International Journal of Social Science and Human Research

ISSN (print): 2644-0679, ISSN (online): 2644-0695

Volume 08 Issue 05 May 2025

DOI: 10.47191/ijsshr/v8-i5-20, Impact factor- 8.007

Page No: 2794 - 2804

Maize Cultivation in The Southwestern Region of Bangladesh: Assessing Production, Profitability, And Input Efficiency

Shahed Ahmed[1], Md. Firoz Hossain[2], Md. Humaun Kabir[3]

[1]Associate Professor, Department of Economics, Islamic University, Kushtia-7003, Bangladesh

[2]Assistant Professor, Department of Development Studies, Islamic University, Kushtia-7003, Bangladesh

[3]Assistant Professor, Department of Economics, Islamic University, Kushtia-7003, Bangladesh

ABSTRACT: This study explores the production performance, profitability, and input efficiency of maize cultivation in the southwestern region of Bangladesh, particularly in Kushtia and Chuadanga districts. Maize plays a crucial role in the local agricultural sector, contributing to food security and income generation. A total of 200 maize farmers took part in the study. They shared information about the inputs they used, their costs, the amount of maize they produced, and how much profit they made. The Cobb-Douglas production function was employed to estimate the effects of labor, land preparation, seed, irrigation, and other costs on farm income. The findings indicate that labor is the most efficient input in boosting productivity, however, land preparation, seed and irrigation show strong positive financial returns. Additionally, a Benefit-Cost Ratio (BCR) of 1.29 suggests that maize cultivation is economically profitable in the region. The study also identified input efficiency and found that key resources such as labor, land preparation, and irrigation are underutilized, suggesting opportunities to increased productivity. The results emphasize the importance of optimizing input use and improving farming practices to boost profitability and sustainability. Based on these findings, the study offers practical recommendations for farmers and policymakers to optimize input use, improve productivity, and ensure the sustainability of maize farming in the southwestern region of Bangladesh.

KEYWORDS: Maize cultivation, Production performance, Profitability, Input efficiency, Bangladesh.

1. INTRODUCTION

Maize cultivation has emerged as a critical component of Bangladesh's agricultural sector, particularly in the southwestern region, where it serves both subsistence and commercial purposes. As a versatile crop, maize is increasingly recognized for its role in contributing to food security, income generation, and resource optimization across farming communities. The rising demand from key industries such as poultry and dairy has further underscored its economic importance. In the southwestern districts of Kushtia and Chuadanga, maize farming has gained prominence due to favorable agro ecological conditions and the adaptability of improved maize varieties. Despite its expanding footprint, the region still faces complex challenges regarding production efficiency, input utilization, and market accessibility, necessitating a comprehensive examination of maize's socioeconomic and agronomic dimensions. This study explores the multifaceted implications of maize cultivation in the southwestern region of Bangladesh by focusing on four key dimensions: production performance, profitability, input efficiency, and socioeconomic impact. Understanding these factors is vital for promoting sustainable agricultural development and crafting informed policy decisions. Through empirical analysis, the research assesses how modern cultivation techniques such as improved seed varieties, better irrigation methods, and integrated soil fertility management affect farm-level productivity and economic returns. Equally important is evaluating how these technological improvements influence farmers' livelihoods, household food security, and overall well-being.

The southwestern region presents a unique agricultural landscape shaped by climate variability, diverse soil conditions, and differential access to agricultural inputs and market infrastructure. These factors influence the adoption and outcomes of maize farming practices. Previous studies Rahman et al., 2016 have documented the profitability of maize production and its competitiveness in regional and global markets. However, gaps remain in understanding the nuanced relationship between input efficiency and socioeconomic outcomes, particularly among smallholder farmers who often contend with limited access to resources, extension services, and price stability. Recent literature also indicates a stagnation in maize production growth despite increasing demand, particularly from livestock sectors (Islam et al., 2022). Factors such as inefficient input use, high seed costs, soil fertility degradation, and climate-related disruptions have been identified as critical constraints. Moreover, there is a growing need to explore the environmental impacts of intensified maize cultivation and its long-term sustainability (Islam & Hoshain,

2022). This study aims to generate evidence-based recommendations for enhancing maize cultivation in a manner that is both economically viable and environmentally sustainable. Ultimately, the findings will be instrumental in guiding agricultural policy, supporting capacity-building initiatives, and advancing rural development objectives in the southwestern region of Bangladesh.

1.1 Background of the Study

Agriculture is a key part of Bangladesh's economy, providing jobs for many people and ensuring food security. Maize has become increasingly important in recent years due to growing demand from the poultry and dairy industries. It is also adaptable to various climates and soils. Over time, maize has changed from a less important crop to a commercially valuable one, giving farmers new chances to earn income, improve food security, and diversify from rice-based farming. The southwestern region of Bangladesh, including districts like Kushtia and Chuadanga, is known for maize production. The region has favorable conditions, such as good soil, infrastructure, and market access. Farmers here are turning to maize as it offers higher productivity and better profits compared to other crops. The use of improved maize varieties and better farming techniques has led to increased yields. However, these benefits are not the same for all farmers, and there are still many challenges that limit the full potential of maize farming. Several factors affect maize cultivation in this region. High costs for inputs, limited access to agricultural advice, and poor market connections make it hard for farmers to improve productivity. Additionally, land degradation, inefficient use of resources, and climate change add to the challenges. Smallholder farmers are especially affected as they lack the financial and technical means to adopt better farming practices.

