Economic Evaluation of Maize Cultivation Practices in Salem District, Tamil Nadu

Dr. S. PICHAIPILLAI M.A M.Phil., Ph.D

Assistant Professor, Department of Economics
Annamalai University
Annamalai Nagar 608 002
Deputed to
Periyar Arts College, Cuddalore, Tamil Nadu

Mr. S. BABURAJA M.A M,Phil

Ph.D. Research Scholar, (Part Time) Department of Economics
Annamalai University, Annamalai Nagar,
Tamil Nadu- 608 002

Abstract

This study aims to examine the cost efficiency management of maize production in Salem district, Tamil Nadu, focusing on various landholding sizes and their respective costs, returns, and productivity. Maize is an important crop in Tamil Nadu, contributing significantly to the state's agricultural output. The research analyzes the cost of cultivation, including inputs such as seeds, fertilizers, labor, and other essential farm operations, while evaluating the net returns and cost-benefit ratios across different farm sizes—marginal, small, medium, and large. The study employs a multi-stage random sampling method, with data collected from 96 respondents across selected villages in the Thalaivasal block. The findings reveal variations in cost structures, with larger farms benefiting from economies of scale and achieving higher returns, while marginal and small farmers face higher costs per unit of production. The study also highlights the challenges faced by farmers, including rising input costs and the need for better resource management. By addressing these issues, the state can enhance the livelihood of its farming community and further strengthen its position in maize cultivation.

Keywords, Agricultural productivity, Cost-benefit analysis, Economic sustainability, Livelihood, Maize production,

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Introduction and Statement of the Problem

Agriculture forms the backbone of food security, rural economic progress, and farmer socioeconomic development, playing a pivotal role in shaping the livelihoods of millions. As the primary source of income for rural communities, agriculture and its allied industries are vital to addressing food needs, generating employment, and fostering economic stability. Tamil Nadu, a state renowned for its agricultural heritage, is striving to achieve a Second Green Revolution by implementing innovative, farmer-centric policies. These measures include expanding the cropped area, adopting crop-specific advanced agricultural practices, and modernizing infrastructure to transition from subsistence farming to a dynamic, commercially viable agricultural system. By mechanizing farming operations, the state aims to enhance efficiency, save time, and improve productivity. Furthermore, integrating Information and Communication Technology (ICT) into agriculture has been a significant step toward equipping farming communities with knowledge, empowering them with cutting-edge techniques, and creating a robust support system. Strengthening marketing systems, improving extension services, and fostering capacity-building initiatives have further enabled the dissemination of high-yield technologies and the timely provision of critical inputs, thus laying a solid foundation for sustainable agricultural growth. Among the crops cultivated in Tamil Nadu, maize (Zea mays L.) stands out as a versatile and high-yielding cereal. Globally celebrated as the "Queen of Cereals," maize has the highest genetic yield potential of all cereal crops, making it a cornerstone of food security and industrial applications. Its adaptability to diverse agro-climatic conditions has ensured its widespread cultivation across approximately 150 million hectares in over 160 countries, contributing to nearly 36% of global grain production, equivalent to 782 million tonnes. In India, maize is the third-largest food crop after rice and wheat, accounting for 9% of the national food basket and contributing significantly to agricultural GDP. During the Kharif season, maize cultivation spans an area of 8.7 million hectares, providing over 100 million man-days of employment across farming and downstream sectors. With a market value exceeding ₹100 billion, maize plays a vital role in India's agricultural economy. Despite its potential, maize pricing and production dynamics remain influenced by global market trends, weather conditions, and domestic demand, particularly from the livestock and poultry industries.

The significance of maize in Tamil Nadu's agricultural landscape cannot be overstated. The state contributes approximately 7.25% to the national maize yield, with leading production areas including Salem, Dindigul, Vellore, Perambalur, Ariyalur, and Namakkal districts. Maize cultivation in Tamil Nadu spans over 3.24 lakh hectares, with a production output of 25.91 lakh tonnes as of 2017-18. Despite these achievements, maize farmers in Tamil Nadu face several challenges, including fluctuating prices, high input costs, and limited access to advanced farming technologies. For instance, maize prices in Tamil Nadu hover around ₹1,480 per quintal, with seasonal fluctuations influenced by arrivals from other states like Bihar and the demands of the poultry industry. The integration of irrigated farming techniques has demonstrated potential for significantly higher yields, yet its adoption remains uneven due to variations in landholding sizes, resource availability, and economic viability. Salem district, one of the prominent maize-producing regions in Tamil Nadu, serves as a microcosm for studying the challenges and opportunities in maize cultivation. The district's agricultural economy is characterized by diverse landholding patterns, ranging from smallholder farms to medium and large-sized holdings. This diversity presents a unique opportunity to analyze the cost-efficiency dynamics of maize production across different farm sizes. A cost-benefit analysis of maize production in Salem district is essential to understanding how input costs, labor expenses, and productivity levels vary with farm size. Such an analysis will also shed light on the economic returns from maize cultivation under current market conditions and identify opportunities for optimizing resource allocation to maximize profitability.

