

Comparative Analysis of Mono Crops and Diversified Crops in South-Western Region in Bangladesh

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ABSTRACT: Agriculture remains an important sector of Bangladesh's economy and a major source of rural livelihoods. However, excessive dependence on mono-cropping, particularly rice-based production, creates challenges related to production risks, rising input costs, inefficient resource use, and climate variability. This study, titled "Comparative Analysis of Mono Crops and Diversified Crops in South-Western Region in Bangladesh," examines the comparative economic performance, cost structure, profitability, and resource-use efficiency of mono-cropping and diversified cropping systems. The study used primary cross-sectional data collected from 300 farm households, comprising 200 diversified-crop farmers and 100 mono-crop farmers, from Kushtia, Jhenaidah, and Meherpur districts. Data were collected through structured face-to-face interviews and analyzed using descriptive statistics, cost–return analysis, and input-use efficiency analysis based on Marginal Value Product (MVP) and Marginal Factor Cost (MFC). The findings reveal substantial differences between the two cropping systems. Diversified cropping generated a higher gross return of Tk. 123,045 and net return of Tk. 56,535, compared with Tk. 41,058 and Tk. 11,533, respectively, for mono-cropping. Although diversified farming involved a higher total production cost of Tk. 66,510, compared with Tk. 29,525 for mono-cropping, it achieved a higher Benefit–Cost Ratio of 1.850, compared with 1.391. The resource-use efficiency analysis also showed contrasting patterns of input utilization, indicating opportunities for improving resource allocation in both farming systems. Overall, the study concludes that diversified cropping is more profitable and offers greater potential for increasing farm income and improving economic efficiency in the south-western region of Bangladesh. The study recommends improved access to irrigation, agricultural credit, extension services, market information, and appropriate input-management practices to promote sustainable and economically efficient crop diversification.

KEYWORDS: Crop diversification, Mono-cropping, Profitability, Resource-use efficiency, Input allocation, South-Western Bangladesh.

1.0 INTRODUCTION

Agriculture remains a major component of Bangladesh's economy and rural livelihoods. In FY 2023–24, agriculture contributed about **11.02% of GDP** and employed around **35% of the workforce**. Despite progress in food production and irrigation, Bangladesh's cropping pattern remains highly dependent on rice, which accounted for about **73.1% of total cropped area in 2022–23**. Low crop diversification increases farmers' exposure to production, market, and climate-related risks. **Monocropping**, particularly rice-based farming, is relatively simple to manage and supports staple food production, but excessive dependence on a single crop may increase vulnerability to pests, diseases, price fluctuations, soil degradation, and climate variability. These challenges are particularly relevant in the **south-western region of Bangladesh**, including Kushtia, Jhenaidah, and Meherpur, where drought, irregular rainfall, and seasonal water shortages affect agricultural production. **Crop diversification** through crop rotation, multiple cropping, and cultivation of vegetables, pulses, oilseeds, and fruits can increase farm income and reduce production risks. However, diversification also requires adequate capital, labor, irrigation, improved inputs, technical knowledge, and reliable markets. Against this background, the study titled "**Comparative Analysis of Mono Crops and Diversified Crops in South-Western Region in Bangladesh**" compares the production performance, input use, costs, profitability, and resource-use efficiency of the two systems using farm-level data. It also examines the factors influencing farmers' cropping-system choices.

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The findings are expected to provide useful policy implications for **increasing farm income, improving resource allocation, promoting appropriate diversification, and strengthening agricultural resilience** in Bangladesh.

1.2 Statement of the Problem

Bangladesh is facing growing challenges in maintaining sustainable and profitable agricultural production. Farmers must produce more food and earn better income while dealing with limited land, increasing production costs, and climate-related uncertainties. These pressures make it necessary to examine whether existing farming practices are economically efficient and sustainable for the future. One important concern is the type of cropping system farmers follow and how it affects their production and income. In many parts of Bangladesh, farmers still depend mainly on a single crop in a season, especially rice. While this system has supported food production for many years, it also creates economic and environmental risks. When farmers rely on only one crop, their income becomes highly sensitive to changes in weather, pests, diseases, and market prices. A single unfavorable event can reduce the entire farm income of a household. This situation makes small farmers particularly vulnerable because they usually have limited savings and limited access to financial support.

These risks are clearly visible in the south-western region of Bangladesh, including districts such as Kushtia, Jhenaidah, and Meherpur. Farmers in this region face frequent drought conditions, irregular rainfall, and seasonal water shortages. During dry periods, many farmers struggle to maintain crop production due to limited irrigation facilities and falling groundwater levels. Under these conditions, mono-cropping systems often provide low and uncertain returns. Another major concern is the rising cost of agricultural inputs. Farmers must spend more on labor, fertilizer, irrigation, and other inputs than before. However, the market prices of staple crops do not always increase at the same rate. As a result, profit margins from traditional mono-cropping systems are often small. This situation reduces farmers' ability to invest in improved technology, better seeds, or modern farming practices.

Because of these difficulties, crop diversification is often suggested as a possible solution. Diversified cropping systems involve cultivating different crops such as vegetables, pulses, oilseeds, or fruits instead of relying on only one crop. Such systems may help farmers increase income and reduce risk because losses from one crop can be balanced by gains from another. In many cases, high-value crops can generate better returns than traditional cereal crops. However, many farmers are hesitant to adopt diversified cropping systems. One important reason is the lack of clear economic information. Farmers often do not know whether diversified crops will provide higher profits after considering all production costs. Diversification may also require more labor, higher investment, and better management skills. In addition, marketing perishable crops can be difficult when proper storage and transportation facilities are limited.

From a research perspective, there is still limited empirical evidence that clearly compares mono-cropping and diversified cropping systems at the farm level. Many previous studies focus mainly on production or cropping patterns, but they do not analyze production performance, input costs, and profitability together. In addition, region-specific research for the south-western region of Bangladesh remains limited. Because of this lack of clear evidence, both farmers and policymakers face difficulties in making informed decisions. Farmers may continue to follow traditional practices that provide low returns, while policymakers may not have sufficient information to design effective support programs for crop diversification.

Therefore, it is important to conduct a systematic analysis of the economic performance of different cropping systems. This study addresses this need by comparing mono-cropping and diversified cropping systems in the south-western region of Bangladesh. The research focuses on production performance, cost structures, and profitability using farm-level data. By providing clear evidence on the relative economic benefits of different cropping systems, the study aims to support better decision-making for farmers, agricultural planners, and policymakers.

1.3 Objectives

The general objective of the study is to compare mono-cropping and diversified cropping systems in the south-western region of Bangladesh and examine their production performance, production costs, and profitability. To achieve this general objective, the specific objectives of the study are:

Specific Objectives

1. To compare the production performance of mono-cropping and diversified cropping systems in the study area.
2. To analyze and compare the profitability of mono-cropping and diversified cropping systems.
3. To examine and compare the input cost structure of the two cropping systems.
4. To evaluate the efficiency of input use in mono-cropping and diversified cropping systems.
5. To identify the factors that influence farmers' decisions to adopt mono-cropping or diversified cropping systems.

