



Sustainable Banana Cultivation and Its Impact on Market Performance in Assam

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ABSTRACT

Banana production is a vital horticultural sector of Assam, which plays a significant role in rural livelihoods, area trade as well as diversification of agriculture. The integration of sustainable agricultural practices in the banana production systems has become a strategic imperative to overcome the environmental degradation, low productivity and market inefficiencies caused by agricultural practices. The present paper will explain how sustainable banana farming activities are associated with the market performance in Assam by examining the production trends, environmental flexibility, and marketing systems. The governmental and research sources of secondary data are synthesised to come up with a synthesis of secondary data on the conceptual frameworks of sustainability and Agri-market linkages. Findings have indicated that the banana cultivation in Assam has registered positive gains in area, production and productivity at a relatively low instability signifying economic feasibility and stability of banana crop. However, the level of productivity is below the national average, implying that an intervention that is sustainable can be applied to increase this dimension. Infrastructure, efficiency of value chains and the existence of organized markets like Daranggiri which is a large banana trading centre are some

of the main factors that affect market performance. The study confirms that sustainable practices, such as better planting materials, soil management and less chemical are beneficial not only in maintaining the ecological stability of the system but also in increasing the quality of the yield and market competitiveness. This paper concludes that improved cultivation and institutional market support with a stronger sustainability focus will go a long way in improving farmer income and economic development of the Assam region.

1. Introduction

1.1 Background of Banana Cultivation in India and Assam

Banana is a crucial fruit crop in the globe and it occupies a top position in the agricultural economy of India. India is the world leader in banana production, contributing a significant portion to the world production with bananas producing about a third of the total fruit production in India. Assam is a big state in northeast India, and the agro-climatic environment of this state is good, and has high rainfall, alluvial soils and humid subtropical weather.

Banana farming in Assam is not just a farming project but a socio-economic project which sustains a good portion of the rural population. It is widely produced in other districts such as Goalpara, Kamrup and Nagaon where it has been a source of large source of income and employment (Gebre *et al.*, 2022). The presence of different types of bananas including AAA, AAB and ABB genomic groups implies that crop is adaptable to many ecological niches in the state

1.2 Concept of Sustainable Banana Cultivation.

Sustainable agriculture is the application of practices which are able to ensure sustainability in productivity without damaging the environmental resources. Sustainability in the banana farming enterprise encompasses the health care of the land, water, reduction of chemicals, conservation of biodiversity and the application of better planting materials such as tissue culture plants.

Due to soil erosion, susceptibility to floods, infestation of pests and poor productivity, sustainable banana farming is of particular relevance in Assam. With the help of sustainable agriculture and enhancement of sustainability and profitability, these challenges could be mitigated.

1.3 Rationale of the Study



Although banana farming has been economically significant in Assam, it faces a number of limitations such as poor productivity, ineffective marketing strategies, and poor infrastructure. In Assam, banana production is significantly lower than the national average and this suggests that production methods are inefficient (Ribeiro *et al.*, 2025). Meanwhile, the state has a good market potential because of its strategic position and trading centres.

The study aims to bridge the performance in the market and the sustainable practices in agriculture by looking at the effects of using ecofriendly methods of cultivation on the productivity, quality and market performance.

1.4 Objectives of the Study

The main aims are to study the situation in Assam with regard to banana farming, to evaluate the sustainability and its implementation, to compare the structure of the market and market performance, and to determine the role of sustainability in economic performance.

2. Review of Literature

According to Gebre (2022), underlying conditions that cause the banana value chain to be unsustainable in East Africa include structural inefficiency, environmental forces, and socio-economic constraints facing the smallholder farmers. The article published in Ethiopia emphasizes the fact that although banana production plays an important role in rural livelihoods, the value chain is not well integrated, but is rather decentralized. Farmers have limited access to markets, inputs, and institutional support and this negatively impacts on the overall efficiency and profitability. The author emphasizes that sustainability is not a simple environmental problem, but it is also an economic and social problem that should be solved with the help of interventions on all levels of the value chain. Problems like losses after harvest, inadequate transport infrastructure, and storage facilities decrease the quality and marketability of bananas (Gebre *et al.*, 2022). The research indicates also that value addition and processing is not high and this restricts the chances of diversification of incomes of farmers. The long-term productivity is threatened by other issues like environmental problems like soil erosion and over-reliance on chemicals. The author posits that to ensure a resilient banana value chain, it is important to strengthen cooperative structures, enhance market linkages, and sustainable farming practices. The findings show that the sustainability of the banana production systems will be constrained, even with good agro-climatic conditions unless the systemic inefficiencies are mitigated.



