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Profitability Analysis of Greenhouse Tomato Production in Oyo State, Nigeria

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ABSTRACT

Greenhouse technology has been recognized as the best innovation in addressing issues of food insecurity, improved agricultural production, and climate change issues. Therefore, this study investigates the profitability of greenhouse tomato production in Oyo State, Nigeria. Data were collected from 60 respondents across six local government areas using a multistage sampling technique. Descriptive statistics analysis, gross margin analysis, and the Cobb-Douglas production function analysis were only used to assess the profitability as well as establish the factors affecting it. This finding shows that greenhouse tomato production is very lucrative with a gross margin of ₦10,678,978.65, and the benefit-cost ratio of 3.99 means every ₦1.00 invested yields ₦3.99. The computed annual net farm income of ₦9,331,986.65 reasserts this farming system as economically feasible irrespective of the high initial investments. Significant determinants of profitability include farm size, farming experience, and labor costs, all statistically significant at the 5% level. However, the high cost of seeds negatively affects its profitability, which stands out as an essential constraint. Some critical issues facing greenhouse tomato producers include water scarcity, high costs of production input and competition in the market. Such challenges require policy interventions, such as subsidies on agricultural inputs, support for sustainable means of irrigation and strengthening of farmers' technical knowledge. This study calls for collective action between the government, private stakeholders and researchers to scale up adoption and overcome existing barriers, all of which can help enhance rural development and national food security.

Keywords: Greenhouse technology, Tomato production, Profitability Analysis, Cobb-Douglass production function, Food security.

INTRODUCTION

Greenhouse technology is recognized worldwide for its great impact on increasing food production, conserving energy, minimizing greenhouse gas emissions, water and energy utilization, and improving the sustainability of the natural resources base (Abindaw *et al.,* 2024). However, despite these numerous benefits, its use by farmers remains limited (Abindaw *et al.,* 2024). There is also limited evidence on how this technology could boost tomato production, especially in view of challenges such as climate change and shrinking land resources (Abindaw *et al.,* 2024). This gap has led to widespread land degradation and continuous reliance on costly tomato imports (Abindaw *et al.,* 2024).

Tomato (*Solanum Lycopersicon)* is one of the most widely cultivated and consumed vegetables globally as well as in Nigeria (Gebremariam, 2015; Foraminifera Market Research, 2016). However, tomatoes can be grown across all Nigerian states. Commercial production

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is primarily concentrated in northern states like Kaduna, Bauchi, Kano, Katsina, Benue, Jigawa, and Plateau, while in the southern states like Kwara, Oyo, and Delta (Ugonna *et al.,* 2015). Tomato farming provides substantial returns to farmers to enhance their living standards, income, and job creation in the agricultural and agribusiness sectors that support national growth and development. It promotes innovation in agriculture, creates funds for reinvestment in the farming sector, and fosters rural development (Dolapo *et al.,* 2022). Available records show that approximately one million hectares of land are used for tomato farming in Nigeria and that tomatoes contribute about 18% of the average daily vegetable consumption in Nigerian homes (Dolapo *et al.,* 2022).

The Food and Agriculture Organization of the United Nations (FAOSTAT) (2020) estimated that global tomato production in 2020 was about 186,821 million tonnes produced from about 5,051,983 hectares of land. This has increased by 3.35% from 180,766 million tonnes in the previous year of 2019. China remains the global leader with an output contribution approximating 34.67%. Egypt appears fifth internationally and constitutes 3.6% of the production and leads Africa with an approximated output of 6,731.22 million tons grown on 170,862 hectares. Countries with mixed climates in North Africa, including Algeria, Tunisia, and Morocco, contributed 2.39% of the global output. In West Africa, Nigeria and Cameroon lead tomato production with outputs of 3,693.72 million and 1,246.65 million tonnes respectively, while Kenya tops East African production with 1,056.18 million tonnes (Hortoinfo Worldwide, 2020). In Ghana, the Ministry of Food and Agriculture (MoFA) estimated tomato production at 420,000 tonnes in 2019, cultivated on 47,000 hectares (MoFA, 2020; IFPRI, 2020).