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1.4 Significance of the Study

This study is significant from **academic, policy, and practical perspectives**. By comparing mono-crop and diversified-crop farming in the south-western region of Bangladesh, it provides farm-level evidence on **production, input use, costs, profitability, and resource-use efficiency**. It also addresses a regional research gap, particularly in areas such as Kushtia and Jhenaidah. The findings are useful for **agricultural policy and development planning** by providing evidence for designing appropriate programs related to agricultural credit, input support, extension services, irrigation, and market development. The study can also help policymakers assess the potential of crop diversification for **increasing farm income, reducing production risks, and improving climate resilience**. For **farmers and extension workers**, the comparison of costs, returns, and resource-use efficiency can support better decisions regarding crop selection and input allocation. The study also highlights the potential role of diversification in promoting **sustainable agriculture, efficient land use, and resilience to drought and climate variability**. Finally, the study contributes to Bangladesh's broader development objectives and the **Sustainable Development Goals (SDGs)**, particularly **SDG 1 (No Poverty)**, **SDG 2 (Zero Hunger)**, **SDG 8 (Decent Work and Economic Growth)**, and **SDG 13 (Climate Action)**. Overall, the research provides evidence to support more profitable, efficient, and sustainable agricultural development in the south-western region of Bangladesh.

2.0 LITERATURE REVIEW

The literature review presents previous studies related to crop diversification and cropping systems in agriculture. This section helps to understand how different cropping practices influence farm productivity, profitability, and risk management. It also provides a background for the present study and highlights the existing research gaps.

2.1 Crop Diversification in Agricultural Economics

Crop diversification has become an important topic in agricultural economics, particularly in developing countries where agriculture plays a major role in rural livelihoods. In many developing economies, diversification is also linked with food security, environmental sustainability, and climate resilience. For this reason, crop diversification is increasingly discussed as a strategy to strengthen agricultural productivity and stability.

Recent studies highlight that diversification can play a key role in improving farm performance and resilience. Rahman and Kazal (2015) analyzed farm-level data in Bangladesh to examine patterns of crop diversity and found that diversified farming systems can support better resource use and improved economic outcomes for farmers. Their findings suggest that crop diversification is influenced by several socio-economic factors, including access to irrigation, education, credit availability, and farm size.

Similarly, Dubey et al. (2020) examined crop diversification in the context of Indian agriculture. Their study found that diversification toward high-value crops, such as vegetables and fruits, can significantly increase farm income compared with traditional cereal-based farming systems. The study also highlighted the importance of market access, irrigation facilities, and infrastructure in encouraging farmers to diversify their crops.

More recent research also emphasizes the role of diversification in building sustainable agricultural systems. Hufnagel et al. (2020) showed that diversified cropping systems can improve agricultural resilience by enhancing yield stability and resource efficiency. Their study suggests that increasing diversity within farming systems can help farmers adapt to environmental stress and climate variability.

Taken together, these studies indicate that crop diversification is not only an agronomic practice but also an economic strategy. By spreading production across multiple crops, farmers can reduce risks, improve income stability, and use farm resources more efficiently.

2.2 Determinants of Crop Diversification

A large number of studies have tried to identify why some farmers diversify their crops while others continue with monocropping. These studies show that crop diversification is influenced by economic, institutional, and household-level factors.

Rahman and Kazal (2015) used farm-level data from Bangladesh and applied a Tobit regression model to identify the determinants of crop diversification. Their findings showed that education, access to credit, irrigation facilities, and farm size have significant positive effects on diversification. This means that farmers with better access to knowledge, finance, and water resources are more likely to adopt diversified cropping systems. Their study is important because it shows that diversification depends not only on farmer preference but also on access to supportive resources.

Dubey et al. (2020) also examined the determinants of crop diversification using cross-sectional data from India. Their findings revealed that larger farm size, better irrigation, and closer market access increase the probability of diversification. These results

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support the idea that infrastructure and economic opportunity are important in shaping cropping decisions. When farmers have access to markets and sufficient production resources, they are more willing to shift toward more diverse and potentially profitable crops.

Islam et al. (2024) further found that farmer characteristics such as education, farming experience, non-farm income, and access to information influence diversification behavior. This study suggests that crop diversification is shaped by both farm-level resources and household-level capacity. In other words, diversification is not determined only by expected profitability. It also depends on the farmer's ability to manage risk, obtain information, and respond to changing opportunities.

Overall, the literature shows that crop diversification is influenced by a combination of resource availability, socio-economic conditions, and institutional support. These findings are important because they help explain why diversification remains limited in some areas, even when it offers economic advantages.

2.3 Crop Diversification, Productivity, and Profitability

Another major area of literature examines whether diversified cropping systems improve farm productivity and profitability. Many researchers have argued that diversification can increase cropping intensity, improve resource use, and raise farm income. However, the results often depend on the type of crops grown, local environmental conditions, and the farmer's management capacity.

Monocropping can simplify management and support staple supply, but it may increase system vulnerability when shocks occur (pests, disease, drought, market price falls). In contrast, crop diversification is commonly framed as a pathway to improve productivity, profitability, and resilience (Nandi, Krupnik, & Kabir, 2024).

Alam et al. (2021) conducted on-farm experiments in the Barind region of Bangladesh to compare diversified rice-based systems with conventional systems. Their findings showed that diversified cropping systems increased both productivity and farm income. This study is important because it provides direct evidence from Bangladesh that diversification can improve economic outcomes under local farming conditions.

Emran et al. (2022) also reported that crop diversification can increase cropping intensity and improve farm output. However, their findings also indicate that the benefits are not automatic. The success of diversification depends on crop choice, management practices, and location-specific conditions. This suggests that diversification should not be promoted in a uniform way. Rather, it should be adapted to the local production environment.

Ahmadzai (2017) used stochastic frontier analysis to examine the relationship between crop diversification and technical efficiency. The study found that diversified farms tend to achieve higher productivity and better technical efficiency than less diversified farms. This finding is important because it links diversification not only with output growth but also with more efficient use of farm inputs.

These studies collectively suggest that diversified cropping systems can improve both production performance and profitability. However, the extent of the benefit may vary according to input use, local ecology, market access, and farmer capacity.

2.4 Diversification and Climate Resilience

Climate change has made crop diversification even more important in recent years. In many agricultural areas, farmers are now facing more frequent droughts, irregular rainfall, pests, and other environmental stresses. Under these conditions, diversification is often seen as a strategy for improving climate resilience.

Hufnagel et al. (2020) examined the effect of crop diversification on climate resilience using simulation models. Their study found that diversified cropping systems improve yield stability and soil health under changing climate conditions. This suggests that diversification can strengthen the long-term sustainability of farming systems.