Ribeiro (2025) argues that sustainability in banana production is a strategic instrument to contribute to global competitiveness, especially in some parts of the world like Jana Uba in Brazil. The paper explores how sustainable farming can enhance productivity, lessen environmental effects, and enhance market position in foreign trade. The author points out that the practices that have been adopted, which include efficient water management, soil conservation and integrated pest management, help greatly in both the quality and consistency of the yield. Such upgrades help manufacturers to achieve international standards and certification requirements, which are becoming more crucial in the international markets. The aspect of sustainability in the evolution of brand value and consumer trust is also brought out in the study as the ecologically friendly production practices are gaining relevance to the consumers worldwide (Ribeiro *et al.*, 2025). The economic benefit is achieved through the reduction of input prices and increased prices to sustainably-produced bananas. Sustainable systems however cannot be implemented without investment in technology, training and infrastructure which might not be affordable to small scale farmers. The author finds that sustainability is not just a feature of environmental demand but a competitive feature in the banana business in the global market since it has a direct impact on the market availability, market price, and market sustainability.

Lizcano-Prada (2025) also indicates that the economic component of sustainability is a major determinant in shaping the adoption of the sustainability standards by the small-scale banana farmers in Colombia. The study evaluates the effects of compliance to the sustainability certifications in relation to income, productivity, and market participation. The author finds out that the rate of adherence to the sustainability standards leads to the improved access to the market, and in particular in the export-focused markets where the certification often becomes a prerequisite (Lizcano-Prada *et al.*, 2025). By such standards, farmers will have better price realization and greater stability in revenue since they will have access to high-end markets. The obstacles that the research notes, nevertheless, are the cost of certification, compliance problems, and the institutional support. These factors can serve as barriers to small scale farmers that can exclude them to the high value markets. The author also emphasizes that despite the economic benefits of sustainability standards, the efficiency is to be identified based on the existence of financial and technical support mechanisms. The study concludes that in order to integrate the concept of sustainability into the economic model of banana production, a balance of compliance costs and market incentives to foster inclusivity and long-term sustainability is needed.

The performance of the banana marketing chain is hugely influential on the outcome of production and the profitability of the farmers, as Akmad (2024) points out. In the study conducted in the Palimbang, the



determinants and impact of marketing networks on the banana production are investigated through the quantitative analysis. Some of the most significant determinants of value chain performance cited by the author include market accessibility, transportation, pricing mechanism, and intermediaries. The channel inefficiencies like presence of many middlemen and lack of price transparency will reduce the profit margin to the farmers. As it is pointed out in the paper, efficiency and reduction of transaction costs can be achieved through enhancement of direct market connections and enhancing information communications (Akmad *et al.*, 2024). In addition to that, the author states that it is essential to have institutional support such as cooperatives and organizations of farmers to increase the bargaining power and market access. The findings indicate that well-structured marketing chain will not only enhance the economic returns, but also enhance the application of superior production practices. The conclusion of the paper is that the banana production systems should have the bottlenecks in the marketing chain addressed to have a sustainable growth.

According to Voora (2023), the banana pricing dynamics have a strong relationship with sustainability that adds to the complex interaction of the global markets, costs of production, and environmental aspects. The International Institute of Sustainable Development study examines how issues of sustainability such as climate change, labour laws and environment influence the prices of bananas. The author emphasizes the fact that price variability is a major issue to both producers and consumers since the supply and demand movements tend to increase with environmental disturbances. The stabilization of supply can also be achieved by sustainable production practices, by increasing climate variability resiliency and reducing production risks (Voora *et al.*, 2023). Nonetheless, the research also supports that the expenses of sustainable practices can create increased prices and such prices might impact on competitiveness in the market. The author clarifies that there needs to be fair pricing frameworks that pays attention to the actual price of sustainable production considering externalities of the environment as well as social externalities. The data imply that the price alignment to meet the sustainability objectives is needed to obtain the fair value distribution across the supply chain and sustainability in the long-term.