In Nigeria, most tomatoes are produced in an open field, which makes them vulnerable to factors such as weather changes, pests, and diseases (Binuomote, 2021). Due to their high sensitivity to humidity, farmers often harvest tomatoes prematurely and sell them at reduced prices to prevent spoilage and recover production costs (Binuomote, 2021). Momoh (2018) agrees with this observation, stating that tomatoes, due to their relatively short shelf life, become scarce during the off-season, resulting in high prices, while during the planting season, they become readily available. Furthermore, farmers suffer a major income reduction because tomatoes are highly perishable, and they are inadequately processed and preserved. Many of the agricultural-related activities depending on the climatic factors are highly sensitive to fluctuations in rainfall and therefore act as determinants of crop preferences, planting seasons, and yields Therefore, the current increased rate of changes in climate and other factors such as pests and diseases makes it necessary to adopt high technologies in agriculture to help improve on productivity, profitability, and sustainability of tomato farming. Greenhouse technology offers a viable solution to address the challenges of open-field cultivation for high-value horticultural crops (Omoro *et al.,* 2014).

Several individuals, private entrepreneurs, research institutions, and state governments in Nigeria have initiated greenhouse technology projects (for instance, Ogun State established not less than 1,000 greenhouse units across its three senatorial districts to create employment opportunities for youth (Binuomote, 2021). Another example is the Soilless Farm Lab in Abeokuta, owned by Farmer Samson Ogbole, which produces various greenhouse tomato varieties and also trains youth interested in agriculture through a program called EyiA (Enterprise Youth in Agriculture). In Oyo State, a survey assessed the current status of greenhouse adoption; 114 greenhouses identified are primarily used for research and as nurseries within teaching and research institutions (Mijinyawa & Osiade, 2011). To meet the growing demand for tomatoes in Nigeria, production must transcend beyond subsistence open-field farming. The implementation and utilization of these technologies, particularly in large-scale greenhouse-based tomato farming, require strong support from all the tiers of the government, federal, state, and local, and private actors. Greenhouse technology, when promoted across the country, could eliminate reliance on rain-fed farming and

possibly go a long way in addressing Nigerian food insecurity.

Research on greenhouse technologies has produced diverse findings. For example, Chauhan *et al.* (2017) found that farmers possess a moderate understanding of low-cost greenhouse technology. Mijinyawa and Osiade (2011) reported that greenhouses in Oyo State are mostly owned by research institutions and are underutilized by entrepreneurs due to high construction and maintenance costs, alongside limited awareness of technology's potential. Aznar-Sánchez *et al.* (2020) noted that greenhouse technology research is predominantly technical, with only 3.6% related to social sciences, revealing the lack of knowledge on the social factors affecting greenhouse technology adoption. Additionally, Itigi-Prabhakar *et al.* (2017) conducted a multidimensional analysis of the barriers to adopting polyhouse technology and suggested strategies for its promotion. Despite all these efforts, there remains a lack of information on the cost-effectiveness, profitability, and constraints of greenhouse tomato farming in Oyo State, Nigeria.

This study aims to estimate the cost, returns, and profitability of greenhouse tomato farming in Oyo State, identify constraints faced by greenhouse tomato producers, and analyze factors influencing the use of greenhouse tomato farming in the study area.

METHODOLOGY

Study Area

The study area for this work is Oyo State, which stretches from latitude 7° N to latitude 9° N and longitude 2.8° E to longitude 4.5° E. It is bounded in the West by the Republic of Benin, in the East by Osun State, in the North by Kwara State, and in the South by Ogun State (Fig. 1). The area lies within the rainforest region and has two distinct seasons, the rainy season from April to October with an August break and dry season from November to March. The annual rainfall ranges from 1,200 – 1,300 mm. The temperatures vary from a minimum of 21°C in July to a maximum of 39°C in February (Mijinyawa & Osiade, 2011).