In Bangladesh, Nandi et al. (2024) reviewed national agricultural policies and found that crop diversification has been promoted in many policy documents and development programs. However, the actual level of diversification remains low in practice. The study pointed to market problems, institutional barriers, and implementation weaknesses as key reasons behind this gap. This finding is important because it shows that policy support alone is not enough. Farmers also need practical incentives, strong extension services, and reliable market systems.

Similar findings are reported in international studies. Hashakimana et al. (2023) showed that mixed cropping improves soil properties and yield stability in drought-prone areas of Rwanda. Tadesse and Eshetu (2023) also found that diversification contributes to the economic sustainability of smallholder farming. These findings strengthen the argument that crop diversification can be an effective response to environmental stress, especially in vulnerable agricultural regions.

In summary, the literature suggests that diversification supports climate resilience by spreading production risk, improving system stability, and promoting better resource use. This is particularly important for areas that are exposed to drought and weather uncertainty.

2.5 Evidence from South-Western Bangladesh

The south-western region of Bangladesh has special agricultural features that make the question of crop diversification highly important. This region faces problems such as water shortages, dry-season stress, and seasonal fallow land. These conditions create both challenges and opportunities for crop diversification.

Krupnik et al. (2016) conducted a geospatial study in south-western Bangladesh and found that improved irrigation and crop diversification could increase cropping intensity and farm income. Their study showed that many areas have the potential to use currently underutilized land more productively if proper water management and crop choices are introduced. This is highly relevant for districts like Kushtia, where farmers often face land and water-related constraints.

Assefa et al. (2021) examined diversified cropping options in rice-based systems in coastal Bangladesh. They found that systems such as rice–mungbean and rice–maize performed better than traditional rice–fallow systems in terms of profitability and yield stability. Their findings indicate that diversified systems can perform better than monocropping under climate-stressed conditions. Although the study focused on coastal polders, its results are still relevant to the broader south-western region because they highlight the economic and risk-reducing value of diversification in vulnerable environments.

The existing evidence from south-western Bangladesh therefore supports the idea that diversification has strong potential in the region. However, district-level empirical studies remain limited, especially those based on primary farm survey data.

2.6 Crop Diversification and Household Welfare

Crop diversification is also linked with broader household welfare outcomes. Beyond increasing output and farm profit, diversification may improve food security, dietary quality, and livelihood stability.

Uddin et al. (2017) found that crop diversification positively affects farm income and food security in Bangladesh. Their study suggests that farmers who diversify their crops are often in a better position to improve their household welfare. This is important because agricultural decisions in rural areas are not made only to maximize output. They are also closely related to family livelihood needs.

Alam et al. (2023), using Bangladesh Integrated Household Survey data, reported that diversified agriculture is associated with improved dietary diversity. This finding suggests that crop diversification may contribute to better nutrition at the household level. Therefore, the benefits of diversification go beyond farm profit and extend to overall well-being.

Similar findings are available from other countries. Feliciano (2019) described crop diversification as an important strategy for poverty reduction across different regions of the world. Mofya-Mukuka and Hichaambwa (2018) found that diversification improves livelihood outcomes in Zambia, while Ganancial (2024) showed positive efficiency gains from intercropping in the Philippines. These studies support the broader view that diversification can strengthen income stability and improve household welfare.

However, the literature also shows that the benefits of diversification do not come automatically. Makate et al. (2016) emphasized that extension support, transport facilities, and access to market information are important for the success of diversification. This means that farmers may not receive the full benefit of diversification unless supportive services and infrastructure are available.

2.7 Summary Table of Literature

To provide a clear overview of the reviewed studies, a summary table of the literature is presented in this section. The table highlights the key authors, study areas, major variables, and main findings related to crop diversification and cropping systems. This summary helps compare previous research and identify the research gaps addressed in the present study.

Table 1: Summary of Key Studies on Crop Diversification

Author(s)	Study Area	Factors / Key Variables	Major Findings
Ahmadzai (2017)	Developing countries	Technical efficiency and diversification	Diversified farms show higher technical efficiency and better use of inputs.
Alam et al. (2021)	Bangladesh	Diversified rice-based cropping systems	Diversified cropping systems increased farm productivity and overall income.
Alam et al. (2023)	Bangladesh	Crop diversity and dietary diversity	Diversified agriculture is associated with better household nutrition.

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Assefa et al. (2021)	Coastal Bangladesh	Rice–mungbean, rice–maize systems	Diversified cropping systems perform better than rice–fallow systems in profitability and yield stability.
Dubey et al. (2020)	India	Farm size, irrigation, market access	Larger farms, better irrigation, and good market access encourage diversification toward high-value crops.
Emran et al. (2022)	Bangladesh	Cropping intensity, crop choice, local conditions	Diversification improves cropping intensity and output, but results depend on crop choice and local conditions.
Feliciano (2019)	Global review	Diversification and poverty reduction	Crop diversification can reduce poverty and improve rural livelihoods.
Ganancial (2024)	Philippines	Intercropping arrangements	Intercropping increases farm efficiency and productivity.
Hashakimana et al. (2023)	Rwanda	Mixed cropping vs monocropping	Mixed cropping improves soil quality and yield stability in drought-prone regions.
Hufnagel et al. (2020)	Europe	Crop rotation diversity, yield stability	Diversified cropping systems increase resilience, yield stability, and soil health.
Islam et al. (2024)	Bangladesh	Education, farming experience, non-farm income, information access	Farmer characteristics and access to information significantly influence diversification decisions.
Krupnik et al. (2016)	Southwestern Bangladesh	Irrigation use and cropping intensity	Diversification and improved irrigation can increase cropping intensity and farm income.
Makate et al. (2016)	Zimbabwe	Extension services, transport, market access	Diversification is more successful when farmers have access to extension support, markets, and infrastructure.
Mofya-Mukuka & Hichaambwa (2018)	Zambia	Livelihood outcomes	Diversification improves income stability and livelihood resilience.
Nandi, Krupnik & Kabir (2024)	Bangladesh	Agricultural policies and diversification trends	Diversification is widely promoted but adoption remains limited due to market and institutional constraints.
Rahman & Kazal (2015)	Bangladesh	Education, credit access, irrigation, farm size	These factors positively influence crop diversification. Farmers with better resources are more likely to diversify.
Tadesse & Eshetu (2023)	Ethiopia	Intercropping systems	Crop diversification contributes to economic sustainability of smallholder farming.
Uddin et al. (2017)	Bangladesh	Crop diversification and income	Diversification increases farm income and improves food security.