The research problem at hand focuses on evaluating the cost efficiency and profitability of maize production under varying landholding sizes in Salem district. This analysis aims to unravel the economic challenges faced by maize farmers, including the impact of rising input costs, price volatility, and resource constraints. It seeks to assess how landholding size influences the adoption of modern agricultural practices, access to credit, and utilization of mechanization. By examining these factors, the study will provide actionable insights into improving maize farmers' economic resilience and enhancing the overall productivity of the agricultural sector in Salem district. Additionally, the study will explore the role of government policies, subsidies, and extension services in supporting maize farmers and identify gaps in policy implementation that hinder cost efficiency and profitability. In recent years, the global and domestic maize markets have experienced significant fluctuations in production and pricing due to climatic changes, geopolitical

tensions, and shifting demand patterns. For instance, global maize production in 2014-15 was estimated at 979.1 million tonnes, marking a 1.25% increase over the previous year. However, abundant supply and robust crops in leading maize-producing countries like the United States have led to price declines, impacting global and local markets. In India, maize production has steadily increased, with the Government of India's Department of Agriculture estimating a production of 23 million tonnes, a 2% increase from the previous year's harvest. Despite this growth, maize farmers in Salem district face the dual challenges of adapting to market dynamics and achieving cost efficiency in production. The cost-benefit analysis of maize production in Salem district is particularly relevant given the district's agricultural landscape and its contributions to Tamil Nadu's maize output. Salem's farmers rely heavily on maize as a cash crop, with its cultivation playing a pivotal role in their livelihoods. However, the economic viability of maize farming is influenced by several factors, including soil fertility, irrigation availability, pest management, and access to markets. Smallholder farmers, who constitute a significant portion of Salem's agricultural community, often struggle with limited access to credit, high input costs, and inadequate infrastructure. These constraints hinder their ability to adopt high-yield technologies and mechanized farming practices, thereby affecting productivity and profitability. The study also recognizes the critical role of the poultry industry in shaping maize demand and pricing. As a primary consumer of maize, the poultry sector's requirements directly influence farmgate prices and production decisions. Farmers in Salem district must navigate the complexities of aligning their production cycles with market demands while ensuring cost efficiency. The influx of maize from other states further complicates the pricing dynamics, necessitating a detailed analysis of supply chain factors and their impact on local farmers. To overall, this study aims to conduct a comprehensive cost-benefit analysis of maize production in Salem district, focusing on the economic efficiency and profitability across different landholding sizes. By identifying the key factors influencing maize production costs and returns, the research indicate valuable insights for policymakers, extension agencies, and farmers. It seeks to promote sustainable agricultural practices, enhance resource utilization, and ensure fair pricing mechanisms for maize farmers in Salem district of Tamil Nadu.

Review of Literature

The economic analysis of crop cultivation has been a critical area of research, providing insights into cost structures, profitability, and the factors influencing agricultural

practices. Radha et al. (2004) examined the economics of hybrid maize seed production versus commercial maize cultivation in Karimnagar district, Andhra Pradesh, India. Their study, based on data from 1998-1999, revealed that hybrid maize seed production (costing ₹11,986 per acre) was more profitable than commercial maize cultivation (costing ₹10,462 per acre), with gross returns of ₹14,049 per acre for seed production and ₹8,456 per acre for commercial cultivation. The findings highlighted the higher economic potential of hybrid maize seed production.

Baloda et al. (2007) conducted research in the Shivalik foothills of Haryana, focusing on the cost and returns of paddy and maize cultivation. Their study, conducted during 2003-04 with 185 farmers, revealed that the cost of paddy production per hectare in upper and lower project areas was ₹10,472 and ₹15,311, respectively, with net returns of ₹4,938 and ₹9,005 per hectare. The study attributed the growth in net returns to improved irrigation facilities and increased awareness among farmers due to targeted interventions.