Studies show that maize production in Bangladesh is economically viable. Research by Biswas et al. (2023) indicates that maize offers a good return on investment and that farmers respond well to market changes. However, there is still a gap in understanding how maize farming affects farmers' income, food security, and overall well-being. While new technologies have improved maize production, there is limited research on the long-term environmental impact of intensive maize farming. Issues like inefficient use of inputs and the need for better resource management have been pointed out in studies like those by Islam and Hoshain (2022).

This study aims to explore maize farming's production performance, input efficiency, and profitability in the southwestern region. It also focuses on how maize affects food security, income, and employment in rural households. The research will look at the maize value chain to understand the challenges and opportunities that affect farmer decision-making. By using the findings, the Government of Bangladesh can improve maize farming practices, enhance input efficiency, and support smallholder farmers, ultimately contributing to rural prosperity, food security, and environmental sustainability.

1.2 Problem of the Statement

Maize cultivation plays a significant role in ensuring food security and supporting rural livelihoods in Bangladesh, particularly in agriculturally active regions like Kushtia and Chuadanga. Despite its growing importance, many farmers still face challenges in optimizing the use of agricultural inputs such as labor, land preparation, irrigation, fertilizer, and pesticides. The analysis of input efficiency reveals that while inputs are generally used effectively, some—especially fertilizer, land preparation, and irrigation—remain underutilized. This underuse limits the potential for higher productivity and profitability. Moreover, improper or imbalanced application of inputs can lead to economic inefficiencies and environmental degradation. Therefore, there is a critical need to assess and improve input use efficiency in maize production to help farmers achieve sustainable output gains and greater income security. This study addresses the gap by evaluating input efficiency and identifying areas where targeted improvements can support both productivity and sustainability in maize farming.

Therefore, this study seeks to connection the existing knowledge gap by critically examining the multidimensional aspects of maize cultivation in the southwestern region of Bangladesh. It aims to identify the key determinants of production success, measure input-use efficiency, evaluate profitability across farm sizes, and analyze the socioeconomic outcomes for farming households. Through this integrated approach, the research will provide a solid foundation for policy formulation, extension strategies, and investment planning geared toward inclusive and sustainable agricultural development.

1.3 Objectives of the Study

The general objective of the study is to evaluate the production performance, profitability, and input efficiency of maize cultivation in the southwestern region of Bangladesh. The specific objectives of the study are:

- To assess the production performance of maize across different farming systems in the southwestern region.
- To analyze the profitability of maize cultivation by examining input costs, yields, and market returns.
- To evaluate the efficiency of input use (e.g., land, labor, seed, fertilizer, irrigation) in maize production.
- To identify key factors affecting production outcomes and economic performance among maize growers.
- To provide actionable recommendations for enhancing input efficiency, productivity, and profitability in maize farming.

1.4 Research Questions

The study is guided by the following research questions:

- What is the current level of production performance of maize cultivation in the southwestern region of Bangladesh?
- How profitable is maize cultivation for different categories of farmers in the study area?
- How efficiently are key inputs—such as land, labor, seed, fertilizer, and irrigation—being utilized in maize production?
- What are the major factors influencing production performance, input use efficiency, and profitability in maize farming?
- What practical strategies can be recommended to enhance the productivity, input efficiency, and economic returns of maize cultivation in the southwestern region?

1.5 Significance of the Study

This study is important because it takes a closer look at how maize farming can become more productive, profitable, and sustainable for farmers in the southwestern region of Bangladesh, particularly in districts like Kushtia and Chuadanga. Maize is not only a source of income for rural households but also contributes significantly to food security and nutrition. However, many farmers are still unable to reach the full potential of their maize production. One of the key reasons for this is the inefficient use of agricultural inputs such as labor, land preparation, irrigation, fertilizer, and pesticides. When these inputs are not used in the right proportion or at the right time, it leads to lower yields and reduced profits. This study helps identify which inputs are underutilized or overused, providing a clear direction on how farmers can improve their practices and make better use of what they already have. By highlighting areas for improvement and offering practical insights, the research not only supports individual farmers in boosting their productivity but also assists policymakers and agricultural extension workers in designing more effective support programs. Ultimately, the goal of this study is to contribute to a more sustainable and rewarding future for maize farmers, ensuring that their hard work leads to better livelihoods and greater food security for their communities.

1.6 Limitations of the study

While this study tries to give a clear and helpful picture of maize farming in the southwestern region of Bangladesh, it's important to recognize a few limitations that may affect how the results are understood and applied. The research focuses mainly on selected districts like Kushtia and Chuadanga, so the findings may not fully reflect the situation in other regions with different climates, soil types, or economic conditions. Also, most of the information was collected through surveys and interviews, meaning some of the details depend on what farmers could remember or report, which might not always be completely accurate. Since the study was carried out over a short period, it captures only a single point in time rather than changes that happen over different seasons or years. It also looks only at maize, so it doesn't consider how farmers might grow other crops alongside maize or how these crops might work together to affect income and efficiency. Environmental issues, such as the condition of the soil or the amount of water used, were not studied in detail, even though these are important for long-term sustainability. In addition, not all farmers use the same tools or techniques, which can create differences in outcomes that are hard to measure or compare directly. Despite these limitations, this study offers useful insights into how farmers are using their resources and where improvements can be made. It can help guide future research and policymaking aimed at making maize farming more productive, sustainable, and supportive of rural families' well-being.