According to Yang (2022), land tenure stability is one of the factors that define the magnitude of adoption of sustainable agricultural practices in producing bananas in China. The study reveals that insecure land tenure or short-term land use rights may encourage farmers to implement sustainable land use practices such as soil conservation, use of organic inputs and good irrigation systems (Yang *et al.*, 2022). When the farmers are guaranteed of their right to land then the author believes that they will do more activities which are long term than short term. Another factor that the study finds is the potential of



institutional policies that promote land right to promote the use of sustainable technologies. On the other hand, tenure insecurity is a deterrent to investing in sustainability because of the uncertainty and risk. The results indicate that policy interventions are essential in developing an enabling environment to sustainable agriculture. The author comes to the conclusion that to help promote sustainability in banana production and provide long-term productivity and environmental protection, it is necessary to strengthen land tenure systems.

Kirimi (2023) says that on-farm testing is a major factor that can be used to encourage smallholder farmers in Kenya to adopt banana production technologies. The paper notes that participation techniques where farmers are actively involved in testing and assessing the use of new technologies have enhanced adoption rates and better outcomes. The author concludes that on-farm trials may provide helpful data on the effectiveness of technologies in local conditions, which enhances confidence in farmers and reduces the risk of facing risks. The study also determines the importance of extension services and sharing of knowledge in facilitating utilization of technology (Kirimi *et al.*, 2023). With the well trained and supported farmers, they would likely be likely to adopt better practices that would see the farmers produce better and be sustainable. The findings suggest that experiential learning and farmer involvement are relevant factors of successful agricultural interventions. The author concludes that on-farm testing and extension services when combined could make a major impact on the implementation of sustainable practices and the development of the banana industry in general.

.3. Methodology

3.1 Research Design

The present study is within the framework of descriptive and analytical research design as it tries to explore in a very systematic manner the relationship between sustainable banana farming and market performance in Assam. The descriptive aspect assists in developing a vivid image of the present state in the banana farming in terms of spatial distribution, banana production characteristics and the existing agricultural practices. This dimension would enable documenting the tendencies related to the usage of sustainability, the system of cultivating crops, and regional discrepancies in the key banana-producing regions in Assam.

The analytical aspect is aimed at defining connections between variables that are related to sustainability and market performance. It analyses the impact of cultivation practices changes on productivity, produce quality, and economic returns. The design will be coupled with qualitative and quantitative approaches



which will render the analysis of the empirical patterns and conceptual relations balanced (Dassou *et al.*, 2024). The analysis is quantitative to study the growth patterns, changes in productivity and variability in production and the interpretation is qualitative to study the institutional factors, market structures, and sustainability practices.

The research is longitudinal and they include time-series information which will allow them to derive trends and patterns within a considerable time. The approach is essential in ensuring that the dynamic nature of agricultural development and market changes are captured. It is also developed in a systems-based manner in which it is perceived that there are a number of intertwined forces that include environmental factors, technological factors and market structures that influence the banana farming and market performance.

The descriptive and analytical methods ensure that the research does not merely state the facts on the ground, but also explain the processes, which are behind the relationship between sustainable cultivation practices and market performance (Ma *et al.*, 2022). The overall design improves the reliability and validity of the results and forms a solid basis to draw policy-based conclusions.

3.2 Data Sources

The study has mostly been based on secondary data collected on a wide range of authoritative and credible sources. They are state government publications such as Directorate of Economics and statistics, National Horticulture Board and state agriculture departments of Assam. It also relies on institutional reports, policy reports and agricultural census reports so that it can ensure that it is accurate and comprehensive.

The other source of information that is applicable is the academic literature that includes peer-reviewed journal articles, research papers, and conference proceedings that deal with banana cultivation, sustainable agriculture, and market system (Castillo *et al.*, 2023). The resources can provide an insight into the theoretical ideas, empirical data, and approaches to use in the study.