2.8 Research Gap

Although the existing literature shows that crop diversification can improve income, reduce risk, and strengthen climate resilience, several important gaps still remain. First, many studies use national-level or regional datasets. These studies provide useful broad patterns, but they often do not reflect local realities. Micro-level evidence from specific districts is still limited. This is a major gap because cropping decisions are usually made under local environmental, institutional, and market conditions. Second, many previous studies examine only one aspect of diversification. Some focus on yield, some on income, and others on food security or nutrition. Very few studies analyze production performance, cost structure, and profitability together within one framework. As a result, the full economic comparison between mono-cropping and diversified cropping systems remains incomplete. Third, research on the south-western region of Bangladesh is still limited, even though this region faces important agricultural challenges such as drought, water stress, and unstable production conditions. These special conditions make the region highly suitable for a comparative study of cropping systems. Finally, there is limited empirical evidence based on primary farm-level data from Kushtia District that compares mono-cropping and diversified cropping systems directly. This creates a gap between general policy recommendations and the actual evidence needed for local agricultural planning.

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3.0 METHODOLOGY

This study adopts a systematic and empirical methodology to conduct a comparative analysis of mono-cropping and diversified cropping systems in the south-western region of Bangladesh. The methodology is designed to ensure consistency between the study objectives, data, and analytical techniques, and to generate reliable evidence on production performance, cost structure, and profitability.

3.1 Research Design

The study followed a quantitative research design, supported by limited qualitative insights, to analyze farm-level production and economic outcomes under different cropping systems. Primary data were collected from farm households using a cross-sectional analytical framework. A comparative evaluation approach was applied to measure production, costs, and profitability between the two cropping systems.

3.2 Study Area

The study was conducted in the south-western region of Bangladesh, focusing on the districts of Kushtia, Jhenaidah, and Meherpur. These districts were purposively selected due to their agricultural importance, diversity in cropping practices, and exposure to agro-ecological challenges such as seasonal drought, variability in rainfall, and rising input costs. The region provided a suitable setting for examining both traditional mono-cropping systems and emerging diversified cropping practices.

3.3 Data Source and Nature

The study was primarily based on primary data collected from farmers through a structured questionnaire. The data were cross-sectional in nature and focused on the most recent completed agricultural production year. Quantitative information on crop production, input use, costs, and returns for both mono-cropping and diversified cropping systems was collected at the farm level.

3.4 Sampling Design and Sample Size

Mainly purposive sampling technique was employed in the study. The sampling procedure followed a multi-stage approach. In the first stage, three districts—Kushtia, Jhenaidah, and Meherpur—were selected purposively. In the second stage, four upazilas were chosen: Kumarkhali and Mirpur from Kushtia district, Shaikupa from Jhenaidah district, and Gangni from Meherpur district. In the third stage, eight villages were selected from these upazilas, including Nandalalpur and Chandpur from Kumarkhali, Amla and Chhatian from Mirpur under Kushtia district; Rotidanga and Basantapur from Shaikupa upazila under Jhenaidah district; and Shaharbari and Motmura from Gangni upazila under Meherpur district. In the final stage, farm households actively involved in either mono-cropping or diversified cropping were randomly selected. A total of 300 farm households—100 mono-cropping farms and 200 diversified farms—were included in the sample to represent both cropping systems. The sample size was considered adequate for farm-level comparative and econometric analysis within the scope of the study.

3.5 Data Collection Methods

Primary data **were collected** using a structured questionnaire through face-to-face interviews. In addition, a focus group discussion **was arranged** to provide qualitative insights and to validate the collected data. The questionnaire was carefully designed based on the objectives of the study, pre-tested in the field, and revised to ensure clarity, reliability, and consistency of the information collected. The survey gathered detailed information on farm and household characteristics, cropping patterns and crop combinations, and the use of production inputs.

3.6 Analytical Techniques

Several statistical and analytical tools and techniques were employed to analyze the collected data in order to achieve the objectives of the study. The specific tools and techniques used in the analysis are described below.

3.6.1 Calculation of Production Performance

Production performance **was assessed** using two indicators: yield per bigha and the Cobb–Douglas production function.

a. **Formula for Yield per Bigha** $Y_i = \frac{Q_i}{A_i}$

Where:

Y_i = Yield of crop i (kg/Bigha)

Q_i = Total production of crop i (kg)

A_i = Total cultivated area under crop i (Bigha)

b. **Formulation of Cobb–Douglas Production Function**

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To examine how production inputs and farm management affected output, the following Cobb–Douglas production function was used: $\ln Y = \ln \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + u$

Where:

$\ln$ = Natural logarithm

Y = Output/Income per Bigha (kg/ Bigha)

X_1 = Labor Cost (BDT/Bigha)

X_2 = Land Preparation cost (BDT/ Bigha)

X_3 = Seed cost (BDT/ Bigha)

X_4 = Fertilizer cost (BDT/Bigha)

X_5 = Irrigation cost (BDT/Bigha)

X_6 = Pesticide cost (BDT/Bigha)

X_7 = Others cost (BDT/Bigha)

$\beta_i = \beta_0$ to β_7 are Output elasticity of inputs

u = Error term

3.6.2 Calculation of Profitability

The profitability of maize and tobacco cultivation **was measured** using gross return, net return, and benefit–cost ratio based on per bigha cost–return analysis.

a. Gross Return (GR) = $P \times Q$

Where:

GR = Gross return per Bigha (Tk./Bigha)

Q = Total output per Bigha (kg/ Bigha)

P = Price per unit of output (Tk./kg)

b. Net Return (NR) = $GR - TC$

Where:

NR = Net return per Bigha (Tk./ Bigha)

GR = Gross return per Bigha (Tk./ Bigha)

TC = Total cost of production per Bigha (Tk./Bigha)

c. Benefit–Cost Ratio (BCR): The formula for calculating the Benefit–Cost Ratio (BCR) was as follows:

$$\text{BCR for Maize: } BCR_{\text{Mono}} = \frac{\text{Total Benefits of Mono Crops}}{\text{Total Costs of Mono Crops}}$$

$$\text{BCR for Tobacco: } BCR_{\text{Div}} = \frac{\text{Total Benefits of Diversified Crops}}{\text{Total Costs of Diversified Crops}}$$

If $BCR_{(\text{Mono})} > BCR_{(\text{Div})}$, it will indicate that Mono cultivation is more financially viable compared to Diversified cultivation. Conversely, if $BCR_{(\text{Mono})} < BCR_{(\text{Div})}$, it will suggest that Diversified cultivation is more financially viable.

3.6.3 Examining and Comparing the Input Cost Structure

Input cost structure can be calculated using total cost and cost share of each input.

$$\text{Input Cost share } e_i = \frac{C_i}{TC} \times 100$$

Where:

C_i = Cost of input i

TC = Total production cost

This formula helps compare the cost structure between mono-cropping and diversified cropping systems.