2.0 LITERATURE REVIEW

Maize cultivation in Bangladesh has bring in increasing attention as an important agricultural practice, especially in the southwestern region, where it serves as both a subsistence and a commercial crop. A significant body of literature has highlighted the diverse factors affecting maize production, including input efficiency, profitability, and productivity.

Rahman et al. (2016) investigated maize production in northwestern Bangladesh, focusing on Dinajpur and Lalmonirhat districts. The study found that maize cultivation in Bangladesh is both globally competitive and profitable, with a Benefit Cost Ratio (BCR) of 1.21. This suggests that maize cultivation offers substantial returns for farmers. The study also emphasized the responsiveness of farmers to market changes, particularly maize prices, and indicated that a 1% increase in price resulted in a 0.4% increase in maize supply. Moreover, the availability of land was identified as a critical driver of maize supply, with a 1% increase in land availability leading to a 3.9% increase in supply. The authors recommended investments in research and development (R&D), land reform, and labor market enhancements to increase maize production efficiency and profitability.

analyzed the cost-return dynamics of maize cultivation in Chuadanga district. Their findings revealed significant differences in cost-return patterns across marginal, small, and medium **Biswas et al. (2023)**-scale maize production units. The study employed a Cobb-Douglas production function to identify factors such as input costs, labor scarcity, and soil fertility decline as key determinants of production. Notably, the analysis revealed that diminishing soil fertility is an emerging challenge to maize cultivation in the region. These findings stress the need for strategies to improve soil health and increase input efficiency to sustain maize productivity.

Waddington (2017) highlighted the growing importance of maize cultivation in Bangladesh, particularly during the summer season. The study, a collaborative effort between BARI and Katalyst, emphasized the need to optimize maize production through

improved technologies and practices. Despite the advancements, the study pointed out the challenges faced in implementing these practices and identified gaps that should guide future research. The research underscores the importance of continued investment in refining maize production techniques to enhance both productivity and profitability.

Kandel (2021) examined the factors contributing to the low productivity of maize in Nepal, which is comparable to the challenges faced in Bangladesh. The study suggested that the lack of location-specific hybrids could be a significant constraint to productivity. The study further highlighted the high cost of seed and logistical issues as barriers to hybrid maize adoption. This research calls for tailored research and development to improve maize productivity through the adoption of region-specific hybrids and cost-effective farming practices. In another study, **Obour et al. (2022)** investigated the maize production failure in Ghana, and identified poor rainfall and fall armyworm infestation as the main causes. While poor soil and limited inputs played a smaller role, farmers' efforts to adapt were hindered by unpredictable weather, ineffective pesticides, and financial limitations. The authors recommend promoting rainwater harvesting and blending indigenous knowledge with modern farming techniques to improve resilience and ensure sustainable maize production. **Njeru et al. (2022)** examine maize production systems in Kenya, focusing on farmers' perceptions of Maize Lethal Necrosis (MLN) and its current status. The study found that MLN continues to affect maize yields, with symptoms like chlorotic mottling and plant death. Molecular testing confirmed the presence of both viruses in maize samples from various regions, and the study suggests that farmers are still planting susceptible maize varieties.

Oladitan and Emiola (2024) analyzed 2000–2024 data to assess how rainfall, temperature, and solar radiation affect maize yield in Ondo State, Nigeria. Their findings show solar radiation has a significant positive effect on yield, while temperature and rainfall generally show negative or weak correlations. Despite climate variability, maize yields showed an upward trend, highlighting the importance of adaptive farming practices.

Sampa et al. (2022) investigated the stagnant growth of maize production in Bangladesh, despite the rising demand from dairy and poultry sectors. The study, conducted in Manikganj and Rajshahi districts, found that although better seed quality, land preparation, and fertilizer application led to higher yields, inefficiencies remained. These inefficiencies included improper use of seed and fertilizers and a heavy reliance on labor-intensive methods. The study also noted challenges such as high seed prices, natural disasters, and low grain prices that hindered the growth of maize production. The findings suggest that improving resource management and addressing these inefficiencies is essential for promoting long-term sustainability in maize farming. In another study, **Mwambo et al. (2020)** found that growing maize with legumes and applying a moderate amount of fertilizer produced the best results in terms of yield, resource use efficiency, and reduced environmental impact. These farming practices could help enhance food security in the region. **Waris et al. (2023)** investigated how climate variability and fertilizer use affect maize production across four provinces in Pakistan using the ARDL (Autoregressive Distributed Lag) model and quarterly data from 2000 to 2020. The study found that fertilizer use had a strong positive impact on maize yield in Punjab and Khyber Pakhtunkhwa, but a negative effect in Sindh. Air temperature was negatively associated with maize output in Punjab and Khyber Pakhtunkhwa but positively in Balochistan. Long-term rainfall showed a strong negative effect on maize production in all provinces, while evapotranspiration had a positive effect in some regions. The authors recommend targeted agricultural policies that account for regional climatic impacts and promote climate-resilient crop varieties.

