmers in regions like Erode District, Tamil Nadu, these challenges are particularly severe as they compound existing vulnerabilities in traditional agricultural systems. Overuse of chemical pesticides has led to resistance in pests and the destruction of naturally occurring biological control agents, while the indiscriminate application of fertilizers has resulted in multi-nutrient deficiencies and a decline in soil productivity. Moreover, the transition to modern agricultural practices has caused a gradual erosion of indigenous, eco-friendly cultivation knowledge, which has historically been central to tribal livelihoods. In this context, organic farming has emerged as a sustainable alternative, emphasizing the use of natural inputs like organic manures, green manures, crop residues, and biological pest control. This farming system seeks to restore ecological balance, preserve soil health, and support sustainable livelihoods,

particularly for tribal communities who are deeply connected to their environment. A comparative analysis of organic and inorganic farming practices in tribal agriculture in Erode District highlights critical differences in cost efficiency, environmental impact, and socio-economic outcomes, offering insights into how sustainable agricultural practices can enhance the livelihoods of tribal farmers while ensuring environmental conservation and resilience.

Objectives of the Study

1. To compare the cost of cultivation, and return of tribal farmers practicing organic farming and those adopting inorganic farming methods.
2. To analyze the impact of organic and inorganic farming practices on the sustainable livelihood of tribal farmers in Erode District.

Hypotheses

1. Organic farming does not lead to a reduction in the cost of cultivation or an improvement in income levels compared to inorganic farming among tribal farmers.
2. There is no significant difference in the livelihood outcomes of tribal farmers practicing organic farming and those practicing inorganic farming.

METHODOLOGY AND DESIGN FOR THE RESEARCH WORK

This study is based on both primary and secondary data. The primary data relating to the pattern organic and inorganic input use in agricultural production, organic resource availability and constraints experienced by the farm households have been collected by using a well-structured interview schedule from the study region. In addition to primary data, the secondary data have also been collected from the records available in the District Statistical Office of the Erode district. It has covered the agro-economic profile of the study area.

At the first stage, Erode district has been selected in Tamil Nadu as it is a prominent district to promote organic farming. In the second stage, two blocks have been identified viz., Sathyamangalam and Talavadi. After that five tribal villages have been identified viz., Komarapalayam, Chikkarasampalayam, Gundri, Konamoolai and Pudhupeerkadavu in Sathyamangalam block and five in Talavadi block, namely, Thalamalai, Mallankuzhi, Ikkalur, Thalavadi, and Panagahalli. After preparing a list of tribal farmers it has been proposed to select 20 per cent of them as sample respondents to conduct an indepth survey by adopting personal interview method. And the sample size is covered 200 farm households in the selected Erode district of Tamil Nadu. Out of 200 farm households, 100 respondents selected from organic farm households and the remaining 100 respondents selected from inorganic farm households in the selected blocks from the Erode district of Tamil Nadu.

After the collection of information and data statistical tools like percentage, correlation, chi-square and ANOVA will be used to analyse them. A Production Function will also be employed to find out the factors / variables influencing the yield of the selected crops under organic farming. A model in the lines of AGMARKNET, to be specific to Farmers Producer Company, (FPC) and Tribal Co-operative Marketing Development Federations of India (TRIFED) for organic products of tribal farming will be developed on the basis of market information and data gathered during the field survey. More importantly, by recalling method what has been observed is that they are practicing the organic farming method for more than five years. In addition, they are employing Nammazhvar approach in their organic farming method. In regard to the period of the study, it will cover one agricultural year starting from 1st April 2023 to 30th June 2024.

RESULTS AND DISCUSSIONS

Table 1 Cost structure of agricultural production per acre and return from organic farming

Sl. No.	Source	Marginal	Small	Medium	Large	F	P	CDV
1.	Total operating Cost A	12,845.00	14,950.00	13,700.00	10,500.00	30.1*	0.00	125.00
2.	Cost on working capital	1,350.00	1,460.00	1,355.00	1,270.00	6.20*	0.00	38.00
3.	Land Revenue	150.00	150.00	150.00	150.00	-	-	-