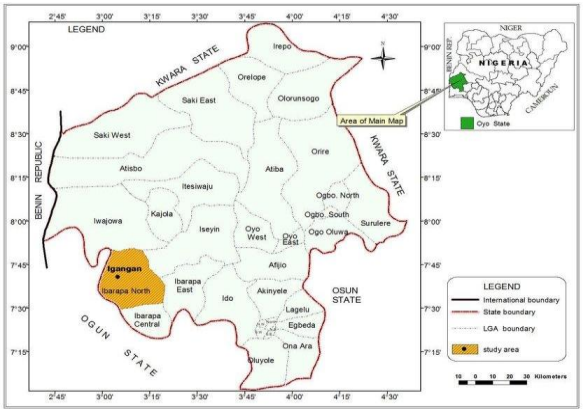

Figure 1: Map of Oyo State showing local government areas

Source of Data and Sampling Procedure

The study primarily used primary data collected through interview schedules and well-structured questionnaires administered to greenhouse tomato farmers in the study area. A multistage sampling procedure was used. In the first phase, six of the 33 Local Government Areas (LGAs) in Oyo State, namely Akinyele, Ido, Ibarapa Central, Ibarapa East, Ibarapa North, and Ibadan North Local Government were purposively selected because of the predominance of greenhouse tomato farmers in these areas. In the second stage, 10 greenhouse farmers were randomly selected from each of the selected local governments, resulting in a total sample size of 60 respondents.

Data Analysis

The study used several analytical techniques, which include descriptive statistics, Gross Margin Analysis, and Double-Log (Cobb-Douglas) Function. Descriptive statistics such as frequency distribution, mean, and percentages were used to describe the socio-economic characteristics of the respondents and to identify constraints faced by greenhouse tomato producers. The Gross Margin Analysis was used to evaluate the cost, return, and profitability of greenhouse tomato production, and the Double-Log (Cobb-Douglass) Function was used to determine the factors influencing the profitability of

greenhouse tomato farming in the study area. The function is specified as:

$InY = In\beta_o + \beta_1 InX_1 + \beta_2 InX_2 + \beta_3 InX_3 + \beta_4 InX_4 + \beta_5 InX_5 + \beta_6 InX_6 + \beta_7 InX_7 + \beta_8 InX_8 + ei.$

Where, Y = Gross margin

β_o = Constant

X_1 = Age (years)

X_2 = Household size

X_3 = Educational level

X_4 = farm size (ha)

X_5 = Farming experience (years)

X_6 = Cost of seed

X_7 = Cost of input

X_8 = Cost of labor

e_i = Error term

Profitability Metrics include:

GM = TR – TC

BCR = TR/TC

NFI = TR – (TVC + TFC)

GFI = (TC/TR) * 100

Where GM = Gross Margin, TR = Total Revenue, TC = Total Cost, NFI = Net Farm Income, GFI = Gross Farm Income, BCR = Benefit Cost Ratio, TVC = Total Variable Cost, and TFC = Total Fixed Cost.

RESULT AND DISCUSSION

Socioeconomic Characteristics of Respondents

Table 1 shows a detailed insight into the socioeconomic characteristics of greenhouse tomato farmers in Oyo State, Nigeria. From the result obtained, the majority of the farmers are within the age group of 50 – 59 years, representing 33.3% of the respondents, with an average age of 47.9 years, indicating a predominantly middle-aged farmer population. This aligns with the facts exposed in earlier research that this age group maintains physical capacity and farming competence (Binuomote, 2021; Oyetoro *et al.*, 2022). Most of the farmers have small to medium-sized households, with 53.3% having 1-3 members, and an average household of 3.56 members. This is reflective of trends in a small-scale farming system, where household size often complements hired labor (Omoare *et al.*, 2020). In terms of experience, the farmers are relatively experienced, with 38.3 percent of the farmers having been farming in greenhouse tomatoes for a period of 6–8 years, and the average farmer has been in farming for a period of 7.25 years. This supports the previous findings that experienced farmers are more likely to shift to greenhouse farming, leveraging previous knowledge (Anifowose *et al.*, 2022). The farm size varies, with 40.0% of the respondents managing small farms of 1-3 hectares and an average of 4.97 hectares. These figures are consistent with literature suggesting that greenhouse farming in the region is dominated by small to medium-scale operators due to land and capital constraints (Omoare *et al.*, 2020).