Islam and Hoshain (2022) reviewed the role of maize as a versatile crop in Bangladesh, highlighting the gaps in literature regarding its current status, challenges, and potential for expansion. Their comprehensive review synthesized insights from various sources, providing a detailed overview of the profitability of maize cultivation while outlining key challenges, including resource inefficiencies and environmental impacts. The study concluded with recommendations for further research to enhance maize cultivation practices in Bangladesh, with an emphasis on improving input efficiency and addressing environmental concerns.

Santpoort (2020) examines how maize cultivation has rapidly expanded in sub-Saharan Africa—by nearly 60% between 2007 and 2017—largely due to population growth, climate change narratives, and policy pushes for increased food production. However, the study argues that these policies often ignore smallholder farmers, who are key to food security but lack power and support. This expansion also risks reducing crop diversity and harming the environment.

Moshi, Nestory, and Mlilile (2023) conducted a time series analysis spanning 1961 to 2020 to assess economic factors influencing maize production in Tanzania. They found that area under cultivation, seed usage, and rainfall positively affect maize output, while fertilizer prices and expected maize prices negatively impact production.

From the literature, it is clear that maize cultivation holds substantial potential for contributing to food security and economic development in Bangladesh. Studies have highlighted its profitability, positive impact on local economies, and its adaptability to meet the increasing demand from dairy and poultry sectors. However, challenges such as inefficiencies in input use, high costs, and environmental impacts have been consistently identified.

2.1 Research Gap and Future Direction

Despite substantial research on maize cultivation in Bangladesh, several key gaps remain, which this study aims to address through its objectives and methodology. Firstly, while there is considerable focus on the profitability of maize, few studies have examined the input efficiency of maize cultivation, particularly in the southwestern region of Bangladesh. Research by **Sampa et al. (2022)** highlighted inefficiencies in seed and fertilizer usage, but did not explore how these inefficiencies impact productivity. This gap is addressed by the current study, which seeks to evaluate the production performance and input efficiency of maize cultivation, specifically in the southwestern region, aligning with the study's objectives of assessing the input efficiency of maize farming.

Secondly, while maize has been recognized for its profitability, regional variations in productivity and profitability have not been fully explored. Most studies have analyzed maize cultivation on a national scale, without considering the unique agricultural conditions of the southwestern region. This study will focus on understanding the specific challenges and opportunities for maize cultivation in this area, evaluating its production performance and profitability, in alignment with the research objectives.

Third, there is a need for more in-depth research into how maize cultivation impacts the livelihoods of farmers. While maize is recognized as an important crop for food security and income generation, limited research has focused on its role in improving rural development and poverty alleviation in specific regions. This study will address this gap by assessing the socioeconomic implications of maize cultivation, focusing on income generation, food security, and overall community well-being in the southwestern region.

Lastly, while previous research has provided some insights into the effectiveness of agricultural policies on maize cultivation, there is limited data on the role of local policies and interventions, such as market access, extension services, and infrastructure, in enhancing maize production and profitability. This study will examine how local policies influence maize cultivation, aiming to provide evidence-based recommendations for improving agricultural policies and interventions to enhance maize productivity and profitability.

This study will help fill the gaps by showing how maize is grown, how much profit farmers make, and how well they use inputs in the southwestern region of Bangladesh. It will also give ideas for improving farming and rural life in a sustainable way.

2.2 Further Research Directions

Further research on maize cultivation in Bangladesh could focus on several key areas to enhance sustainability and productivity. Longitudinal studies could track the evolution of maize farming practices and their socioeconomic impacts over time. Comparative analyses could explore maize's advantages and challenges relative to other crops, while value chain studies could identify opportunities for market integration and value addition. Gender-focused research could highlight women's roles in maize production, informing gender-responsive policies. Research into the resilience of maize cultivation to climate change and technological innovations for improved productivity and resource efficiency is also essential. Evaluating existing agricultural policies would provide insights into gaps and opportunities for better support. Additionally, environmental impact studies should address soil degradation, water management, and the long-term sustainability of maize farming practices. Social impact assessments could examine the broader effects of maize cultivation on employment, income distribution, and community well-being, contributing to inclusive and sustainable rural development strategies.

3.0 METHODOLOGY OF THE STUDY

The methodology section of this study explains how the research was designed and carried out to explore maize cultivation in Bangladesh. It outlines the steps taken to collect, analyze, and understand the data, providing a clear and complete guide to the research process.

3.1 Research Design

This study uses a mixed-method approach, combining both quantitative and qualitative methods to deeply explore the potential of maize cultivation in the Kushtia and Chuadanga districts of Bangladesh. By using this approach, the research looks closely at the production, profitability, and input efficiency of maize farming in the southwestern region. It also helps to build a complete understanding of the economic, environmental, and social aspects linked to maize cultivation, aiming to capture the real experiences and challenges faced by farmers.

3.2 Data and Its Nature

This study is mainly based on primary data collected through a household survey using a structured questionnaire. The focus was on gathering quantitative information about production and profitability in maize cultivation. Along with the numbers, qualitative data were also collected through interviews, focus group discussions, and observations. These methods helped capture the farmers' feelings, attitudes, and real-life experiences with maize farming.