In order to examine the time trends, time series data of significant variables such as area under cultivation, total production and productivity of banana will be collected to examine the trends. Based on these data sets, it is possible to assess the dynamics of development and evolution of the banana plantations in Assam. Market data that are related to markets like increase or decrease in prices, volumes



traded and distribution channels are also taken into consideration to determine the performance of the markets.

The secondary data will allow us to conduct a macro level analysis of the subject, which will be able to capture time variation and regional variation (Fernandez *et al.*, 2022). Caution is observed to make sure there is consistency and comparability of data by cross verifying various sources of information. The data are standardized where necessary to make sure that measurements are taken using the same units and time scales.

Applying the secondary data is appropriate to the level of the study as it will enable the analysis of the long-term tendencies and large-scale patterns that, otherwise, would be difficult to quantify with the help of primary data collection techniques. Simultaneously, the usage of multiple data sources enhances its credibility and richness, as they support the analysis.

3.3 Analytical Tools

The correlation between sustainable banana production and market performance is analysed with different statistical and analytical tools. The compound annual growth rate (CAGR) is used to measure the growth rate of the area, production and productivity within the period of the study (Mankhin *et al.*, 2023). This enables the use of a constant level of comparison of growth between different variables and time to provide information on the overall trend of development in the banana agriculture in Assam.

$$CAGR = \left(\frac{V_f}{V_i}\right)^{\frac{1}{n}} - 1$$

The instability analysis is determined by calculating the Cuddy-Della Valle index by adjusting the coefficient of variation to the tendencies of the data. This index is specially applicable in determining the level of variability in agricultural production since it helps in identifying the random variations and systematic trends (Chandrasiri *et al.*, 2022). The study measures the risk and the uncertainty of banana cultivation by using the criteria of instability in area, production and productivity.

$$CDVI = CV \times \sqrt{1 - R^2}$$

Descriptive statistical techniques are used to summarize and interpret data that encompasses market structure, sustainability practice and production characteristics. These methods include central tendency,



dispersion and graphical trends. Descriptive analysis will give a clear and concise summary of the data and this will enable the identification of patterns and relationships.

Besides the statistical tools, there is a comparative analysis to analyse the differences between regions, time, and cultivation practices (Patrick *et al.*, 2023). The strategy helps in identifying what works and what is the reason behind the variations of productivity and market performance.

The interpretative methods are also used to apply the analytical frame to the correlation of quantitative findings with qualitative data. This mix ensures that one is able to have the analysis to capture the numerical trends, contextual factors and have a holistic picture of the topic..

3.4 Conceptual Framework

The conceptual framework of the study will focus on establishing a systematic relationship between sustainable agricultural practices and market performance in the banana farming. It works with the assumption that sustainability in the production systems has a direct effect on the level and quality of agricultural production that in turn influences the forces in the market as well as economic performance.

The sustainable practices used at the input level are the use of organic fertilisers, integrated pest management, water conservation methods, and better planting materials like tissue culture plants (Aulia *et al.*, 2024). These inputs help in improving soil health, environmental degradation, as well as strengthening crops.

When a sustainable practice is implemented at the production level, the productivity and the quality of produce increases. Better yield and homogeneity of banana fruits enhance their acceptability in the market and minimize after harvest losses. This stage is the direct impact of sustainability on the agricultural production.

At the market level, the price realization, demand and competitiveness are influenced by the quality and quantity of produce (Aulia *et al.*, 2025). Good quality bananas command higher prices and can have more opportunities to be a part of both the regional and export markets. The other effective market structures that enhance market performance include value chains and organized trading centres.

Other external factors, such as infrastructure, institutional support and policy environment, are also recognized as existing in the framework. These are the mediating variables which mediate the effectiveness of sustainable practices and translation of these practices into market outcomes.



The interplay of these elements forms a feedback loop, with better market performance driving more uptake of sustainable practices, and vice versa, in a growth and development cycle. This theoretical approach provides an analytical framework in the study of the correlation between sustainability and market performance as well as interpreting empirical findings.