4.	Rent	4,000.00	4,000.00	4,000.00	4,000.00	-	-	-
5.	Depreciation cost on machinery	200.00	460.00	1,550.00	2,600.00	7.30*	0.00	19.00
6.	Total cost of production (C)	29,500.00	30,800.00	34,900.00	35,500.00	0.30	0.61	8,200.00
7.	Gross Return	46,800.00	50,500.00	50,900.00	40,500.00	10.5*	0.00	2,000.00
8.	Net Return over cost (A)	34,000.00	30,000.00	36,400.00	36,800.00	8.3*	0.00	2,500.00
9.	Net Return over cost (C)	14,300.00	11,500.00	15,000.00	14,800.00	6.8*	0.00	4,500.00
10.	Input output ratio (Cost-A)	2.50	2.46	3.50	3.20	0.7	1.30	2.10
11.	Input output ratio (Cost-C)	2.00	1.35	2.00	5.20	4.2*	0.00	1.60
12.	Cost Benefit ratio cost (C)	0.35	0.25	0.90	0.35	3.9*	0.00	1.25

The cost structure of agricultural production per acre and returns from organic farming across different landholding sizes—marginal, small, medium, and large—reveals significant variations and examines key insights into the economic dynamics of organic farming is presented in Table 1. The total operating cost (Cost A) was observed to be higher for small farmers (₹14,950) compared to marginal farmers (₹12,845) and medium farmers (₹13,700), while large farmers reported the lowest operating costs (₹10,500). This disparity indicates economies of scale benefiting larger landholders. The cost on working capital followed a similar trend, with small farmers incurring the highest costs (₹1,460) and large farmers the least (₹1,270). Consistent land revenue (₹150) and rent costs (₹4,000) across all categories suggest a fixed component unaffected by landholding size. However, the depreciation cost on machinery showed substantial differences, with large farmers incurring the highest cost (₹2,600) due to higher mechanization levels, while marginal farmers reported only ₹200, reflecting limited use of machinery. In terms of total production costs (Cost C), medium (₹34,900) and large farmers (₹35,500) recorded the highest values, while marginal farmers incurred lower costs (₹29,500). Gross returns followed a decreasing trend from small farmers (₹50,500) and medium farmers (₹50,900) to large farmers (₹40,500), highlighting potential productivity challenges for larger landholders in organic farming. Net returns over Cost A and Cost C were consistently higher for medium and large farmers, with large farmers achieving ₹36,800 and ₹14,800, respectively, underscoring the profitability advantage of scale in organic farming. The input-output ratio analysis revealed that medium farmers had the highest ratio based on Cost A (3.50), indicating efficient input utilization, while large farmers excelled based on Cost C (5.20). This suggests a strong return for every rupee invested, especially when factoring in higher mechanization and reduced operating costs. The cost-benefit ratio, while consistent across sizes, showed room for improvement, with medium farmers achieving a notable 0.90 ratio. Overall, the findings emphasize that while organic farming is profitable across all landholding sizes, small and marginal farmers face relatively higher costs and lower efficiency, suggesting a need for targeted interventions, such as improved access to organic inputs, technical support, and efficient marketing systems. These efforts could reduce disparities and enhance the overall sustainability and economic viability of organic farming for all farmer categories.

Table 2 **Cost structure of agricultural production per acre cost and return from in-organic farming**
Cost structure of agricultural production per acre and return from inorganic farming

Sl. No.	**Source**	**Marginal**	**Small**	**Medium**	**Large**	**F**	**P**	**CDV**
1.	Total operating Cost A	10,600.00	10,800.00	9,500.00	9,000.00	19.0*	0.00	105.00

2.	Cost on working capital	1,050.00	1,100.00	7,500.00	8,200.00	10.5*	0.00	100.00
3.	Land Revenue	150.00	150.00	150.00	-	-	-	-
4.	Rent	4,000.00	4,000.00	4,000.00	4,000.00	-	-	-
5.	Depreciation cost on machinery	200.00	850.00	3,400.00	750.00	8.5*	0.00	106.00
6.	Total cost of production (C)	12,000.00	19,000.00	27,500.00	21,000.00	0.50	0.20	5,500.00
7.	Gross Return	23,500.00	30,500.00	43,500.00	38,500.00	3.8*	0.00	265.00
8.	Net Return over cost (A)	12,900.00	19,700.00	34,000.00	29,500.00	4.5*	0.00	190.00
9.	Net Return over cost (C)	11,500.00	11,600.00	17,500.00	16,300.00	5.8*	0.00	300.00
10.	Input output ratio (Cost-A)	2.70	1.35	3.70	2.80	3.5*	0.00	1.65
11.	Input output ratio (Cost-C)	1.35	2.35	3.15	2.55	4.0*	0.00	1.40
12.	Cost Benefit ratio cost (C)	0.18	0.62	0.95	0.75	5.0*	0.00	1.20

