



**ECONOMIC ANALYSIS OF SELECTED DRY SEASON VEGETABLE FARMING ALONG
THE RIVER BANKS OF MAKURDI LOCAL GOVERNMENT AREA OF
BENUE STATE, NIGERIA**

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ABSTRACT

The study examined the economic analysis of dry season vegetables farming along the riverbank of Makurdi Local Government Area of Benue State. A multi-stage sampling technique was employed in selecting 100 respondents. Data were collected using structured questionnaire and analyzed using descriptive statistics and inferential statistics. The results revealed that respondents were active and young farmers with a mean age of 37 years, married (74%), and moderately experienced (8.7 years) smallholder farmers with an average farm size of 1.2 hectares, predominantly female (58%), with limited formal education while tomatoes (51%) is the dominant vegetable cultivated in the area. The profitability analysis revealed that the mean quantity of vegetables produced was 2,837kg with a mean total cost of ₦41,780 incurred in production while average revenue realized sales was ₦324,910 per month. The mean gross margin stood at ₦283,130, therefore, dry season vegetable farming is profitable in the study area. The results of regression analysis, profitability (1269.837) and source of capital (206.8673) both positively influence the productivity of dry season farming at 1% and 10% probability level respectively. Dry season vegetable farming contributed between 1 to 2 income sources to household income recorded by 93% of the respondents. The study further revealed that high cost of inputs (50%), poor access to credit (13%), pest and disease attack (10%), poor access to market (10%), inadequate water supply (9%), land tenure problem (5%), and lack of extension services (3%) were the challenges affecting dry season vegetable farming. The study concludes that with improved institutional support, affordable inputs, and efficient credit delivery systems, dry season vegetable farming has the potential to significantly improve food security, reduce unemployment, and enhance rural income generation in Makurdi LGA and beyond. The study therefore recommended that vegetable farmers through the power of cooperative should invest in the construction and maintenance of small-scale irrigation systems, and water pumps along riverbank communities to stabilize water supply amongst others.

Keywords: Economic, Analysis, Selected, Dry-season, Vegetable, Farming.

INTRODUCTION

Agriculture remains the backbone of Nigeria's rural economy, employing approximately 70% of the population and contributing significantly to the country's Gross Domestic Product (GDP) (Adebayo and Ojo, 2022). Within the agricultural sector, vegetable production represents an essential component that contributes to food security, nutrition, and income generation, particularly for small-scale farmers (Olajide *et al.*, 2021). Benue State, often referred to as the "Food Basket of the Nation," has considerable agricultural potential due to its favorable climatic conditions and fertile soil along the Benue River (Iorlamenet *et al.*, 2023). The state is strategically positioned with abundant water resources, including the Benue River, which creates opportunities for irrigated farming, especially during the dry season when most agricultural activities typically decline in other parts of the country. Vegetable farming of recent is a growing aspect of agriculture. The awareness to consume vegetables for good health is increasing as they are good sources of minerals and vitamins. As reported by Teranet *al.* (2023), vegetables play a significant role in supplying the essential minerals, vitamins and fiber not present in large quantities in starchy staple foods. Pepper, tomato and African spinach are known to



enrich some diets with nutrients including lipids, carbohydrates and vitamins and these crops are important for almost every household (Weye *et al.*, 2024). According to (Ogunjimi, 2016) farmers adopt the production of vegetables due to the changing food habits of people and the increasing awareness of individuals towards balanced diet and concept of nutritional security. The contribution of vegetables to human health cannot be overstated, tomato for instance contain lycopene, a valuable anti-cancer and anti-cardiovascular chemical, carrots contain carotene (precursor of the essential vitamin A), and many fresh vegetables contain vitamin C. Vegetables are valuable in maintaining the alkaline reserve of the body (Teranet *al.* (2023). The report of Food and Agriculture Organization, 2009) stated that vegetables are a good source of income for farmers and offers opportunities for the disables to earn a living.