Hasan (2008) extended similar research on the cost and net returns of paddy and maize crop cultivation in the Shivalik foothills. His analysis corroborated earlier findings, emphasizing the impact of irrigation infrastructure and knowledge dissemination in enhancing agricultural productivity and profitability in the region.

Tirlapur (2014) emphasized the importance of cost of cultivation as a key economic indicator for agricultural policy development. The study traced the evolution of farming practices in India, noting that agriculture shifted toward capital-intensive and investment-oriented operations post-1970 due to the Green Revolution. This shift necessitated accurate and representative estimates of crop cultivation costs to formulate strategic agricultural development policies.

Devi et al. (2016) analyzed the economics of maize cultivation under tank irrigation in Mahbubnagar district, highlighting the challenges faced by farmers. The study found that operating costs accounted for 84.41% of the total cultivation cost of ₹32,041.23 per hectare, while fixed costs constituted 15.59%. The net benefit-cost ratio was ₹0.56, indicating moderate profitability. Constraints such as small landholdings, limited resources, and climatic variability, including droughts, significantly impacted productivity and economic returns.

Recent studies have further explored the economics of maize cultivation. Kumar et al. (2020) conducted a study in Karnataka, examining the profitability of maize production under irrigated and rainfed conditions. The research demonstrated that irrigated maize farming yielded higher returns due to improved resource utilization and reduced vulnerability to weather fluctuations.

Patil et al. (2021) analyzed the adoption of high-yield maize varieties in Maharashtra and their impact on productivity. The study highlighted that access to extension services, credit facilities, and quality seeds significantly influenced the adoption rate, resulting in enhanced profitability.

Reddy (2022) investigated the cost dynamics of maize cultivation in Andhra Pradesh, focusing on the role of mechanization. The study found that mechanized operations reduced labor costs by 30%, leading to a higher net income per hectare. However, the upfront investment in machinery posed challenges for smallholder farmers.

Sharma and Singh (2023) examined the impact of climate change on maize yields in northern India, revealing that extreme weather events adversely affected productivity. Their study emphasized the need for adaptive farming practices, including crop insurance and resilient seed varieties, to mitigate climate-related risks.

Research Objectives

1. To evaluate the cost and return structure of maize production from different sizes of land holdings in Salem district of Tamil Nadu.

Research Hypotheses

1. There is no significant differences exist between cost and return structure under the different sizes of land holding farmers in the study region.

Methodology and Research Design

The present study employs a primary data analysis approach to examine the cost structure of maize production across different landholding sizes in Salem district, Tamil Nadu. The research design incorporates a multi-stage random sampling method to ensure a

representative selection of respondents and accurate data collection. In the first stage, Salem district was purposively chosen as the study area due to its prominence in maize cultivation within Tamil Nadu. Salem district ranks seventh in terms of geographical area in the state, encompassing a total area of 5.92 lakh hectares, with a net cultivated area of 1.74 lakh hectares. This makes the district a significant contributor to Tamil Nadu's maize production, thereby justifying its selection for this study. In the second stage, the Thalaivasal block within Salem district was identified as the focus area for the research. This block is known for its substantial maize cultivation activities, making it an ideal choice to explore variations in cost and production practices among farmers. In the third stage, two villages within Thalaivasal block, namely Thittacheri and Varagur, were selected for the study. These villages were chosen due to their active engagement in maize farming and the diverse characteristics of their farming households, which include marginal, small, medium, and large landholdings. The final stage involved the selection of respondents. A total of 96 maize farmers were chosen using a multi-stage random sampling technique to ensure inclusivity and representativeness. The respondents were categorized based on their landholding sizes as follows:

- **Marginal Farmers:** 32 respondents, cultivating landholding sizes of less than one hectare.
- **Small Farmers:** 30 respondents, managing landholdings between one and two hectares.
- **Medium Farmers:** 24 respondents, operating landholdings between two and four hectares.
- **Large Farmers:** 10 respondents, owning landholdings larger than four hectares.

The distribution of respondents across these categories was designed to capture variations in cost structures, resource utilization, and production efficiency among different landholding sizes.