The gender distribution shows that greenhouse farming is male-dominated, with 63.3% of the respondents being male, while 36.7% are female. This is consistent with the earlier study showing that males had increased participation in farming as compared to females because of enhanced availability of resources and decision-making power (Oyediran *et al.*, 2020). Most of the farmers are married, accounting for 85.0% of the respondents. This implies that there are well-established families that are capable of providing labor support and resource mobilization for greenhouse farming activities, as Anifowose *et al.* (2022). From the educational point of view, most of the farmers are qualitatively educated, and 58.3 percent of the respondents had attained tertiary education, which could assist them in embracing modern techniques and technology in farming. This is underpinned by research pointing at the importance of education in improving the adoption of improved practices in agriculture (Binuomote, 2021; Oyetoro *et al.*, 2022). These socioeconomic attributes give a general picture of the greenhouse tomato farmers in the study area concerning their experience, their level of education, and the size of their households.

Table 1. Socio-economic characteristics of greenhouse tomato farmers in Oyo State

Variable	Category	Frequency	Percentage	Mean
Age (years)	20-29	6	10.0	47.9
	30-39	9	15.0	
	40-49	15	25.0	
	50-59	20	33.3	
	60 and above	10	16.7	
	Total	**60**	**100**	
Household size (number)	1-3	32	53.3	3.56
	4-5	21	33.3	
	6 and above	7	13.4	
	Total	**60**	**100**	
Years of experience	3-5	21	35.0	7.25
	6-8	23	38.3	
	9 and above	16	26.7	
	Total	**60**	**100**	
Farm size (hectares)	1-3	24	40.0	4.97
	4-6	20	33.3	
	10 and above	16	26.7	
	Total	**60**	**100**	
Gender	Male	38	63.3	
	Female	22	36.7	
	Total	**60**	**100**	
Marital status	Married	51	85.0	
	Single	9	15.0	
	Total	**60**	**100**	
Educational background	Secondary	25	41.7	
	Tertiary	35	58.3	
	Total	**60**	**100**	

Source: Field survey, 2024

Analysis of Cost, Returns, and Profitability of Greenhouse Tomato Production in the Study Area

The analysis of cost, returns, and profitability of greenhouse tomato production in the study area is shown in Table 2. It provides an insight into the farming system's performance over a year. The total variable cost (TVC) for the year is ₦1,773,381.85, representing the recurring annual production expenses and the Total fixed cost of ₦1,346,992.46 due to the cost of the greenhouse. Altogether, the total cost (TC) for the year is ₦3,120,374.31. The greenhouse system generates a total revenue (TR) of ₦12,452,360.50 annually, which shows that it is capable of earning a significant income. Gross margin, which is obtained by subtracting the total variable cost from the total revenue, is ₦10,678,978.65, indicating enough income after incurring operational costs. The net farm income (NFI) calculated is ₦9,331,986.19, which provides the strong system's profitability in a year.

The farm gross ratio (FGR) for the greenhouse tomato enterprises was found to be 0.2506, which shows that 25.06% of revenue is used to cover production cost, leaving 74.94% as profit, which is in line with Godwin (2011), who states that a Gross Ratio of less than one is desirable for any farm business. Therefore, based on the information shown in Table 2, it is obvious that greenhouse tomato production was profitable in the study area. From the analysis, the benefit-cost ratio (BCR) of 3.99 indicates that every ₦1 invested returns ₦3.99, confirming the strong viability and profitability of greenhouse tomato farming under the present production system.