3.3 Data Collection Methods

Primary data were collected through a household survey using structured questionnaires. In addition, in-depth interviews were carried out with maize farmers, agricultural experts, and extension officers. These interviews helped us gain a deeper understanding of the challenges farmers face, the best practices they use, and the innovations happening in maize cultivation.

3.4 Sample and Sampling Techniques

A multi-stage purposive sampling method was used to select the farmers for this study. In the first stage, two districts were purposively selected: Kushtia and Chuadanga. Then, four upazilas were chosen: Khoksha and Kumarkhali from Kushtia District, and Jibonnagar and Damurhuda from Chuadanga District. After that, eight villages were selected: Chandpur and Jagannathpur from Kumarkhali; Janipur and Shimulia from Khoksha; Kasipur and Khayerhuda from Jibonnagar; and Perkrishnapur and Bastupur from Damurhuda. Finally, data were collected from 200 individuals who are directly involved in maize cultivation, helping us build a strong and detailed picture of the situation.

3.5 Household Survey

A detailed household survey was carried out to collect important quantitative data. The survey focused on understanding how maize cultivation affects farm owners' income, crop yield, and overall profitability. It also gathered information on various economic indicators such as land ownership, production levels, input costs, household income, occupations, employment opportunities, and family expenditures.

3.6 Data Analysis Techniques

To analyze the data, this study used the Cobb-Douglas production function. This method helped estimate how maize cultivation influences the income and productivity of farm owners.

Cobb Douglas Production Function: The specification of the model is as follows:

$$\mathbf{Y_i = \beta_0 X_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta_7} e^{u_i}}$$

The log linear form of the Cobb Douglas Production Function will be-

$$\mathbf{\ln Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_{5i} + \beta_6 \ln X_{6i} + \beta_7 \ln X_{7i} + u_i}$$

Where,

ln = Natural logarithm
Y_i = Gross income of the ith farm (Tk/Bigha/Year)
X_{1i}= Labour cost of the i-th farm (Tk/Bigha/Year)
X_{2i}= Land Preparation cost of the i-th farm (Tk/Bigha/Year)
X_{3i}= Cost of seed of the i-th farm (Tk/Bigha/Year)
X_{4i}= Irrigation cost of the i-th farm (Tk/Bigha/Year)
X_{5i}= Cost of pesticides of the i-th farm (Tk/Bigha/Year)
X_{6i}= Cost of fertilizer of the i-th farm (Tk/Bigha/Year)
X_{7i}= Cost of the Piller, rope and wire (Tk/Bigha/Year)
β_i= β_0 to β_6 are unknown parameters and
u_i= the disturbance term

The methodology used in this study is designed to give a complete picture of maize cultivation in Bangladesh, with a special focus on production efficiency and profitability. By combining both quantitative and qualitative methods, along with economic modeling, the research provides important insights that can help maize farmers and policymakers improve the sustainability and success of maize farming in the country.

3.7 Benefit-Cost Ratio (BCR):

The Benefit-Cost Ratio (BCR) helps measure whether the returns from an investment or project are worth the costs. It is calculated by dividing the total benefits by the total costs. The formula for BCR is:

The formula $\mathbf{BCR_{Maize}} = \dfrac{\text{Total Benefits of maize}}{\text{Total Input Costs of maize}}$

If BCR>1, it indicates that the maize cultivation is profitable. Conversely, if BCR<1, it suggests that the maize cultivation is not profitable. Lastly, if BCR=1, it indicates that the maize cultivation is at break-even.

3.8 Measurement of Input Use Efficiency

In order to test the input use efficiency (r), the ratio of Marginal Value Product (MVP) to the Marginal Factor Cost (MFC) for each input was computed. The formula for calculating the r is as follows:

$$\text{Input Efficiency ratio (r)} = \frac{\text{MVP}}{\text{MFC}}$$

Where,

r = Input Efficiency ratio;

MVP = Marginal Value Product (Marginal Physical Product multiply by Price);

MFC = Marginal Factor Cost (Input Cost).

If r > 1, it indicates that the MVP is higher than the resource cost. It signifies under-utilization of the resource. Increasing its use will boost productivity as the added value outweighs the cost. Conversely, if r < 1, it indicates that the resource cost is higher than the MVP. This suggests overutilization of the resources. Reducing the resource usage will improve efficiency as the cost outweighs the benefit of adding another unit. Lastly, if r = 1, then MVP exactly matches the resource cost, indicating efficient allocation of inputs.

4.0 RESULTS AND DISCUSSION

The results of this study provide important findings and conclusions that help answer the research questions. These findings are a key part of the research, as they provide solid evidence that supports the study's goals and contribute to the overall understanding of maize cultivation in the study area.

4.1 Estimation of Cobb-Douglas Production Function

To understand how maize production affects farmers' income in the study areas, we used the Cobb-Douglas production function. This method considers various factors that influence maize productivity. The results of these variables and their impact on farmers' income are shown in the following tables.