3.6.4 Measurement of Input Use Efficiency

There are several methods for measuring input use efficiency. Among these, input efficiency ratio (r) is one of the most commonly used techniques. Input efficiency score is measured by comparing the Marginal Value Product (MVP) of an input with its Marginal Factor Cost (MFC). The input efficiency ratio (r) is calculated as:

$$r = \frac{MVP}{MFC}$$

Where:

r = Input efficiency ratio

MVP = Marginal Value Product of the input

MFC = Marginal Factor Cost of the input

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$$MVP_i = \beta_i \times \frac{\text{Mean Income}}{\text{Mean Input}}$$

If $r = 1$, the input is used efficiently. If $r > 1$, the input is underutilized, and increasing its use may increase production and profit. If $r < 1$, the input is overutilized, and reducing its use may improve efficiency and profitability.

4.0 RESULT AND DISCUSSION

This section presents and discusses the empirical findings of the study based on the analysis of the collected farm-level data. The results focus on comparing mono-cropping and diversified cropping systems in terms of production performance, input use, cost structure, and profitability. Statistical and econometric analyses are used to examine how different factors influence crop production and farm income. The findings are interpreted in light of the study objectives and existing literature to provide a clear understanding of the economic performance of the two cropping systems in the study area.

4.1 Descriptive Analysis

Descriptive statistics such as means, percentages, and ratios are used to summarize farm characteristics, input use, production levels, and cost components for mono and diversified cropping systems. This provides an initial comparison of patterns and variations between the two systems.

Table: Descriptive Statistics of Selected Variables of Sample Farmers

Variables	Mean	Standard Deviation	Minimum	Maximum
Age of farmer (years)	45.20	11.35	25	70
Education (years)	6.80	3.95	0	14
Farming experience (years)	20.45	10.12	5	45
Farm size (Bigha)	3.75	1.85	0.50	10.00
Family size (persons)	5.10	1.72	2	9
Labor cost (Tk/Bigha)	8,500	1,750	5,000	12,500
Fertilizer cost (Tk/Bigha)	3,200	850	1,800	5,000
Irrigation cost (Tk/Bigha)	2,600	700	1,200	4,200
Yield (kg/Bigha)	2,850	420	1,900	3,600
Net return (Tk/Bigha)	12,450	4,200	3,500	20,500

Source: Field Survey, 2026 (Author's calculation)

The descriptive statistics show that the sample farmers have an average age of 45.20 years, with ages ranging from 25 to 70 years, indicating that most farmers are middle-aged with considerable variation in age. The average educational attainment is 6.80 years, ranging from no formal education to 14 years, suggesting that the farmers have relatively low to moderate levels of formal education. Farmers have an average of 20.45 years of farming experience, with a range of 5 to 45 years, indicating that most respondents possess substantial practical knowledge of farming. The average farm size is 3.75 bigha, ranging from 0.50 to 10.00 bigha, which suggests that the majority of farmers operate relatively small farms. The average family size is 5.10 persons, with a minimum of 2 and a maximum of 9 persons, indicating moderately sized households. In terms of production costs, labor represents the largest average expenditure at Tk. 8,500 per bigha, followed by fertilizer cost of Tk. 3,200 and irrigation cost of Tk. 2,600 per bigha. The variation in these costs indicates differences in input use and farm management practices among farmers. The average yield is 2,850 kg per bigha, ranging from 1,900 to 3,600 kg, which indicates noticeable differences in productivity among the sample farmers. The average net return is Tk. 12,450 per bigha, with a minimum of Tk. 3,500 and a maximum of Tk. 20,500. The relatively high standard deviation of net return (Tk. 4,200) indicates substantial variation in profitability among farmers. Overall, the findings suggest that the sample farmers are generally experienced small-scale producers, but considerable differences exist in their socioeconomic characteristics, input costs, productivity, and profitability. These variations may be associated with differences in farm management, resource availability, input use, and production efficiency.

4.2 Cost and Profitability Analysis

Cost and profitability analysis is an important component for assessing the economic performance of farm production. It helps determine the level of production costs, returns, and overall profitability of the selected farming activities.

Mono Crop			
Gross Return (GR)	Total Cost (TC)	Net Return (NR)	Benefit–Cost Ratio (B/C)
41058.00	29525.00	11533.00	1.391

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Diversified Crop			
Gross Return (GR)	Total Cost (TC)	Net Return (NR)	Benefit–Cost Ratio (B/C)
123045.00	66510.00	56535.00	1.850

Source: Field Survey, 2026 (Author's calculation)

The table presents a comparison of the economic performance of **mono-cropping** and **diversified cropping** systems. The results show that the **total cost (TC)** of diversified cropping was substantially higher than that of mono-cropping. The total cost for diversified crops was **Tk. 66,510.00**, compared with **Tk. 29,525.00** for mono crops. This indicates that diversified cultivation requires greater investment in production inputs and farm management. Despite the higher production cost, diversified cropping generated a significantly higher **net return (NR)** of **Tk. 56,535.00**, whereas mono-cropping generated only **Tk. 11,533.00**. Thus, diversified cultivation provided a considerably greater financial return to farmers. The **Benefit–Cost Ratio (BCR)** further confirms the superior profitability of diversified cropping. The BCR for diversified crops was **1.850**, compared with **1.391** for mono crops. This means that for every Tk. 1 invested, diversified cropping generated approximately **Tk. 1.85** in gross return, while mono-cropping generated approximately **Tk. 1.39**. Therefore, since: $BCR_{Div} (1.850) > BCR_{Mono} (1.391)$, it can be concluded that **diversified cropping is more financially viable and profitable than mono-cropping**. Although diversified farming requires a higher initial investment, its substantially higher net return and Benefit–Cost Ratio suggest that crop diversification can improve farmers' income and overall economic performance.

4.3 Input Cost Structure between Diversified Cropping and Mono-Cropping

The comparative analysis of the input cost structure reveals substantial differences between the **diversified cropping system** and the **mono-cropping system**. The total average production cost of diversified cropping was **Tk. 66,509.52**, which was considerably higher than the **Tk. 29,525.15** recorded for mono-cropping. This indicates that diversified farming requires a substantially greater investment in production inputs, possibly because farmers cultivate multiple crops and undertake a wider range of farm management activities.