Table 2: Cost, Return, and Profitability Analysis

Category	**Total Cost**	**Percentage**
A. Cost of production		
1. Variable Cost		
Cost of seed	140,025.50	7.9
Nutrients and Fertilizer	213,991.35	12.1
Cost of labor	747,170.225	42.1
Transportation cost	391,196.05	22.1
Other Variable cost	280,998.55	15.8
Total Variable Cost	**1,773,381.85**	**100**

2. Fixed Cost		
Annual Depreciation of Greenhouse	1,230,315.01	91.3
Other Fixed Cost	116,677.45	8.7
Total Fixed Cost	**1,346,992.46**	**100**
Total Cost	**3,120,374.31**	
Total Revenue	**12,452,360.50**	
Gross Margin		
GM = TR - TVC	**10,678,978.65**	
NET FARM INCOME		
NFI = TR - TC	**9,331,986.19**	
Farm Gross Ratio (FGR)	**0.2506**	**25.06**
Benefit-Cost Ratio (BCR)	**3.99**	

Source: Field Survey, 2024

Regression Results of Factors influencing the profitability of Greenhouse Tomato Production in the Study Area

Table 3 below presents the Cobb-Douglas regression result of factors influencing the profitability of greenhouse tomato production in Oyo state, Nigeria. The model shows a good fit, the value of R-square equals 0.882, and the adjusted R-square of 0.863, meaning that about 88% of the variation in profitability in the study can be explained by the independent variables. As expected, the F-statistic of the obtained model is equal to 47.540; therefore, we can conclude that the model is highly reliable. Farm size has a positive and significant effect on profitability at the 5% level, with a unit increase in ln(farm size) leading to a 0.225 increase in ln(profitability). These findings suggest that large-scale operation of farming is efficient because it increases returns on resources, hence enhancing farmers' profitability. Farming experience significantly and positively impacts profitability at the 5% level. A one-unit increase in ln(farming experience) increases ln(profitability) by 3.115. This suggests experience in ways of improving techniques of production, efficient management of resources, and even reducing loss. Cost of labor also has a positive and significant effect on profitability at the 1% level. A unit increase in ln(labor cost) increases ln(profitability) by 2.754. This implies that investment in labour resources, including skilled workers or adequate labour allocation, enhances yield and increases profit margin.

Conversely, the cost of seed negatively influences profitability and is significant at the 5% level. A unit increase in ln(cost of seed) reduces ln(profitability) by 0.864. This implies that suppliers of seeds impose a financial burden, hence reducing the profit of greenhouse tomato farmers. Other variables, including age, household size, educational level, and cost of inputs, are not statistically significant.

Age, household size, educational level, and cost of other inputs all showed insignificant effects. Age has a positive coefficient but is not significant, with a one-unit increase in ln(age) increasing ln(profitability) by 0.018. This implies that profitability in greenhouse tomato does not depend on the farmer's age. Therefore, technical knowledge, innovation, and access to resources matter more than whether the farmer is young or old. Household size has a negative coefficient but is not significant (0.026), suggesting that family labor availability does not contribute meaningfully in greenhouse systems where hired or skilled labor is more effective. Educational level also shows a negative but insignificant (-0.226), meaning that formal education does not directly translate to higher profitability in greenhouse tomato production; instead, practical training and experience are more valuable. Similarly, the cost of other inputs has a negative but insignificant coefficient (-0.501), suggesting that while these costs add to production expenses, they do not critically determine profitability variations across farmers in the study area.

Consequently, the findings show the need to scale up, the need to use farming experience, and the need to control costs of inputs to improve profitability. Farmers

are encouraged to optimize costs on seeds and ensure they spend more on skilled workers in order to gain more. This substantial and positive influence of farm size and farming experience implies that expansion of land rights and capacity enhancement initiatives for farmers will be productive in boosting greenhouse tomato production.