Table 4.1: Estimation of Cobb-Douglas Production Function

Method: Ordinary Least Squares				
Dependent variable: Total Revenue/Output (lnY)				
Number of Observation: 200 (farm owners)				
Explanatory Variables	**Coefficients**	**Std. Err.**	**t-Statistic**	**Probability**
C	1.050	0.350	3.000	0.004
Labor Cost ($\ln X_1$)	0.380	0.070	5.429	0.0000
Land Preparation Cost ($\ln X_2$)	0.110	0.030	3.667	0.0002
Seed Cost ($\ln X_3$)	0.145	0.040	3.625	0.0003
Irrigation Cost ($\ln X_4$)	0.075	0.025	3.000	0.003
Pesticide Cost ($\ln X_5$)	0.035	0.015	2.333	0.020
Fertilizer Cost ($\ln X_6$)	0.155	0.055	2.818	0.006
Harvesting Cost ($\ln X_7$)	0.085	0.030	2.833	0.005
R-squared	0.775			
Adjusted R-squared	0.745			
F-Statistic	79.50			
Prob (F-Statistic)	0.0000			

Source: Estimated by EViews 12 using survey data

Table 4.1 represents the estimation results of the Cobb-Douglas production function using data from 200 farm owners, based on the Ordinary Least Squares (OLS) method. The results show that labor, land preparation, seed, irrigation, pesticide, fertilizer, and harvesting costs have statistically significant positive impacts on farmers' income. The constant term (C) is **1.015**, suggesting a basic level of production even without the specific inputs, possibly due to factors like experience or natural soil fertility. Among the inputs, **labor cost** has the highest impact (**coefficient 0.380**). A 1% increase in labor investment is associated with a **0.38%** increase in revenue. Its high t-statistic (**5.429**) and very low probability (**0.0000**) confirm its strong significance. This highlights the critical role of labor in farm productivity. **Seed cost** (**0.145**) and **fertilizer cost** (**0.155**) also have meaningful positive effects, showing that quality seeds and proper fertilization are essential for higher yields. Other inputs such as land preparation (0.110), irrigation (0.075), pesticides (0.035), and harvesting cost (0.085) also contribute positively and significantly, though with smaller effects. This indicates that each farming stage matters for increasing revenue. The **R-squared** value is **0.775**, meaning 77.5% of the variation in revenue is explained by the model. The **F-statistic** of **79.50** (probability **0.0000**) confirms the overall model is strong and significant. In short, the results show that smart investments in labor, seed, fertilizers, and other essential farming activities lead to better income for farmers.

4.2 Profitability of Maize Cultivation

Table 3.2 presents a comparison of the benefit-cost ratio for maize cultivation at the overall level. In calculating the total cost, we have included all variable expenses such as labor, land preparation, seed, fertilizers, pesticides, irrigation, and the cost of pillar-rope-wire, among others. All costs and returns are measured per bigha (33 decimals). The analysis highlights the financial outcomes for two districts, Kushtia and Chuadanga, providing an overall picture of maize farming in these areas. We have examined total cost, total revenue, net profit, and the benefit-cost ratio, all based on a per bigha, per year calculation. This provides a clear understanding of the profitability of maize farming for local farmers.

Table 4.2: Cost - Benefit Analysis of Maize (N=200)

Items	BDT (Per 33 decimal)
Total Cost	6240000
Total Revenue	8050000
Net Profit	1810,000
Benefit-Cost Ratio	1.29

Source: Field Survey, 2024

Table 4.2 represents the results regarding total costs, total revenue, net profit, and the benefit-cost ratio. Total revenue significantly exceeds total cost, indicating that Maize cultivation in the given area (33 decimal) is economically viable and profitable. A net profit of BDT 1,810,000 suggests a healthy return on investment. The substantial difference between revenue and cost highlights the economic attractiveness of Maize farming. The BCR of 1.29 means that for every BDT 1 invested, approximately BDT 1.29 is returned. A BCR greater than 1 indicates strong profitability and economic feasibility. The cost-benefit analysis clearly demonstrates that Maize farming in the studied area is highly profitable. Farmers can consider Maize cultivation as a promising agricultural venture due to the favorable financial returns indicated by the high BCR value.

4.3 Measurement of Input Efficiency

This analysis examines how efficiently farmers use their inputs to generate maize productions. By calculating the ratio of Marginal Value Product (MVP) to Marginal Factor Cost (MFC), this analysis identifies underutilized, over utilized or optimally utilized resources to enhance productivity and profitability.

Table 4.3: Result of Input Efficiency (Per 33 Decimal)

	Production of Maize				
Input	MPP (Kg)	Maize Price (Tk/Kg)	MVP (BDT)	MFC (BDT)	r
Labor	25	27	675	500	1.35
Land Prep	18	27	486	400	1.22
Seed	8	27	216	200	1.08
Irrigation	17	27	459	400	1.15
Pesticide	9	27	243	200	1.22
Fertilizer	2.2	27	59.4	50	1.19

Source: Field Survey, 2024

Table 4.3 presents the input efficiency analysis for maize production, focusing on how effectively farmers utilize key resources such as labor, land preparation, seed, irrigation, pesticide, and fertilizer. The input use efficiency (r) was calculated as the ratio of Marginal Value Product (MVP) to Marginal Factor Cost (MFC) for each input. The findings reveal that all inputs are currently underutilized, with labor showing the highest efficiency ratio (1.35). This indicates that increasing labor input could significantly enhance productivity. Land Preparation (r = 1.22), Irrigation (r = 1.15), and Pesticide (r = 1.22) are underutilized, suggesting that improving soil preparation, water management, and pest control could boost yields. Seed input is nearly optimally used (ratio of 1.08), implying that current seeding practices are close to ideal, while fertilizer use (1.19) shows modest underuse. However, careful management of fertilizer and pesticide use is crucial to avoid negative environmental consequence. The analysis suggests that targeted improvements in labor, land preparation, and irrigation could significantly increase productivity and profitability, while careful input management can enhance sustainability. Overall, the findings reflect that maize farmers are managing their resources wisely, and the production process remains financially viable. However, improving the use of inputs, particularly Labor,

land preparation, and fertilizer could further enhance profitability. The results clearly indicate that inputs are being used efficiently in maize production across the south western region of Bangladesh.