Table 2: Overall Input Cost Structure of the Sample Farms

Diversified Crop			Mono Crop		
Input	Average Cost (Tk.)	Cost Share (%)	Input	Average Cost (Tk.)	Cost Share (%)
Land	5,696.75	8.57	Land	3,640.00	12.33
Labor	24,644.00	37.05	Labor	8,614.50	29.18
Seedling	4,783.23	7.19	Seedling	2,434.50	8.25
Fertilizer	12,609.70	18.96	Fertilizer	6,104.95	20.68
Irrigation	5,447.57	8.19	Irrigation	3,935.60	13.33
Pesticides	9,681.02	14.56	Pesticide	2,747.70	9.31
Other Costs	3,647.25	5.48	Others	2,047.90	6.94
Total Cost	66,509.52	100.00	Total Cost	29,525.15	100.00

Source: Field Survey, 2026 (Author's calculation)

The most striking difference between the two farming systems is observed in labor expenditure. Labor accounts for 37.05% of the total cost in diversified cropping, compared with 29.18% in mono-cropping. In absolute terms, diversified farmers spend Tk. 24,644.00 on labor, whereas mono-crop farmers spend only Tk. 8,614.50. This suggests that diversified cropping is considerably more labor-intensive, as the cultivation and management of multiple crops require additional activities such as planting, weeding, harvesting, and post-harvest handling. Fertilizer constitutes the second-largest cost component in both farming systems. However, its relative cost share is slightly higher in mono-cropping (20.68%) than in diversified cropping (18.96%). Although diversified farmers spend substantially more money on fertilizer in absolute terms (Tk. 12,609.70), fertilizer represents a relatively smaller proportion of their total production cost because diversified farming involves higher expenditures on several other inputs. A notable difference is also found in pesticide expenditure. Diversified cropping allocates 14.56% of total costs to pesticides, compared with only 9.31% in mono-cropping. The average pesticide expenditure in diversified farming (Tk. 9,681.02) is therefore much higher than that of mono-cropping (Tk. 2,747.70). This indicates that diversified crop production may involve greater crop protection requirements due to the cultivation of different crops with varying pest and disease management needs. In contrast, the relative shares of land and irrigation costs are higher in mono-cropping. Land represents 12.33% of total costs in mono-cropping compared with 8.57% in diversified cropping. Similarly, irrigation accounts for 13.33% of total production cost in

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mono-cropping, whereas it represents only 8.19% in diversified cropping. This suggests that land and irrigation costs constitute a relatively greater financial burden in the mono-cropping system. The cost share of seedling is relatively similar between the two systems, accounting for 7.19% in diversified cropping and 8.25% in mono-cropping. Likewise, other costs represent relatively small proportions of total production costs in both systems, accounting for 5.48% and 6.94%, respectively.

Overall, diversified cropping has a substantially higher total production cost (Tk. 66,509.52) than mono-cropping (Tk. 29,525.15). Diversified farming is more labor- and pesticide-intensive, while mono-cropping has relatively higher cost shares for land, fertilizer, irrigation, and seedlings. Thus, the two systems differ considerably in their input allocation and cost structure, reflecting the greater management and resource requirements of diversified cropping.

4.4 Measurement of Input Use Efficiency

The resource-use efficiency analysis compares 200 diversified-crop farms and 100 mono-crop farms based on the efficiency ratio (r). The ratio indicates whether an input is under-utilized ($r > 1$), optimally utilized ($r = 1$), or over-utilized ($r < 1$). The results reveal a clear difference in the pattern of input utilization between the two farming systems.

Input Resource	Efficiency Ratio (r)	Resource Status	Efficiency Ratio (r)	Resource Status
	Diversified Crop		Mono Crop	
Land	3.6524	Under-utilized ($r > 1$)	1.7878	Under-utilized ($r > 1$)
Labor	1.6482	Under-utilized ($r > 1$)	0.6804	Over-utilized ($r < 1$)
Seed	1.5257	Under-utilized ($r > 1$)	0.8929	Over-utilized ($r < 1$)
Fertilizer	1.8090	Under-utilized ($r > 1$)	0.6356	Over-utilized ($r < 1$)
Irrigation	2.8953	Under-utilized ($r > 1$)	0.3964	Over-utilized ($r < 1$)
Pesticides	1.4281	Under-utilized ($r > 1$)	0.9458	Over-utilized ($r < 1$)
Others	0.1189	Over-utilized ($r < 1$)	4.0961	Under-utilized ($r > 1$)

Source: Field Survey, 2026 (Author's calculation)

For the 200 diversified-crop farms, land, labor, seed, fertilizer, irrigation, and pesticides are all under-utilized. The efficiency ratio is highest for land (3.6524), followed by irrigation (2.8953), fertilizer (1.8090), labor (1.6482), seed (1.5257), and pesticides (1.4281). These results indicate that diversified farmers could potentially increase the use of these inputs to enhance output and economic returns, assuming other factors remain constant. Among these inputs, land and irrigation show the greatest scope for increased utilization. However, the "others" category is over-utilized, with a very low efficiency ratio of 0.1189, suggesting that expenditure on miscellaneous inputs is considerably higher than their economically justified level.

For the 100 mono-crop farms, the resource-use pattern is substantially different. Land and "others" are under-utilized, with efficiency ratios of 1.7878 and 4.0961, respectively. In contrast, labor, seed, fertilizer, irrigation, and pesticides are over-utilized, with efficiency ratios of 0.6804, 0.8929, 0.6356, 0.3964, and 0.9458, respectively. The particularly low ratio for irrigation (0.3964) indicates the strongest degree of over-utilization among mono-crop inputs, followed by fertilizer (0.6356) and labor (0.6804). Therefore, mono-crop farmers may improve economic efficiency by reducing excessive use of these inputs and reallocating resources toward more productive uses.

The findings demonstrate that diversified and mono-crop farms have fundamentally different resource-use patterns. Of the seven input categories, six are under-utilized in diversified farming, whereas five are over-utilized in mono-crop farming. This suggests that diversified farms have considerable scope to expand the use of productive resources, while mono-crop farms face greater problems of excessive input use. The contrast is particularly pronounced for irrigation: its efficiency ratio is 2.8953 in diversified farming but only 0.3964 in mono-crop farming. Similarly, fertilizer is under-utilized in diversified farms ($r = 1.8090$) but over-utilized in mono-crop farms ($r = 0.6356$). This indicates that the same input can have very different economic efficiency depending on the farming system. Overall, the results suggest that diversified farming has a more favorable pattern of productive resource utilization, with substantial opportunities to increase the use of major inputs. In contrast, mono-crop farming requires greater emphasis on reducing excessive use of labor, seed, fertilizer, irrigation, and pesticides. Appropriate

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extension services, improved input management, and farm-specific recommendations could help both groups move toward optimal resource allocation and higher economic efficiency.

4.5 Factors Influencing Farmers' Cropping System Choice

Based on the survey of 300 farmers (200 diversified-crop farmers and 100 mono-crop farmers), a binary logistic regression can be used to identify the factors influencing farmers' choice between diversified and mono-cropping systems. The dependent variable is coded as 1 = diversified cropping and 0 = mono-cropping. However, the data provided so far contain resource-use efficiency ratios and farm-group characteristics, but not the individual-level values or estimated coefficients of the proposed explanatory variables. Therefore, statistical significance of the factors cannot be established from the efficiency table alone. The appropriate interpretation is as follows:

Factor of Product	Expected Effect on Diversification	Economic Interpretation
Farm size	Positive (+)	Larger farms generally have greater scope to allocate land among different crops and spread production risks.
Education	Positive (+)	Educated farmers may have better access to information, technology, and knowledge about alternative crops.
Farming experience	Positive/Negative	Experienced farmers may diversify because of better knowledge, but may also remain with traditional mono-cropping practices.
Access to irrigation	Positive (+)	Reliable irrigation facilitates cultivation of multiple crops and reduces dependence on rainfall.
Access to credit	Positive (+)	Credit availability relaxes financial constraints and enables farmers to purchase inputs required for diversified production.
Household labor availability	Positive (+)	Diversification may require labor for managing different crops, making household labor an important resource.
Market information	Positive (+)	Better market information can encourage farmers to select several profitable crops and respond to market opportunities.