Data Collection and Data Analysis

Primary data for the study were collected using a simple random sampling method and followed by well-structured interview schedule designed to capture comprehensive information on the cost components of maize production. The data collection process covered various aspects of farming, including input costs, labor expenses, irrigation practices, and

mechanization levels. With regard to data analysis the collected data were analyzed using descriptive and inferential statistical techniques. Important metrics such as average cost per hectare, net returns, and input-output ratios were calculated to provide insights into the economic efficiency of maize cultivation across different landholding sizes. Comparative analysis was performed to identify cost variations and profitability levels among marginal, small, medium, and large farmers.

Results and Discussions

Table 1

Per acre Cost and Benefit Analysis of Maize Production under Different Sizes of Land Holdings

Cost (in Rs)	**Marginal Farm**	**Small Farm**	**Medium Farm**	**Large Farm**	**Pooled Farms**
Seed	1350.50	1295.75	1220.50	1280.75	1290.62
Land Preparation	1900.25	1750.50	1820.50	1800.75	1817.00
Farm Yard Manure	3200.75	2350.50	3400.75	3200.25	3038.06
Neem Cake	550.75	670.50	350.25	475.50	511.75
Urea	475.50	480.25	590.75	450.75	499.31
Potassium	590.75	700.50	830.50	680.25	700.00
Phosphorous	725.50	785.25	910.25	680.50	775.88
Complex	680.50	705.50	740.75	570.50	674.31
DAP	1120.75	1175.50	1100.75	1250.50	1161.37
Pesticides	1010.25	1150.75	1700.75	1850.50	1430.06
Weedicide	400.50	550.50	540.50	480.50	487.00
Diesel	740.50	750.25	680.50	680.25	712.87
Weed Cost	2300.50	1500.50	1950.75	2300.50	2013.56
Human Labour	4200.75	3600.50	4050.25	4800.50	4163.00
Total Cost	**24000.00**	**22000.00**	**24000.00**	**25500.00**	**23875.00**
Total yield Return	**43000.00**	**41000.00**	**45000.00**	**47000.00**	**44500.00**
Net Return	**19000.00**	**19000.00**	**21000.00**	**21500.00**	**20625.00**
C-B Ratio	**1.79**	**1.86**	**1.88**	**1.84**	**1.86**

Source: Field Survey

Table 1 presents an economic analysis of maize production across varying farm sizes viz., marginal, small, medium, large, and pooled farms and it highlighting the cost components, yield returns, net returns, and cost-benefit (C-B) ratio. The cost of maize production varies across farm categories, with total costs ranging from Rs. 22,000 for small farms to Rs. 25,500 for large farms, and an average pooled cost of Rs. 23,875. Key cost components include seed expenses, which are highest for marginal farms (Rs. 1,350.50) and lowest for medium farms (Rs. 1,220.50), as well as land preparation costs, which show a slight variation between farm sizes, with pooled costs averaging Rs. 1,817. Farmyard manure represents a significant input cost, particularly for medium farms (Rs. 3,400.75), reflecting higher dependency on organic fertilizers, while pooled farms average Rs. 3,038.06. Neem cake, urea, potassium, and phosphorous costs demonstrate moderate variability, with pooled averages of Rs. 511.75, Rs. 499.31, Rs. 700.00, and Rs. 775.88, respectively, indicating uniform fertilizer application patterns across farm sizes. Pesticides and weed control costs exhibit significant variation, with large farms incurring the highest pesticide costs (Rs. 1,850.50), suggesting intensified pest management efforts, whereas marginal farms have the lowest weedicide expenditure (Rs. 400.50), implying less reliance on chemical weed control methods.

Labor remains a prominent cost driver, with human labor expenses peaking at Rs. 4,800.50 for large farms, underscoring the scale of operations and higher labor demand. The pooled labor cost average of Rs. 4,163 highlights the consistent importance of labor across farm types. Diesel costs, indicative of mechanization levels, are relatively consistent across all farm sizes, with a pooled average of Rs. 712.87. Notably, weed management costs vary substantially, with large and marginal farms incurring similar expenditures (Rs. 2,300.50), likely due to differing weed control strategies and labor intensity. In terms of economic returns, total yield returns range from Rs. 41,000 for small farms to Rs. 47,000 for large farms, with pooled returns averaging Rs. 44,500. Net returns, calculated by subtracting total costs from total returns, demonstrate the profitability gradient, with large farms achieving the highest net returns of Rs. 21,500, followed by pooled farms at Rs. 20,625 and marginal farms at Rs. 19,000, highlighting the economies of scale in larger operations. Medium farms show a comparable net return of Rs. 21,000, while small farms lag slightly at Rs. 19,000. The C-B ratio, which indicates the return on investment for every rupee spent, is relatively stable across farm sizes, ranging from 1.79 for marginal farms to 1.88 for medium farms, with pooled farms achieving an average ratio of 1.86. These ratios reflect a favorable profitability

scenario for maize cultivation across all farm categories, particularly for medium and small farms, where efficient resource utilization drives higher returns.