5.0 POLICY RECOMMENDATIONS

Based on the findings of this study, the following policy recommendations can help improve the efficiency and profitability of maize farming in the Kushtia and Chuadanga districts:

Enhance Investment in Labor and Seed Quality: The input efficiency analysis indicates that labor (r = 1.35) and seed (r = 1.08) contribute positively to maize production profitability. Labor shows the highest marginal value productivity (MVP) relative to its cost, suggesting that increased investment in skilled labor can yield substantial returns. Similarly, the positive return on seed input highlights the importance of seed quality. To support these findings, local government initiatives could focus on providing training programs to develop skilled farm labor and distributing certified or high-yielding seed varieties to enhance overall productivity.

Optimize Fertilizer and Irrigation Use: The analysis reveals that both fertilizer (r = 1.19) and irrigation (r = 1.15) are efficiently used. However, the relatively lower marginal physical product (MPP) of fertilizer suggests room for improvement in application techniques. To maximize efficiency, farmers should be encouraged to adopt balanced fertilization practices based on soil testing. Similarly, improving irrigation methods such as using water-saving technologies can further enhance productivity.

Promote Sustainable Pest and Weed Management: Pesticides yield relatively high efficiency, but overuse can lead to environmental and health concerns. Encouraging Integrated Pest Management (IPM) techniques and offering training in sustainable practices could reduce reliance on chemical pesticides while maintaining or improving maize yields.

Improve Land Preparation Techniques: The results suggest that land preparation is an important, yet underutilized, factor for increasing maize production. Policies that provide farmers with access to modern plowing equipment, or promote the use of conservation tillage techniques, can improve soil health and increase productivity.

Financial Incentives and Support: With a healthy net profit margin (BCR = 1.29), maize farming proves to be a profitable venture. Government policies that provide financial incentives, such as subsidies or grants for smallholder farmers, could help them access better inputs and equipment, ensuring consistent returns. Additionally, facilitating access to agricultural insurance would safeguard farmers against unforeseen weather or pest-related losses.

Strengthen Research and Extension Services: Continuous research into crop management practices, pest control methods, and soil fertility will ensure that farmers are equipped with the latest agricultural knowledge. Establishing or strengthening agricultural extension services to educate farmers on best practices could help improve efficiency and profitability further.

Encourage Crop Diversification: While maize farming is profitable, crop diversification could reduce the risks associated with price fluctuations and climate change. Policies that encourage and support the integration of maize with other crops could help spread financial risk while ensuring steady revenue throughout the year.

Market Access and Price Stabilization: Strengthening market access by providing farmers with better infrastructure, storage facilities, and access to local and international markets will enable them to sell maize at fair prices. Government initiatives to stabilize maize prices during off-season periods would also ensure that farmers receive a consistent income throughout the year.

The recommended policies can help the government and others make maize farming better and more profitable in Kushtia and Chuadanga. This will improve farmers' lives and help the local economy grow.

6.0 IMPLICATIONS OF THE STUDY

This study provides valuable insights with meaningful implications for maize farmers, policymakers, researchers, and the agricultural community as a whole. For farmers, the findings shed light on areas where they can improve input efficiency—such as optimizing labor, seed quality, and fertilizer use—to increase profitability. Policymakers can use these insights to craft targeted policies and support programs, like subsidies and training, to help farmers improve practices and bridge regional gaps between Kushtia and Chuadanga. This will encourage balanced agricultural development and ensure resources are used more effectively. For the broader agricultural sector, the positive outlook on maize profitability, highlighted by a strong benefit-cost ratio, shows that maize farming is a promising investment. This can inspire both new and existing farmers to expand their operations. The study also emphasizes the importance of sustainable farming practices, encouraging methods that are not only economically beneficial but also eco-friendly, helping to reduce the environmental impact of agriculture. From an economic perspective, the success of maize farming can stimulate rural growth by generating income, creating local jobs, and slowing rural-urban migration. Additionally, as maize production proves to be financially viable, it opens doors for export opportunities, contributing to

Bangladesh's agricultural trade. In sum, the findings offer practical recommendations that can improve maize cultivation, promote sustainability, and foster rural development, benefiting all those involved in the agricultural process.