Table 3: Regression Results of Factors influencing the profitability of Greenhouse Tomato Production in the Study Area

	Cobb-Douglas			
Variable	Coefficient (β)	Std Error	t-value	Sig
(Constant)	23.799***	2.182	10.906	0.000
Age	0.018	0.080	0.220	0.827
Household size	-0.026	0.154	-0.169	0.867
Educational level	-0.226	0.262	-0.860	0.394
Farm size	0.225**	0.109	2.065	0.044
Farming experience	3.115**	1.355	2.299	0.022
Cost of seed	-0.864**	0.375	-2.304	0.021
Cost of input	-0.501	0.386	-0.720	0.475
Cost of labor	2.754***	1.019	2.703	0.009
R-Square (R^2)	**0.882**			
Adjusted R-Square (R^2)	**0.863**			
F	**47.540**			

*., **., *** means significant at 10%, 5%, and 1% levels, respectively
Source: Field Survey, 2024

Constraints Faced by Greenhouse Tomato Producers in the Study Area

Table 4 shows the constraints faced by greenhouse tomato producers in the study area, divided into production, marketing, and financial challenges. According to the study on production challenges, water supply is the most significant challenge, which affects 38.3% of the farmers. This suggests the need for an efficient irrigation system since water is required for satisfactory crop productivity in a protected environment. Previous studies, such as Ojo *et al*. (2021) and Adeolu *et al.* (2020), also found water scarcity as the limiting factor to greenhouse farming and therefore the need for a sustainable water management system for production throughout the year. In marketing, competition poses the greatest challenge, faced by 38.3% greenhouse farmers. This also implies that farmers struggle to hold market share in the market, especially within a flooded market, which will, in turn, lead to increased prices that affect the farmer's profitability. Oni and Adegbite (2020) opined that due to the numerous small-scale producers in the tomato markets, there is price instability and reduced profit margins; therefore, there is a need for strategic marketing and market access to value chains that provide stable markets and better market prices.

Financially, the high cost of inputs is the most pressing issue, faced by 41.7% of farmers. Seeds, fertilizers, and other essential inputs constitute a major cost in production since a producer is unable to invest in other aspects of production. Oyetoro *et al.* (2022) and Binuomote (2021)

supported this claim, stating that the high capital cost and cost of production in operating greenhouse farming systems are major challenges to the adoption and sustainability of greenhouse farming in Nigeria. Mitigation strategies recommended for these financial constraints include subsidies, group purchasing, and access to affordable credit. These results emphasize the need for interventions to address water supply challenges, enhance market access, and subsidize agricultural input to sustain greenhouse tomato production in the study area.

Table 4: Constraints Faced by Greenhouse Tomato Producers in the Study Area

Production Challenges	**Frequency**	**Percentage (%)**
Climate issue	12	20
Pest and disease control	13	21.7
Soil management	12	20
Water Supply	23	38.3
Total	**60**	**100**
Marketing Challenges		
Competition	23	38.3
Low prices	13	21.7
Market access	12	20
Post-harvest losses	12	20
Total	**60**	**100**
Financial Challenges		
Access to credit	12	20
High cost of input	25	41.7
Price fluctuation	23	38.3
Total	**60**	**100**

Source: Field Survey, 2024

CONCLUSION AND RECOMMENDATION

This study on the profitability analysis of greenhouse tomato production in Oyo State, Nigeria, analyzes the economic viability of greenhouse farming and its influencing factors. The findings indicate that greenhouse tomato production is highly profitable, with a benefit-cost ratio of 1.54 and an average annual net income of ₦4,364,762.94. The study identifies critical socioeconomic determinants such as farm size, farming experience, and labor cost as significant contributors to profitability, while the cost of seed negatively impacts returns. Predominantly middle-aged male farmers with substantial farming experience dominate the greenhouse farming, highlighting socioeconomic trends in greenhouse tomato production.