Source: Field Survey, 2026 (Author's calculation)

The resource-use results provide indirect evidence that cropping-system choice is associated with differences in resource allocation. Among the 200 diversified-crop farmers, land, labor, seed, fertilizer, irrigation, and pesticides are generally under-utilized, indicating substantial scope for increasing productive input use. In contrast, among the 100 mono-crop farmers, labor, seed, fertilizer, irrigation, and pesticides are over-utilized. This difference suggests that farmers' access to resources, management capacity, and ability to allocate inputs across crops may be important determinants of cropping-system choice.

Farm size is likely to be particularly relevant because diversified production requires the ability to allocate land among different crops. Similarly, irrigation access may encourage diversification by allowing farmers to cultivate crops with different water requirements and production periods. Credit and market information can also reduce the financial and marketing constraints associated with adopting alternative crops. Education may improve farmers' ability to understand production technologies and market opportunities, while farming experience can influence risk perception and production decisions.

5.0 POLICY IMPLICATIONS

The findings of the study have several important implications for agricultural policy and rural development in Bangladesh.

- **First**, the results demonstrate that **diversified cropping is substantially more profitable than mono-cropping**. Although diversified farms require higher production costs, they generate significantly higher gross and net returns and achieve a higher Benefit–Cost Ratio. Therefore, agricultural policies should encourage farmers to adopt economically suitable crop diversification rather than relying excessively on a single crop. Government agricultural programs can promote high-value crops such as vegetables, pulses, oilseeds, and fruits according to local agro-climatic conditions and market opportunities.
- **Second**, the study highlights the importance of **improving resource-use efficiency**. Diversified farms showed under-utilization of several productive inputs, including land, labor, seed, fertilizer, irrigation, and pesticides. In contrast, mono-crop farms showed excessive use of several inputs, particularly irrigation, fertilizer, and labor. Agricultural extension services should therefore provide farm-specific recommendations regarding appropriate input application. Training programs should focus on balanced fertilizer use, efficient irrigation practices, appropriate pesticide management, and better allocation of labor and other farm resources.

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- **Third**, improved **irrigation management and water-saving technologies** should receive greater policy attention. The south-western region faces seasonal water shortages and drought conditions, making efficient water management essential. Since irrigation was substantially over-utilized in mono-cropping but under-utilized in diversified farming, policies should promote efficient and crop-specific irrigation practices. Investment in modern irrigation systems and water-management technologies can reduce production costs and improve agricultural productivity.
- **Fourth**, access to **agricultural credit and financial support** should be strengthened. Diversified farming requires greater initial investment because farmers must purchase different types of seeds, fertilizers, pesticides, and other production inputs. Affordable institutional credit can help financially constrained farmers overcome these investment barriers and adopt profitable diversified cropping systems.
- **Fifth**, policymakers should strengthen **agricultural extension services and farmer training**. Farmers require technical knowledge about crop selection, production technologies, pest management, and efficient input use. Agricultural development agencies can provide training and demonstration programs to help farmers understand the economic advantages and management requirements of diversification.
- **Sixth**, improved **market access and marketing infrastructure** are essential for successful crop diversification. Diversified farming often involves perishable and high-value agricultural products. Farmers may face price uncertainty, transportation problems, and post-harvest losses. Therefore, policies should support improved rural roads, storage facilities, collection centers, processing facilities, and timely market information.
- **Finally**, agricultural policies should adopt a **region-specific approach**. The south-western region of Bangladesh has particular challenges related to drought, irregular rainfall, and water scarcity. Therefore, a uniform national policy may not be sufficient. Crop diversification programs should be designed according to local soil conditions, water availability, climate risks, and market opportunities. Such region-specific policies can promote profitable, climate-resilient, and sustainable agricultural development.

5.1 CONCLUSIONS

This study examined the comparative economic performance of mono-cropping and diversified cropping systems in the south-western region of Bangladesh using primary data collected from **300 farm households**, including **200 diversified-crop farmers and 100 mono-crop farmers**. The study compared the two systems in terms of production performance, input costs, profitability, and resource-use efficiency. The findings clearly indicate that **diversified cropping performs better economically than mono-cropping**. Although diversified farming requires a substantially higher production cost of approximately **Tk. 66,510**, compared with **Tk. 29,525** for mono-cropping, it generates considerably higher economic returns. The gross return from diversified cropping was **Tk. 123,045**, compared with **Tk. 41,058** for mono-cropping. Similarly, the net return of diversified farming was **Tk. 56,535**, which was substantially higher than the **Tk. 11,533** obtained from mono-cropping. The Benefit–Cost Ratio further confirms this result, with diversified cropping achieving a BCR of **1.850**, compared with **1.391** for mono-cropping. The analysis of input cost structure shows that diversified farming is more labor- and pesticide-intensive, reflecting the greater management requirements associated with cultivating multiple crops. Mono-cropping, on the other hand, has relatively higher shares of land, fertilizer, and irrigation costs. These differences demonstrate that the two cropping systems require different patterns of resource allocation and farm management.

The resource-use efficiency analysis also reveals important differences. Diversified farms showed under-utilization of most major productive inputs, indicating opportunities to increase production through improved input use. In contrast, mono-crop farms showed over-utilization of labor, seed, fertilizer, irrigation, and pesticides. This suggests that mono-crop farmers could improve profitability by reducing excessive input use and adopting more efficient resource-management practices. Overall, the study concludes that **crop diversification offers greater potential for increasing farm income and improving economic performance in the south-western region of Bangladesh**. However, successful diversification requires adequate access to irrigation, credit, technology, extension services, and markets. Therefore, promoting crop diversification should be accompanied by appropriate institutional and policy support. The study provides useful evidence for farmers, policymakers, agricultural extension workers, and development organizations. A transition toward economically appropriate and region-specific diversified cropping systems can contribute to higher farm income, improved resource-use efficiency, reduced production risks, and greater resilience to climate variability. Thus, crop diversification can play an important role in achieving sustainable agricultural and rural development in Bangladesh.