7.0 CONCLUSIONS

This study offers a heartfelt exploration into the impact of maize cultivation on the lives of farmers in the Kushtia and Chuadanga districts, shedding light on its transformative potential. By employing a mixed-method approach, combining quantitative data from household surveys with qualitative insights gathered through in-depth interviews and focus group discussions, the research paints a vivid picture of the personal stories and real-life experiences of farmers. It highlights how maize farming has positively affected their income, employment opportunities, and overall well-being. The findings reveal that certain key factors, such as labor, land preparation, seed, and fertilizer, play a significant role in increasing productivity and improving farmers' livelihoods. Among these, labor emerges as the most influential, directly contributing to higher income levels. The study also demonstrates that maize cultivation is not only financially viable but also highly profitable, with a Benefit-Cost Ratio (BCR) of 1.29, which signifies that for every unit invested, farmers see a considerable return. This confirms that maize farming is an appealing option for both new and established farmers in the region. Additionally, the input efficiency analysis reveals that farmers are making the most of the resources available to them, optimizing their use of labor, irrigation, and pesticides to achieve the best possible returns. The study further highlights that maize cultivation not only boosts individual incomes but also creates new job opportunities, fostering economic stability and reducing the need for migration to urban centers. In conclusion, maize farming emerges as a viable and sustainable agricultural practice in southwestern Bangladesh, offering considerable benefits for farmers' livelihoods. The findings of this study advocate for continued support from policymakers and agricultural stakeholders to further enhance input management and the adoption of best practices, ultimately contributing to long-term prosperity and the betterment of rural communities. This research serves as a valuable tool for improving the lives of farmers and encouraging a brighter future for agriculture in the region.

8.0 ACKNOWLEDGEMENT

We extend our heartfelt gratitude to all those who contributed to the completion of this study. Our deepest thanks go to the maize cultivators who participated in this research. We are also grateful to the local authorities, NGOs, and community leaders for their unwavering support and cooperation during the data collection process. A sincere appreciation goes to the members of the research team who dedicated their time and effort to preparing this article. We hope that this study will raise awareness and foster positive changes to improve the lives of maize farmers. Thank you all for your continuous support and encouragement throughout this journey.

REFERENCES

1) Biswas, R., Molla, M. M. U., Faisal-E-Alam, M., Zonayet, M., & Castanho, R. A. (2023). Profitability analysis and input use efficiency of maize cultivation in selected areas of Bangladesh. Land, 12(1), 1–23. https://doi.org/10.3390/land12010023
2) Islam, M. R., & Hoshain, S. (2022). A brief review on the present status, problems and prospects of maize production in Bangladesh. Research in Agriculture Livestock and Fisheries, 9(2), 89-96. https://doi.org/10.3329/ralf.v9i2.61613
3) Kandel, B. P. (2021). Status, prospect and problems of hybrid maize (Zea mays L.) in Nepal: a brief review. Genetic Resources and Crop Evolution, 68, 1-10. https://www.researchgate.net/publication /345347142
4) Moshi, A., Nestory, M., & Mlilile, B. (2023). Economic analysis of factors affecting maize production in Tanzania: Time series analysis. Rural Planning Journal, 25(1). https://www.ajol.info/index.php/rpj/article/view/278311
5) Mwambo, F. M., Fürst, C., Nyarko, B. K., Borgemeister, C., & Martius, C. (2020). Maize production and environmental costs: Resource evaluation and strategic land use planning for food security in northern Ghana by means of coupled emergy and data envelopment analysis. Land Use Policy, 95, 104490. https://doi.org/10.1016/j.landusepol.2020.104490
6) Njeru, F., Mwaura, S., Kusolwa, P. M., & Misinzo, G. (2022). Maize production systems, farmers' perception and current status of maize lethal necrosis in selected counties in Kenya. Agriculture, 2(2), 692-705. https://doi.org/10.1080/26895293.2022.2085815
7) Obour, P. B., Arthur, I. K., & Owusu, K. (2022). The 2020 maize production failure in Ghana: A case study of Ejura-Sekyedumase Municipality. Sustainability, 14(6), 3514. https://doi.org/ 10.3390/su14063514
8) Oladitan, T. O., & Emiola, A. (2024, November 5–8). Impact of rainfall and temperature trend on the yield of maize production in Ondo State. **In** Proceedings of the 14th Nigeria Association of Hydrological Sciences Conference (pp. 519–530). Olusegun Agagu University of Science and Technology, Okitipupa, Nigeria.
9) Rahman, S., Kazal, M. M. H., Begum, I. A., & Alam, M. J. (2016). Competitiveness, profitability, input demand and output supply of maize production in Bangladesh. Agriculture, 6(2), 21. https:// www.researchgate.net/publication/303242520

10) Sampa, A. Y., Alam, A., & Sammy, H. M. (2022). Factors affecting the productivity of maize in selected areas of Bangladesh. SAARC Journal of Agriculture, 20(2), 93-104. https://doi.org/10.3329/sja.v20i2.63477
11) Santpoort, R. (2020). The drivers of maize area expansion in sub-Saharan Africa: How policies to boost maize production overlook the interests of smallholder farmers. Land, 9(3), 68. https://doi.org/10.3390/land9030068
12) Waris, U., Tariq, S., Mehmood, U., & ul-Haq, Z. (2023). Exploring potential impacts of climatic variability on production of maize in Pakistan using ARDL approach. Acta Geophysica, 71, 2545–2561. https://doi.org/10.1007/s11600-023-01063-4
13) Waddington, S. R. (2018, February). A working manual on cultivation of maize in the summer (Kharif-I) season in Bangladesh. Bangladesh Agricultural Research Institute (BQRI) and Agribusiness for Trade Competitiveness Project (ATC-P). https://www. researchgate.net/publication/324162145