The regression analysis shows that farm size, and therefore experience with farming, has a positive effect on profitability through enabling economies of scale and effective resource management. We also found that the cost of labor was significantly affecting profitability because human resources were crucial for maximizing production. As a result, high seed costs emerged as a major constraint, reducing net return and bearing a financial burden for farmers.

The problems encountered by greenhouse tomato producers include water scarcity, high input costs, and market competition. Specifically, water supply issues pose the greatest risks, and therefore, there is an important need for reliable irrigation systems to enable year-round production. The limitation of farmers' ability to achieve maximum return is due to the financial challenges, especially the cost of inputs such as seeds and fertilizers, and market competition with regard to pricing and profitability.

Thus, this study recommends that the government should give adequate support to the greenhouse tomato farmers. Improve female participation in training and provide financial incentives, and develop policies related to gender disparity. Supporting sustainable irrigation systems investment to alleviate water scarcity, subsidizing seed, fertilizers, and equipment; reducing input costs; and improving market access through integration along the value chain and strength in export markets. Altogether, these measures will ensure that greenhouse tomato farming remains profitable,

sustainable, and capable of contributing to food security and economic growth in Oyo State and beyond.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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تحليل ربحية إنتاج الطماطم في البيوت المحمية في ولاية أويو، نيجيريا

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ملخص

تم الاعتراف بتكنولوجيا الدفيئة كأفضل ابتكار في معالجة قضايا انعدام الأمن الغذائي وتحسين الإنتاج الزراعي وقضايا تغير المناخ. لذلك، تبحث هذه الدراسة في ربحية إنتاج الطماطم المسببة للاحتباس الحراري في ولاية أويو، نيجيريا. تم جمع البيانات من 60 مستجيبا عبر ست مناطق حكومية محلية باستخدام تقنية أخذ العينات متعددة المراحل. تم استخدام تحليل الإحصاءات الوصفية وتحليل الهامش الإجمالي وتحليل دالة إنتاج كوب دوغلاس فقط لتقييم الربحية وكذلك تحديد العوامل المؤثرة عليها. تظهر هذه النتيجة أن إنتاج الطماطم المسببة للاحتباس الحراري مربح للغاية بهامش إجمالي قدره 10,678,978.65 ين، ونسبة الفائدة إلى التكلفة البالغة 3.99 تعني أن كل 1.00 ين إسترليني مستثمر ينتج 3.99 جنيه إسترليني. يعيد صافي دخل المزرعة السنوي المحسوب البالغ 9,331,986.65 جنيه إسترليني تأكيد أن هذا النظام الزراعي ممكن اقتصاديا بغض النظر عن الاستثمارات الأولية المرتفعة. تشمل المحددات المهمة للربحية حجم المزرعة والخبرة الزراعية وتكاليف العمالة، وكلها ذات دلالة إحصائية عند مستوى 5٪. ومع ذلك، فإن التكلفة العالية للبذور تؤثر سلبا على ربحيتها، والتي تبرز كقيد أساسي. تشمل بعض القضايا الحرجة التي تواجه منتجي الطماطم المسببة للاحتباس الحراري ندرة المياه وارتفاع تكاليف مدخلات الإنتاج والمنافسة في السوق. وتتطلب هذه التحديات تدخلات في مجال السياسات، مثل تقديم الدعم على المدخلات الزراعية، ودعم وسائل الري المستدامة، وتعزيز المعرفة التقنية للمزارعين. تدعو هذه الدراسة إلى العمل الجماعي بين الحكومة وأصحاب المصلحة من القطاع الخاص والباحثين لتوسيع نطاق التبني والتغلب على الحواجز القائمة، وكلها يمكن أن تساعد في تعزيز التنمية الريفية والأمن الغذائي الوطني.

الكلمات الدالة: تقنية البيوت المحمية، إنتاج الطماطم، تحليل الربحية، دالة الإنتاج كوب دوغلاس، الأمن الغذائي.

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