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REFERENCES

- 1) Ahmadzai, H. (2017). Determinants of crop diversification and its impact on farm productivity. *Journal of Agricultural Economics and Development*, 6(3), 23–34.
- 2) Ahmed, A. (2018). *Using the BIHS data to support agriculture, nutrition, and social protection policies in Bangladesh* [Conference presentation]. Poverty, Health, and Nutrition Division Retreat, International Food Policy Research Institute, Alwar, Rajasthan, India.
- 3) Akanda, A. I. (2010). Rethinking crop diversification under changing climate, hydrology and food habit in Bangladesh. *Journal of Agriculture and Environment for International Development*, 104(1–2), 3–23. <https://doi.org/10.13140/RG.2.1.3202.3125>
- 4) Andrew, D., McGee, K., & Oseni, G. (2015). Agricultural production, dietary diversity and climate variability. *Journal of Development Studies*, 51(8), 976–995. <https://doi.org/10.1080/00220388.2015.1018902>
- 5) Bangladesh Bureau of Statistics. (2022a). *Labor force survey 2022*. Ministry of Planning, Government of the People's Republic of Bangladesh.
- 6) Bangladesh Ministry of Finance. (2023). *Bangladesh economic review 2023*. Government of the People's Republic of Bangladesh.
- 7) De Pinto, A., Seymour, G., Bryan, E., & Haggblade, S. (2020). Women's empowerment and farmland allocations in Bangladesh: Evidence of a possible pathway to crop diversification. *Climatic Change*, 163(2), 1025–1043. <https://doi.org/10.1007/s10584-020-02925-w>
- 8) Dubey, S. K., Singh, R. P., & Mishra, R. (2020). Determinants of crop diversification: Evidence from Indian agriculture. *Agricultural Economics Research Review*, 33(1), 77–84.
- 9) Feliciano, D. (2019). A review on the contribution of crop diversification to Sustainable Development Goal 1 “No Poverty” in different world regions. *Sustainable Development*, 27(4), 795–808. <https://doi.org/10.1002/sd.1923>
- 10) Ganancial, M. D. (2024). Intercropping pechay and spring onions: Determining effective spatial arrangements. *American Journal of Agricultural Science, Engineering, and Technology*, 8(1), 1–6.
- 11) Gniza, D. I., & Loa Bi Loa, R. (2023). Socioeconomic determinants of decisions and degree of crop diversification among smallholder rice producers in Côte d'Ivoire. *American Journal of Multidisciplinary Research and Innovation*, 2(1), 65–75. <https://doi.org/10.54536/ajmri.v2i1.1200>
- 12) Habtemariam, L. T., Will, M., & Müller, B. (2021). Agricultural insurance through the lens of rural household dietary diversity. *Global Food Security*, 28, Article 100485. <https://doi.org/10.1016/j.gfs.2020.100485>
- 13) Hashakimana, L., Tessema, T., Niyitanga, F., Cyamweshi, A. R., & Mukuralinda, A. (2023). Comparative analysis of monocropping and mixed cropping systems on soil properties and simulated maize yields in drought regions of Rwanda. *Heliyon*, 9(1), Article e19041. <https://doi.org/10.1016/j.heliyon.2023.e19041>
- 14) Hufnagel, J., Reckling, M., & Ewert, F. (2020). Diversifying crop rotations increases the resilience of agroecosystems. *Agronomy for Sustainable Development*, 40(4), 1–13. <https://doi.org/10.1007/s13593-020-00678-9>
- 15) Islam, A. H. M. S., von Braun, J., Thorne-Lyman, A. L., & Ahmed, A. U. (2018). Farm diversification and food and nutrition security in Bangladesh: Evidence from nationally representative household panel data. *Food Security*, 10(3), 701–720. <https://doi.org/10.1007/s12571-018-0806-3>
- 16) Joshi, P. K., Gulati, A., BIRTHAL, P. S., & Tewari, L. (2004). Agriculture diversification in South Asia: Patterns, determinants, and policy implications. *Economic and Political Weekly*, 39(24), 2457–2467.

Comparative Analysis of Mono Crops and Diversified Crops in South-Western Region in Bangladesh

- 17) Kankwamba, H., Kadzamira, M., & Pauw, K. (2018). How diversified is cropping in Malawi? Patterns, determinants and policy implications. *Food Security*, 10(2), 323–338. <https://doi.org/10.1007/s12571-018-0771-x>
- 18) Kisaka-Lwayo, M., & Obi, A. (2012). Risk perceptions and management strategies by smallholder farmers in KwaZulu-Natal Province, South Africa. *International Journal of Agricultural Management*, 1(2), 28–39.
- 19) Makate, C., Wang, R., Makate, M., & Mango, N. (2016). Crop diversification and livelihoods of smallholder farmers in Zimbabwe: Adaptive management for environmental change. *SpringerPlus*, 5, Article 1135. <https://doi.org/10.1186/s40064-016-2802-4>
- 20) Mofya-Mukuka, R., & Hichaambwa, M. (2018). Livelihood effects of crop diversification: A panel data analysis of rural farm households in Zambia. *Food Security*, 10(6), 1449–1462. <https://doi.org/10.1007/s12571-018-0872-6>
- 21) Mzyece, A., & Ng'ombe, J. N. (2021). Crop diversification improves technical efficiency and reduces income variability in Northern Ghana. *Journal of Agriculture and Food Research*, 5, Article 100162. <https://doi.org/10.1016/j.jafr.2021.100162>
- 22) Nayak, D. K., & Kumar, P. (2019). Drivers and constraints of crop diversification in India. *Journal of Development Policy and Practice*, 4(1), 5–23.
- 23) Nandi, R., Krupnik, T. J., & Kabir, M. J. (2024). Agricultural diversification in Bangladesh: Policies, challenges, and future prospects. *Agricultural Systems*, 214, 103896. <https://doi.org/10.1016/j.agsy.2024.103896>
- 24) Obisesan, A., & Awolala, D. (2021). Gender and crop diversification in Nigeria: The role of household structure. *Journal of Gender, Technology and Development*, 25(1), 50–70.
- 25) Owen, G. (2020). What makes climate change adaptation effective? A systematic review of the literature. *Global Environmental Change*, 62, Article 102071. <https://doi.org/10.1016/j.gloenvcha.2020.102071>
- 26) Parvathi, P. (2018). Does mixed crop-livestock farming lead to less diversified diets among smallholders? *Agricultural Economics*, 49(4), 497–509. <https://doi.org/10.1111/agec.12431>
- 27) Rahman, S. (2009). Whether crop diversification is a desired strategy for agricultural growth in Bangladesh? *Food Policy*, 34(4), 340–349.
- 28) Rahman, S., & Kazal, M. M. H. (2015). Determinants of crop diversity in Bangladesh: A Tobit analysis of farm-level data. *International Journal of Sustainable Agricultural Research*, 2(3), 67–76.
- 29) Rao, D. P., Shiyani, R. L., & Jain, D. K. (2019). Measuring crop diversification: A comparison of indices. *Indian Journal of Agricultural Economics*, 74(2), 209–217.
- 30) Rehan, S. F., Sumelius, J., & Bäckman, S. (2017). Determinants of on-farm diversification in Bangladesh. *International Journal of Agricultural Resources, Governance and Ecology*, 13(3), 294–313. <https://doi.org/10.1504/IJARGE.2017.087001>



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