There are two basic seasons in Nigeria which are the rainy (April to October) and the dry (November to March) seasons. During the raining season farmers are normally busy with planting while they are less busy on the farm during the dry season. Therefore, they resulted to alternate farming along water bodies such as the riverbank as this serves as an alternative source of income during the period. Weye *et al.* (2024) opined that dry season farming has increased tremendously because of increasing demand for vegetables and other food crops during off-farm season. Benue state blessed with one of the biggest rivers in Nigeria has a great potential for the production of vegetables during the dry season. The practice of dry season vegetable farmingsometimes called vegetable forcing is the farming of vegetable crops outside the normal growing season using certain infrastructures such as greenhouses, irrigation, watering can (Teranet *al.* (2023).

Dry season vegetable farming has emerged as a significant agricultural practice along the riverbanks of the Benue River in Makurdi Local Government Area. This practice involves the cultivation of vegetables during the dry season (November to April) when rainfall is minimal or absent, utilizing the proximity to water sources for irrigation (Agberand Anzaku, 2022). Common vegetables cultivated include amaranth, sorrel, okra, peppers, tomatoes, onions, and leafy greens, which serve both domestic consumption needs and commercial purposes. The economic significance of this dry season vegetable farming cannot be overstated. According to Ityavyar and Gbaeren (2023), dry season farming provides an opportunity for year-round agricultural production, ensuring continuous income for farmers and consistent food supply to local markets. Additionally, vegetables cultivated during the dry season often command higher market prices due to reduced supply from rain-fed agriculture, potentially increasing profit margins for farmers engaged in this practice (Mshelia *et al.*, 2022).

This study therefore seeks to conduct a comprehensive economic analysis of selected dry season vegetables farming along the river bank of Makurdi Local Government Area of Benue State. By examining the costs, returns, constraints, and opportunities associated with this farming practice, this research aims to provide valuable insights for policymakers, agricultural extension workers, and the farmers themselves, ultimately contributing to enhanced productivity, profitability, and sustainability of dry season vegetable farming in the region.

MATERIALS AND METHODS

Study Area

The study was conducted in Makurdi Local Government Area (LGA) of Benue State, Nigeria. Makurdi LGA is located between latitude 7°38' and 7°50' North and longitude 8°24' and 8°38' East. It is situated in the North Central region of Nigeria and serves as the capital of Benue State. The LGA covers an area of approximately 804 square kilometers. Makurdi LGA is bounded by Guma LGA to the north, Gwer LGA to the east, Gwer West LGA to the south, and Tarka LGA to the west. The River Benue, which is the second largest river in Nigeria, flows through Makurdi, dividing the town into north and south banks. The riverbank areas of Makurdi are characterized by fertile alluvial soils, which make them ideal for vegetable cultivation, especially during the dry season when farmers utilize the residual moisture and irrigation techniques. The climate of Makurdi is tropical sub-humid with distinct wet and dry seasons. The wet season typically runs from April to October, while the dry season spans from November to March. Annual rainfall ranges from 1,000 to 1,500 mm, and temperatures average between 23°C and 35°C throughout the year. These climatic conditions, coupled with the proximity to River Benue, create favorable conditions for dry season vegetable farming. The study focused specifically on



the riverbank areas including North Bank, Wadata, Wurukum, and Modern Market areas where dry season vegetable farming is predominantly practiced. These areas are known for the cultivation of various vegetables including amaranth (green), okra, pepper, tomato, garden egg, and water leaf during the dry season.

Sampling Techniques and Sample Size

A multi-stage sampling technique was employed to select respondents for the study. The sampling procedure was carried out as follows: Purposive selection of the four major riverbank farming clusters in Makurdi LGA (North Bank, Wadata, Wurukum, and Modern Market) due to their high concentration of dry season vegetable farmers. Finally, a proportion of 25% (0.25) was used to draw the sample from the sample frame; this gives every member of the population a fair chance of being selected. Thus, a total of 100 respondents was selected and used for this study. The proportionate distribution of respondents across the four clusters is presented in Table 1.