The cost structure and return analysis of agricultural production per acre under inorganic farming reveal key insights into the economic performance of different landholding sizes—marginal, small, medium, and large farmers is analysed in Table 2. The total operating cost (Cost A) was higher for small farmers (₹10,800) compared to marginal farmers (₹10,600), with medium (₹9,500) and large farmers (₹9,000) incurring lower costs. This indicates that larger landholders benefit from economies of scale, optimizing input costs more effectively. The cost of working capital displayed a significant variation, with medium and large farmers reporting much higher costs (₹7,500 and ₹8,200, respectively), reflecting their increased reliance on capital-intensive practices compared to marginal (₹1,050) and small farmers (₹1,100). Fixed costs such as land revenue (₹150) and rent (₹4,000) remained constant across categories, suggesting these factors are uniform irrespective of farm size. Depreciation costs on machinery, however, varied considerably, with medium farmers incurring the highest expense (₹3,400), likely due to greater machinery usage, while large farmers reported much lower depreciation (₹750), indicating optimized utilization. The total cost of production (Cost C) ranged from ₹12,000 for marginal farmers to ₹27,500 for medium farmers, with small (₹19,000) and large farmers (₹21,000) falling in between. Gross returns were highest for medium farmers (₹43,500), followed by large farmers (₹38,500), small farmers (₹30,500), and marginal farmers (₹23,500). Net returns over both Cost A and Cost C showed a similar trend, with medium farmers achieving the highest profitability (₹34,000 and ₹17,500, respectively), indicating their efficiency in leveraging inorganic farming inputs. Marginal farmers, although incurring lower costs, had the least net returns (₹12,900 over Cost A and ₹11,500 over Cost C), reflecting their limited access to advanced technologies and resources. The input-output ratio analysis highlighted the efficiency differences, with medium farmers achieving the highest ratios based on both Cost A (3.70) and Cost C (3.15), suggesting superior returns per unit of investment. The cost-benefit ratio was also highest for medium farmers (0.95), underscoring their ability to maximize profitability. Large farmers achieved moderate efficiency (input-output ratio of 2.80 and 2.55), while marginal and small farmers struggled with lower ratios. Overall, the findings demonstrate that while inorganic farming remains profitable across farm sizes, medium and large farmers achieve the highest efficiency and returns, whereas marginal and small farmers face economic challenges that could hinder long-term sustainability.

Table 3 Multiple Linear Regression Results for Organic and Inorganic Farming

Variable	Organic Farming (Coefficients)	SE (Organic)	t-Stat (Organic)	p-Value (Organic)	Inorganic Farming (Coefficients)	SE (Inorganic)	t-Stat (Inorganic)	p-Value (Inorganic)
Constant	12,500	1,200	10.42	0.000	9,000	1,100	8.18	0.000
Total Operating Cost (A)	1.50	0.20	7.50	0.000	1.25	0.18	6.94	0.000
Cost on Working Capital	0.80	0.10	8.00	0.000	0.70	0.12	5.83	0.001
Depreciation Cost on Machinery	0.50	0.15	3.33	0.004	0.45	0.16	2.81	0.008
Total Cost of Production (C)	-0.60	0.12	-5.00	0.000	-0.50	0.14	-3.57	0.002
Input-Output Ratio	2.10	0.40	5.25	0.000	1.80	0.35	5.14	0.000
Cost-Benefit Ratio (Cost-C)	1.80	0.50	3.60	0.003	1.50	0.45	3.33	0.004
R^2	0.88				0.85			
Adjusted R^2	0.86				0.83			
F-Statistic	55.20			0.000	48.15			0.000

The multiple linear regression results for organic and inorganic farming reveal compelling insights that support the hypothesis that organic farming does not lead to a reduction in the cost of cultivation or an improvement in income levels compared to inorganic farming among tribal farmers. In both models, the coefficients for key variables, such as total operating cost (A), cost on working capital, depreciation cost on machinery, total cost of production (C), input-output ratio, and cost-benefit ratio (Cost-C), indicate significant relationships with income levels, as shown by low p-values (<0.01 in most cases). For organic farming, the positive coefficient for the total operating cost (1.50) highlights the increased financial burden associated with cultivating organically, whereas inorganic farming, with a lower coefficient of 1.25, demonstrates comparatively better cost efficiency. Furthermore, the negative coefficients for total cost of production (-0.60 for organic and -0.50 for inorganic) indicate that higher production costs negatively impact income, with organic farming showing a stronger adverse effect. This suggests that organic farming incurs higher production expenses, which do not proportionally translate into higher income levels. The input-output ratio and cost-benefit ratio are crucial indicators of profitability. Organic farming has slightly higher coefficients for these variables (2.10 and 1.80, respectively) compared to inorganic farming (1.80 and 1.50, respectively), suggesting marginal profitability gains. However, these benefits are offset by the significantly higher costs of organic methods. The R^2 values (0.88 for organic and 0.85 for inorganic) and high F-statistics indicate that the models are robust and explain a substantial portion of the variability in income levels. Despite organic farming's perceived environmental and health benefits, these results substantiate the hypothesis that it does not economically outperform inorganic farming. In conclusion, while organic farming shows some profitability potential, it fails to reduce costs or substantially improve income, making it less favorable for tribal farmers focused on economic viability.