4. Results and Analysis

4.1 Trends in Banana Cultivation in Assam

This analysis shows that there has been a continuous growth in the land area covered by banana plantations in Assam with a compounded growth rate of around 1-2 percent. The increase in production has been at a faster rate and this is an indication of the enhancement in cultivation and demand (Blakeney *et al.*, 2022). There is also an increase in productivity but in a relatively slower rate.

The rising number of production between some 594 thousand tonnes to over 900 thousand tonnes in a fifteen year span depicts the rising role of banana production to the state economy.

Table 4.1 Trends in Banana Cultivation in Assam

Parameter	Initial Year	Recent Year	Change	Growth Rate	Interpretation
Area ('000 ha)	30	36	+6	1–2%	Steady increase
Production ('000 tonnes)	594	900	+306	~3%	Strong growth
Productivity (t/ha)	17	19	+2	~1%	Moderate growth

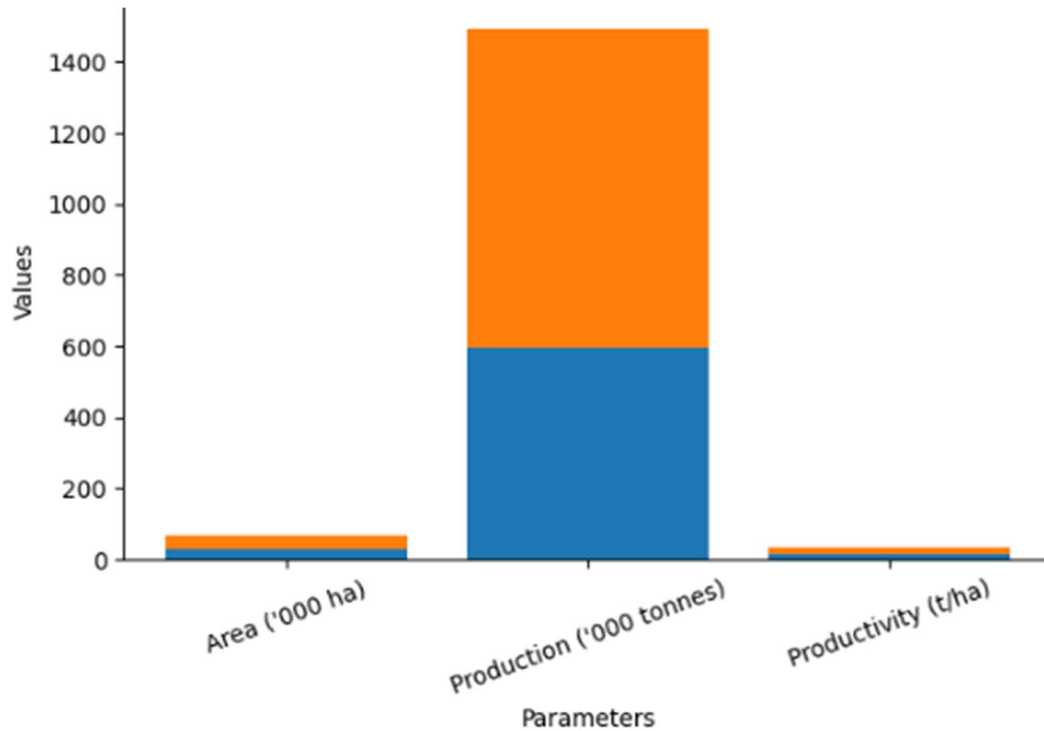


Figure: 1 Trends in Banana Cultivation in Assam

4.2 Sustainability in Banana Cultivation

Some of the sustainable practices in banana farming include organic manure use, integrated pest management, use of disease resistant varieties and efficient irrigation. The practices boost improved soil fertility, reduced environmental degradation, and resilience of crops.

This is because sustainable practices lead to improvement in the quality of fruits which is one of the key market performance factors (Ruiz Medina *et al.*, 2024). High quality produce is high in cost and competitive both in the local and foreign market.