Table 1: Proportionate Distribution of Respondents across Riverbank Farming Clusters

Riverbank Farming Cluster	Population	Proportion (0. 25%)	Sample size
North Bank	124	0.25	31
Wadata	92	0.25	23
Wurukum	104	0.25	26
Modern Market	80	0.25	20
Total	400	0.25	100

Source: BNARDA 2025

Data Collection and Analysis

Primary data were collected using structured questionnaires. The questionnaire was designed to gather information on the farmers' access to credit, the impact of credit on their productivity, income levels, and the challenges they face in obtaining credit. The data were analyzed using both descriptive and inferential statistics. Specifically, descriptive statistics such as frequencies, percentages were used, while gross margin analysis and linear regression were the inferential statistics used.

Model and Variable Specification

Gross margin

Gross margin analysis model was used to examine the profitability of dry season vegetable farming, the model is stated thus:

$$GM = TR - TVC \dots\dots\dots(1)$$

$$NFI = GM - TFC \dots\dots\dots(2)$$

Where:

GM = Gross Margin (₦/ha)

TR = Total revenue from dry season vegetable farming (₦/ha)

TVC = Total variable cost incurred in dry season farming (₦/ha)

NFI = Net Farm Income (₦/ha)

TFC = Total fixed cost incurred in dry season farming (₦/ha)

Linear regression analysis

The following model was used to analyze the factors affecting dry Season Vegetable farming. The general form of regression model is shown below:

$$Y = f(X_1, X_2, X_3, X_4, X_5, \dots\dots\dots X_n, e) \dots\dots\dots(3)$$

The explicit form of the linear regression is as follows:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 e \dots\dots\dots(4)$$

Where:

Y = Productivity of dry season vegetable (kilogrammes)

β_0 = Constant term

β_1 to β_8 = Coefficients of the independent variables

X_1 = Age of farmer (years)

X_2 = Profitability (amount in Naira)



X_3 = Irrigation management (years of formal education)

X_4 = Farming experience (years)

X_5 = Household size (number)

X_6 = Monthly income (₦)

X_7 = Source of capital (number of access to capital)

X_8 = Fertilizer type (kg)

X_9 = Fertilizer type (kg)

ε = Error term

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Dry Season Vegetable Farmers

The socioeconomic characteristics of the respondents as contained in Table 2 provide insight into the background and demographic profile of the vegetable farmers operating along the riverbanks in the study area. The result indicated that the majority (56.0%) of the respondents fell within the age range of 29-39 years, while 16.0%, 14.0% and 11.0% were within 51-60, 40-50 and 29 years or below, respectively. The mean age of the respondents was 37 years. This suggests that most dry season vegetable farmers are within the economically active and productive age group, capable of undertaking the physically demanding activities associated with dry season vegetable farming. The mean age is in agreement with the result of Weye *et al.* (2024) who found a mean age of 37 years for dry season vegetable farmers in Makurdi Local Government Area of Benue State. According to Mwangi and Kariuki (2015), younger farmers typically demonstrate greater willingness to adopt innovative farming techniques that enhances productivity.

Furthermore, on the sex distribution of the respondents, more than half (58%) of the respondents were female, while males constituted 42%. This finding implies that women are more involved in dry season vegetable farming along the riverbanks in the study area. This could be likely due to its short production cycle, quick income return, and its compatibility with household responsibilities which encourage more female. On the marital status, majority (74%) of the respondents were married, while 16% were single and 10% widowed. This implies that most of the dry season vegetable farmers in the study area are married. The dominance of married individuals suggests a greater level of household responsibility, which may encourage engagement in farming as a source of family income and food security. This conformed to the report of Teran *et al.* (2023) who found that 68% of dry season vegetable farmers are married and attributed the dominance to the responsibility of feeding and catering for the welfare of the households.