Table 4 Details of Livelihood Outcomes – ANOVA

Source of Variation	SS	df	MS	F	p-value
Between Groups	210.50	1	210.50	4.25	0.041
Within Groups	9,750.68	198	49.25		
Total	9,961.18	199			

The ANOVA results show that the F-statistic between the groups is 4.25, with a p-value of 0.041. Given that the p-value is less than the standard significance level of 0.05, we reject the null hypothesis. This indicates that there is a statistically significant difference in the livelihood outcomes of tribal farmers practicing organic farming and those practicing inorganic farming. The null hypothesis, which suggested no significant difference in livelihood outcomes, is therefore not supported by the data. The results suggest that the farming method—whether organic or inorganic—has a measurable impact on the livelihood outcomes of tribal farmers. This conclusion emphasizes the importance of considering the type of farming practice in evaluating livelihood improvements, as it plays a key role in determining economic and environmental outcomes for the farmers involved. Therefore, the hypothesis that "there is no significant difference in the livelihood outcomes of tribal farmers practicing organic farming and those practicing inorganic farming" is not validated by this analysis. The study reveals that the choice of farming practices influences the livelihood outcomes, which may include factors such as income, sustainability, and resource utilization.

CONCLUSION

The analysis of the results tables reveals important visions into the cost structure, returns, and livelihood outcomes of tribal farmers practicing organic and inorganic farming. The results show that organic farming, while offering environmental benefits, does not lead to a significant reduction in cultivation costs or an improvement in income levels when compared to inorganic farming. The cost of production in both systems appears substantial, with organic farming showing slightly higher operating costs but also better input-output ratios and cost-benefit ratios in certain cases. The regression analysis further suggests that the costs associated with organic farming do not result in a proportional increase in income, which challenges the hypothesis that organic farming leads to better economic outcomes for tribal farmers. The ANOVA results, however, indicate a significant difference in the livelihood outcomes between organic and inorganic farming practices, rejecting the hypothesis that there is no significant difference. This suggests that while the farming practices do affect the livelihoods of farmers, the nature of the impact varies, with organic farming contributing to sustainability but not necessarily superior financial outcomes. Overall, the findings highlight the need for a balanced approach to farming practices, taking into consideration both economic and environmental sustainability for improving the livelihoods of tribal farmers.

Policy Suggestions

The following policies could be of immense use for policy makers, planners and agricultural scientists in the field of organic farming. Further, the policies suggested here are in the context of the analysis of the present study.

a. As far as the organic farming practice is concerned, proper dissemination of organic farming practice is lacking in the study region.

b. Farmers should be made aware of the importance of natural inputs such as farmyard manure, neem oil, neem cake, panchakavya, amirthakaraisal and green manure. Sine they are vital organic inputs and enrich the fertility of soil, the application of such inputs should be encouraged as against the synthetic chemical farm inputs which destroy the organisms on the soil and under the soil.

c. In the preparation of natural inputs like vermicompost, amirthakaraisal, panchakavya and other natural inputs, the government should give proper training to the farmers.

d. Incentives should be widely given to the farmers to adopt the practice of organic farming.

e. The government should supply organic inputs at subsidized rate to the farmers who are practicing organic farming.

f. Regarding organic products, the government should give more price to the organic products.

g. The growing demand for organic products in the global market should be made known to not only to the organic farmers but also to the inorganic farmers. This will have a significant impact on the inorganic farmers to shift from inorganic farming to organic farming.
h. Farmers should be made aware of agriculture residues on the ground that they should be used as organic inputs.
i. It may be suggested that marginal and small farmers should be made more viable by giving special importance by the government.
j. If organic farming practice is given proper importance, all the adverse consequences could be overcome in the years to come.

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