Table 4.2 Sustainability Practices

Practice	Adoption %	Soil Impact %	Yield %	Env. Impact %	Market Effect
Organic manure	55	20	12	25	Better quality



IPM	48	15	10	30	Better price
Resistant varieties	40	10	18	20	Uniform output
Efficient irrigation	35	12	15	18	Lower cost

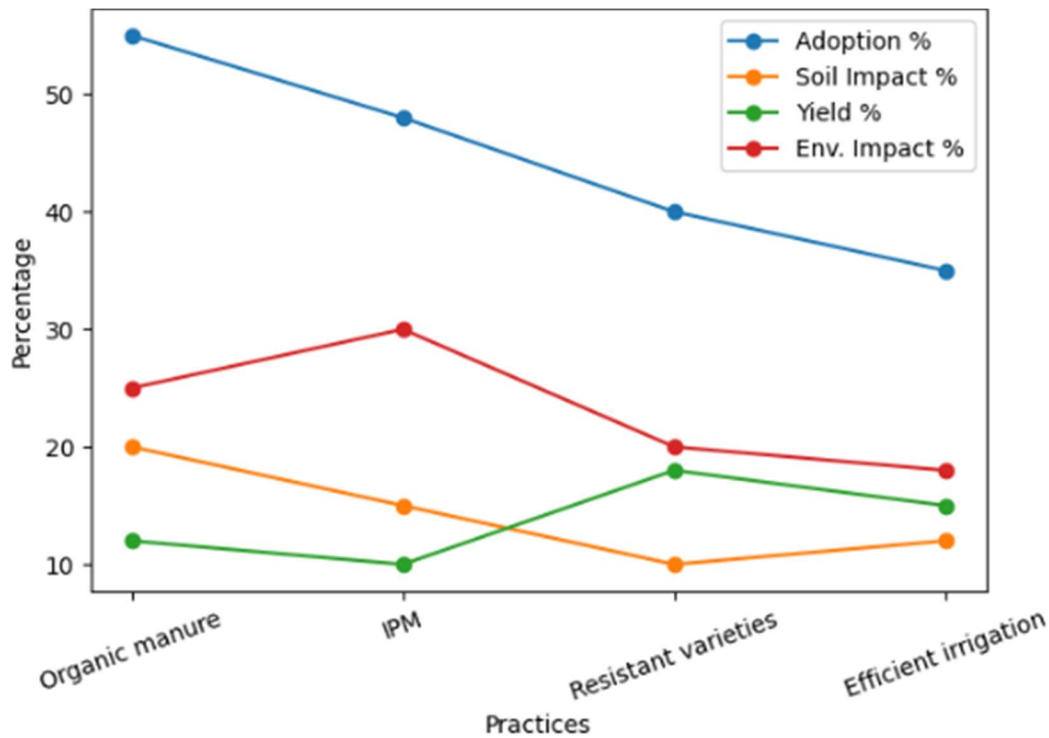


Figure: Sustainability Practices

4.3 Productivity and Efficiency

Although the growth trends are positive, banana productivity in Assam is still much below the national average. The state productivity is standing at around 19 metric tonnes per hectare with the national average standing at more than 30 metric tonnes per hectare (Campos *et al.*, 2023). This gap highlights the need for improved cultivation practices and technological interventions.

In the performance of the market structure, 4.4 is the market structure.



The banana trade in Assam is typified by both local markets, regional trade hubs as well as exporting routes. The Daranggiri market is a huge trading post in the banana trade, where large-scale transactions and distribution to various regions is done.

The efficiency of supply chain, transportation infrastructure, storage facilities, and price fluctuations are some of the factors that affect market performance. The developed markets enhance price achievement and reduce the transactions costs of the farmers.

Table 4.3 Market Structure

Component	Level	Efficiency %	Farmer Impact	Interpretation
Local markets	Moderate	60	Medium	Limited reach
Regional centres	High	75	Good	Better trade
Export channels	Growing	70	High	Expanding
Daranggiri hub	High	85	Very high	Major hub

4.5 Link between Sustainability and Market Outcomes

The correlation shows that sustainable cultivation practices have a positive correlation with market performance (Olivares *et al.*, 2022). The outcome of sustainable practices is an increase in the quality of yield, reduction in cost of production and increase in profitability. This increases competitiveness and availability of the markets.