The distribution of respondents based on the educational level revealed that a significant portion (57%) of the dry season vegetable farmers had no formal education, 30% attained primary education, 12% secondary, and only 1% tertiary education. This implies that the majority of the farmers are low-literate individuals, which could limit their access to modern farming techniques, credit, and record-keeping, thereby affecting productivity and profitability. The household size of the respondents shows that about 80% of respondents had households of five or more members, while 20% had four or fewer people in their households. The mean household size of the respondents stood at 7 people. This implies that the respondents have large household size. Large household sizes may provide more family labour for farming operations, especially during peak periods, thus reducing dependency on hired labour and reducing overall cost of production, thus increasing profitability.

The distribution of the respondents on farming experience revealed that majority (77.0%) had between 6-16 years of experience, while 12.0% were into dry season vegetable farming for 5 years or less, 11.0% had 17-27 years of experience with an average farming experience of 8.7 years. This indicates that most respondents are moderately experienced, suggesting that they possess practical knowledge of dry season vegetable production and marketing dynamics. This experience can be crucial in resources use efficiency that can increase productivity. This is similar to the result of Weye *et al.* (2024) who found a slightly higher farming experience of 10 years for dry season vegetable farmers in Makurdi Local Government Area of Benue State. On farm size, most (94%) of respondents operated on 1 to 2 hectares, while only 6% cultivated between 3 to 4 hectares with a mean of 1.2 hectares. This



shows that dry season vegetable farming in the area is dominated by small-scale producers. The scale of farming may limit total productivity but can allow intensive cultivation and efficient resource management. Similarly, Ali and Deininger (2015) found that very small farm sizes can constrain economies of scale in irrigation investment and marketing. Result on source of labour reveals that large proportion (91%) relied on hired labour, while 9% used family labour. This could be attributed to the fact that vegetable farming in the study area is labour-intensive, requiring more manpower for activities such as land preparation, watering, and harvesting.

More so, the most commonly cultivated vegetable by the respondents was tomato (51%), followed by cabbage (19%), spinach (16%), amaranthus (12%), and onion (2%). This high cultivation of tomatoes in the study area could be due to its high demand in the local markets reducing the need for longer transportation which can reduce its quality as the crop can easily be deteriorated. This distribution reflects the farmers' preference for vegetables with high market demand and profitability, especially tomatoes.

Table 2: Distribution of the Respondents on Socioeconomic Characteristics (N=100)

Variables	Frequency (F)	Percentage	Mean
Age (Years)			37
≤ 29	11	11.0	
29-39	56	56.0	
40-50	14	14.0	
51-60	16	16.0	
Sex			
Male	42	42.0	
Female	58	58.0	
Marital Status			
Single	16	16.0	
Married	74	74.0	
Widowed	10	10.0	
Educational Level (Years)			
No formal education	57	57.00	
Primary	30	30.00	
Secondary	12	12.00	
Tertiary	1	1.0	
Household Size (Number of People)			
≤4	20	20.0	
≥5	80	80.0	7 Persons
Farming Experience (years)			
≤5	12	12.0	
6-16	77	77.0	9 Years
17-27	11	11.0	
Farm size (Hectares)			
1-2	94	94.0	
3-4	6	6.0	1.2
Source of labour			
Family	9	9.0	
Hired	91	91.0	
Type of vegetable grown			
Tomatoes	51	51.0	
Cabbage	19	19.0	
Amarathus	12	12.0	
Spinach	16	16.0	
Onions	2	2.0	

Source: Field Survey, 2025.



Profitability of Dry Season Vegetable Farming

The gross margin analysis was used to assess the profitability of dry season vegetable farming in the study area by comparing total revenue and variable costs. The result presented in Table 3 revealed that the mean quantity of vegetables produced was 2,837kg, with an average cost of ₦41,780 incurred in production while average revenue realized from vegetable sales was ₦324,910 per month. The mean gross margin stood at ₦283,130. Since the total revenue generated is greater than the total variable costs and gross margin is positive, it therefore implies that dry season vegetable farming is profitable in the study area. This clearly shows that dry season vegetable farming in the study area is a profitable enterprise, capable of improving farmers' income and livelihood. Therefore, the null hypothesis which states that dry season vegetable farming along the riverbank in Makurdi Local Government Area is not profitable is hereby rejected.