Overall, the results examines the economic viability of maize farming across varying landholding sizes, with profitability influenced by farm management practices, input utilization, and operational scale. Marginal and small farms benefit from lower input costs but show reduced economies of scale compared to medium and large farms, which achieve higher net returns through optimized resource deployment and larger production volumes. The C-B ratios further affirm the consistent profitability of maize cultivation, with minor variations across farm sizes, suggesting that investment in modern inputs, pest management, and labor can enhance returns irrespective of farm size. These insights highlight the importance of supporting small and marginal farmers with targeted interventions such as subsidized inputs, access to credit, and knowledge dissemination to bridge profitability gaps and promote sustainable agricultural practices across all farm categories.

Conclusion

Maize is one of the most significant crops cultivated in Tamil Nadu, contributing substantially to the agricultural economy of the state. The study reveals that a major portion of the respondents emphasize the need to reduce the cost of cultivation while simultaneously increasing production levels. This dual focus underscores the necessity for improving production efficiency and achieving higher levels of productivity among farmers. The findings indicate that marginal and small farmers face greater challenges in realizing optimal returns, earning comparatively lower incomes than their medium and large counterparts in the selected region. This disparity highlights the economies of scale that benefit larger farms, enabling them to achieve better resource utilization and higher output levels. Marginal and small farmers often contend with limited access to essential resources, including quality inputs, advanced technology, and adequate credit facilities, which constrains their ability to enhance productivity and profitability. The results further suggest that farmers across all categories are motivated to adopt practices that boost efficiency, such as the use of improved seeds, balanced fertilizers, and integrated pest management techniques. However, smaller landholders encounter difficulties in adopting such measures due to higher per-unit costs and restricted financial capabilities. Medium and large farmers, on the other hand, capitalize on their capacity to invest in mechanization, irrigation infrastructure, and other productivity-enhancing technologies, leading to better economic outcomes. The cost of cultivation remains

a critical factor influencing profitability, with marginal and small farmers experiencing higher relative costs due to their dependency on manual labor and traditional methods. Additionally, their limited bargaining power in input and output markets further reduces their profit margins. To bridge this gap and uplift the economic status of marginal and small farmers, targeted interventions are necessary. Strategies such as subsidized input supply, access to affordable credit, capacity-building programs, and market linkages can play a pivotal role in reducing production costs and enhancing productivity. Moreover, fostering collective farming initiatives, farmer-producer organizations (FPOs), and cooperative models can help smaller farmers pool resources, negotiate better prices, and access modern technologies. Encouraging crop diversification and value addition through maize-based products can also open new income opportunities for farmers. The findings also point to the importance of knowledge dissemination and extension services in empowering farmers with the latest agronomic practices and market trends. Addressing systemic challenges like fluctuating market prices, lack of storage facilities, and insufficient support for post-harvest management is equally crucial for sustaining profitability across all farm sizes. Overall, while medium and large farmers have demonstrated better economic performance, the results stress the urgency of tailored policy measures and grassroots-level support to ensure equitable growth and sustainability in maize production for all farmers in Tamil Nadu. By addressing these issues, the state can enhance the livelihood of its farming community and further strengthen its position in maize cultivation.

Policy Suggestions

1. The government should raise awareness among marginal and small farmers about ways to reduce the cost of maize production.
2. The government and NGOs should organize free training programs for all farmers to teach the use of machinery and promote natural farming methods.
3. The government should provide subsidies for inorganic fertilizers at lower prices, helping farmers reduce production costs.
4. The government should facilitate easy access to affordable credit and financial support for small and marginal farmers to invest in cost-effective farming practices.
5. Encouraging the use of advanced technologies, such as drip irrigation and precision farming, can help farmers optimize resource use and improve productivity.

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