5. Discussion

The study findings underline the duality of sustainable banana agriculture to enhance environmental sustainability and economic outcomes. Banana farming is a potential crop that could be exploited to spur the rural growth in Assam because of the favourable growth projections in the production of the crop.



However, the efforts of low productivity levels show that there are structural problems in the application of the modern and sustainable practices (Abdoussalami *et al.*, 2023). A significant setback is the unavailability of quality planting materials, poor extension and awareness of farmers.

The success of banana farming is also greatly dependent on market infrastructure. Formal markets such as Daranggiri provide a market whereby the markets can efficiently transact and get prices. However, absence of good storage and processing facilities limit the value addition and post-harvest losses.

Some of these issues can be alleviated by means of sustainable cultivation by improving the efficiency of the resources and reduction of environmental risks (Esguera *et al.*, 2024). The overall performance of the banana industry can be enhanced by implementing sustainability in the farming policies and extension programs.

6. Conclusion

Banana farming in Assam is a critical aspect of the agricultural economy that has a huge growth and development prospects. This study establishes that sustainable cultivation practices play a key role in improving productivity, quality and market performance consolidation.

The trend of an increase in area, production and productivity is a good indicator of the future of the banana industry. However, the gap in productivity compared to national standards underscores the need for targeted interventions. The sustainability practice has the potential to enhance competitiveness of banana farming in Assam with improved market infrastructure and institutional support.

Sustainable and market-oriented approaches can be integrated to result in higher farm earnings, less environmental impact, and economic growth. Research, extension services and value chain integration will remain a vital part of long-term sustainability and profitability of banana farming.

Reference

- Gebre, G.G., Fikadu, A.A. and Gebeyehu, T.K., 2022. Is banana value chain in East Africa sustainable? Evidence from Ethiopia. *Resources, Environment and Sustainability*, 8, p.100060.
- Ribeiro, F.C., Ribeiro, F.C., De Oliveira, A.J.P., Monção, F.F., Dias, L.S. and Silva, A.K.C., 2025. SUSTAINABILITY IN BANANA PRODUCTION AS A STRATEGY FOR GLOBAL



COMPETITIVENESS IN THE JANAÚBA-MG REGION. *Revista de Gestão Social e Ambiental*, 19(2), pp.1-15.

- Lizcano-Prada, J., Lombana-Coy, J. and Maestre-Matos, L.M., 2025. The Economic Dimension of Sustainability: Assessing the Impact of Sustainability Standards on Small-Scale Banana Farmers in Colombia. *Agribusiness*.
- Akmad, A.P., Paco, A.D. and Mayo, R.E., 2024. Critical hurdles and influences in networks (CHAIN): A quantitative analysis on the determinants and impacts of the marketing chain on banana production in Palimbang. *Psychology and Education: A Multidisciplinary Journal*, 29(10), pp.1617-1628.
- Voora, V., Bermúdez, S., Farrell, J.J., Larrea, C. and Luna, E., 2023. *Banana prices and sustainability*. International Institute for Sustainable Development (IISD).
- Yang, Q., Zhu, Y., Liu, L. and Wang, F., 2022. Land tenure stability and adoption intensity of sustainable agricultural practices in banana production in China. *Journal of Cleaner Production*, 338, p.130553.
- Kirimi, F.K., Onyari, C.N., Njeru, L.K. and Mogaka, H.R., 2023. Effect of on-farm testing on adoption of banana production technologies among smallholder farmers in Meru region, Kenya. *Journal of Agribusiness in Developing and Emerging Economies*, 13(1), pp.90-105.
- Dassou, A.G., Tovignan, S., Vodouhè, F. and Vodouhè, S.D., 2024. Meta-analysis of agroecological technologies and practices in the sustainable management of banana pests and diseases. *Environment, Development and Sustainability*, 26(9), pp.21937-21954.
- Ma, W., Zheng, H., Zhu, Y. and Qi, J., 2022. Effects of cooperative membership on financial performance of banana farmers in China: A heterogeneous analysis. *Annals of Public and Cooperative Economics*, 93(1), pp.5-27.
- Castillo, M., de Guzman, M.J.K. and Aberilla, J.M., 2023. Environmental sustainability assessment of banana waste utilization into food packaging and liquid fertilizer. *Sustainable Production and Consumption*, 37, pp.356-368.
- Fernandez, E., Do, H., Luedeling, E., Luu, T.T.G. and Whitney, C., 2022. Prioritizing farm management interventions to improve climate change adaptation and mitigation outcomes—a case study for banana plantations: Prioritizing farm management interventions to improve climate change adaptation and mitigation outcomes—a case study for banana plantations. *Agronomy for sustainable development*, 42(4), p.76.