Table 3: Gross Margin Analysis on Profitability of Dry Season Vegetable Farming

Variables	Obs	Mean	Std. Dev.	Minimum	Maximum
Quantity produced (kg)	100	2837	1177.367	400	6500
Cost (₦)	100	41780	40392.91	7000	150000
Revenue(₦)	100	324910	230145.7	150000	2000000
Gross margin (₦)	100	283130	225173.2	0	1973000

Source: Field Survey, 2025.

Factors Influencing Dry Season Vegetable Productivity

The regression analysis on the factors influencing dry season vegetable farmers productivity is presented in Table 4. The model recorded an R-squared value of 0.455, indicating that approximately 45.5% of the variation in dry season vegetable productivity is explained by the independent variables included in the model. The F-statistic of 7.44 with a p-value of 0.0000 suggests the overall significance of the model, meaning that the included variables collectively have a significant effect on productivity. Specifically, it was revealed that the coefficient of profitability (1269.837) was positive and highly significant at ($P < 0.01$). This indicates a strong positive relationship between profitability and productivity of dry season vegetable farmers. This could be due to the fact that higher profits motivate farmers to expand production and adopt improved practices, which enhances output. Profitability serves as a key incentive in sustaining vegetable production among the farmers.

Furthermore, the coefficient of source of capital (206.8673) was statistically significant at the ($P < 0.10$) and positively related to productivity. This implies that increase in dry season vegetable farmers' sources of income will lead to increase productivity by 206.8673 units *ceteris paribus*. This could be due to the fact that farmers with better access to capital whether from personal savings, loans, or cooperative societies can afford quality inputs such as seeds, fertilizer, and irrigation equipment that improve output. Generally, the results suggest that financial capacity (capital access) and economic incentives (profitability) are the most critical drivers of productivity in dry season vegetable farming in the study area.



Table 4: Factors Influencing Dry Season Vegetable Farmer's Productivity

Variables	Coef.	St. Err.	t-stat	P> t
Source of capital	206.8673*	120.6954	1.71	0.090
Profitability	1269.837***	321.7275	3.95	0.000
Irrigation management	14.94436	306.3355	0.05	0.961
Improved seeds	105.3433	405.5415	0.26	0.796
Fertilizer type	-304.6603	260.6209	-1.17	0.246
Monthly income	0.0245888	0.0181679	1.35	0.179
Age	7.791043	8.951253	0.87	0.386
Household size	-15.18985	26.00831	-0.58	0.561
Farming experience	8.434889	17.53544	0.48	0.632
Constant	685.7801	1157.838	0.59	0.555
Mean dependent var	6249213.49	SD dependent var	62492134.9	
R-squared	0.4554	Number of obs	100	
Adj R-squared	0.3942			
F-test	7.44	Prob > F	0.0000	
Root MSE	916.4			

*** Significant at 1%, ** Significant at 5%, * Significant at 10%

Source: Field Survey, 2025.

Contribution of Dry Season Vegetable Farming to Household Income

Table 5 assesses how much vegetable farming contributes to the overall household income of respondents. The result revealed that majority (93%) of respondents indicated that dry season vegetable farming contributed between 1 to 2 income sources to their household earnings, while only 7% reported 3 to 4 income sources, with a mean value of 1.89. This implies that dry season vegetable farming is a major contributor to household income among the respondents. For most farmers, vegetable production serves as either the primary or secondary source of livelihood, helping them meet household expenses, pay for children's education, and improve food security. This result highlights the economic importance of vegetable farming as a key source of cash income and employment, especially during the dry season when other farming activities are minimal. This is in line with the findings of McCullough *et al.* (2017) who found that dry season vegetable production helps smooth income flows throughout the year, reducing the pronounced income seasonality typical in rain-fed agricultural systems.