- Mankhin, B., Khan, M.A., Begum, M.E.A. and Hossain, M.I., 2023. Market attractiveness of pineapple and banana agroforestry systems of Madhupur Sal (*Shorea robusta*) forest: A sustainable way of generating income and conserving forests. *Journal of Agriculture and Food Research*, 11, p.100475.
- Chandrasiri, C., Dharmapriya, S., Jayawardana, J., Kulatunga, A.K., Weerasinghe, A.N., Aluwihare, C.P. and Hettiarachchi, D., 2022. Mitigating environmental impact of perishable food supply chain by a novel configuration: Simulating banana supply chain in Sri Lanka. *Sustainability*, 14(19), p.12060.
- Patrick, S., Mirau, S., Mbalawata, I. and Leo, J., 2023. Time series and ensemble models to forecast banana crop yield in Tanzania, considering the effects of climate change. *Resources, Environment and Sustainability*, 14, p.100138.
- Aulia, M.R., Sahputra, D., Fathin, S., Anggraini, P., Agusrianda, A., Putri, G. and Azzahra, M., 2024. Community engagement for realization of regenerative village entrepreneurial groups: Pathway to sustainable banana entrepreneurship in Alue Krueng Village, Aceh Jaya Regency. *SPEKTA (Jurnal Pengabdian Kepada Masyarakat: Teknologi dan Aplikasi)*, 5(2), pp.271-281.
- Aulia, M.R., Yuhendra, A., Zaputra, A. and Muzammil, A., 2025. Development of Local Banana Chips Business Groups Based on Regenerative Agriculture Through Integrated Marketing Communication in Alue Krueng Village, Aceh Jaya Regency. *Journal of Service Innovation*, 1(1).
- Blakeney, M., 2022. Agricultural innovation and sustainable development. *Sustainability*, 14(5), p.2698.
- Ruiz Medina, M.D. and Ruales, J., 2024. Post-Harvest Alternatives in Banana Cultivation. *Agronomy*, 14(9), p.2109.
- Campos, B.O.O., 2023. *Banana production in Venezuela: Novel solutions to productivity and plant health*. Springer Nature.
- Olivares, B.O., Vega, A., Rueda Calderón, M.A., Montenegro-Gracia, E., Araya-Almán, M. and Marys, E., 2022. Prediction of banana production using epidemiological parameters of black sigatoka: An application with random forest. *Sustainability*, 14(21), p.14123.
- Abdoussalami, A., Hu, Z., Islam, A.R.M.T. and Wu, Z., 2023. Climate change and its impacts on banana production: a systematic analysis: A Abdoussalami et al. *Environment, Development and Sustainability*, 25(11), pp.12217-12246.



- Esguera, J.G., Balendres, M.A. and Paguntalan, D.P., 2024. Overview of the Sigatoka leaf spot complex in banana and its current management. *Tropical Plants*, 3(1).
- Coral, C. and Mithöfer, D., 2023. Contemporary narratives about asymmetries in responsibility in global agri-food value chains: the case of the Ecuadorian stakeholders in the banana value chain. *Agriculture and human values*, 40(3), pp.1019-1038.
- Ruangnarong, C., Khojitmate, S., Srivorradatphisan, S., Panyathikun, N. and Chonsakorn, S., 2024. Evaluation of mechanically extracted banana fibers from pseudostem layers: a sustainable textile raw material. *Heliyon*, 10(21).