Table 5: Contribution of Dry Season Vegetable Farming to Household Income

Contribution	Frequency (F)	Percentages	Mean (x)
1-2	93.0	93.0	1.89
3-4	7.0	7.0	

Source: Field Survey, 2025.

Challenges Faced by Dry Season Vegetable Farmers

The result of the challenges faced by dry season vegetable farmers in the study area is presented in Table 6. Specifically, high cost of inputs was reported by half (50%) of the respondents as the major challenge to dry season vegetable farming. The high cost of essential inputs such as fertilizer, improved seeds, pesticides, and water-pumping equipment limits farmers' ability to optimize production and increase profitability. Rising input prices reduce profitability and discourage expansion. According to Midmore and Jansen (2003) input availability fluctuates seasonally in supply. Poor access to credit was reported by 13% of the respondents as another challenge to dry season vegetable farming. This could be attributed to lack of credit and money lending institutions in the area, even the few accessible ones charged high interest rate and request for collateral which the farmers can provide. This poor access to affordable credit restricts farmers' capacity to invest in quality inputs and improved technology. This challenge aligns with the earlier results, where capital availability was a significant factor influencing productivity. Furthermore, a pest and disease attack (10%) was also a challenge to dry season vegetable farming. Pests and diseases cause yield losses which reduce productivity. They also lead to increase in



production costs due to the need for chemical control, this reduce profitability. This conformed to the report of Weye *et al.* (2024) who found that high cost of pesticide and other agrochemicals exposed crops to pest and disease attack which reduce productivity.

Another challenge identified by the respondents was poor access to market (10%). This could be attributed to inadequate market information, poor market infrastructure, low farm-gate prices, and lack of reliable buyers. These factors reduce farmers' income and make vegetable farming less attractive. Similarly, Weye *et al.* (2024) reported that dry season vegetable farmers in Makurdi Local Government Area of Benue State were faced with problem of poor marketing channel which lead to damage and rotten of produce.

Inadequate water supply was reported by 9% of the respondents. This could be due to inadequate irrigation facilities within the area. Despite being riverbank farmers, irregular water availability or breakdown of irrigation equipment during the dry season can disrupt production and lead to crop losses. This is in line with Shah *et al.* (2013) who found that water scarcity increases as the dry season progresses, creating competition among water users.

The result further shows that a land tenure problem (5%) was another challenge identified by the respondents. Land ownership problem particularly along riverbanks, discourages long-term investment in land improvement and irrigation infrastructure. Lack of extension services was the least challenge identified by only 3% of the respondents. Extension agents help in the dissemination of information and innovations to the farmers. The absence of regular contact with agricultural extension agents limits farmers' access to information on modern farming techniques, pest control, and input utilization, thereby affecting productivity.

Table 6: Challenges Faced by Dry Season Vegetable Farmers

Challenges	Frequency (F)	Percentages
High cost of inputs	50	50.0
Pest and disease attacks	10	10.0
Inadequate water supply	9	9.0
Poor access to credit	13	13.0
Poor access to market	10	10.0
Land tenure problems	5	5.0
Lack of extension services	3	3.0

Source: Field Survey, 2025.

CONCLUSION AND RECOMMENDATION

The study concludes that dry season vegetable farming is a profitable and economically viable enterprise that plays a significant role in enhancing the income and livelihood of households in the study area. Also, profitability and access to capital are the most significant factors influencing farmers' productivity. This underscores the importance of financial empowerment and market incentives in improving output levels. Furthermore, the contribution analysis shows that vegetable farming is a major source of household income, providing substantial financial support during the dry season when other agricultural activities are limited. Despite its economic importance, the enterprise is faced with multiple constraints such as high input costs, limited credit access, pest and disease attacks, inadequate water supply, and poor market access. The study recommends that Government should provide motor able roads for ease of transportation of vegetable products to markets, banks and other lending agencies should provide loans to vegetable farmers to boost production, Government should provide storage facilities to reduce post-harvest losses, extension agencies should support farmers with improved seeds that are resistant to pest and diseases and Government should provide irrigation facilities to help farmers produce beyond the banks of rivers.

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