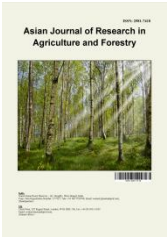

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Unlocking the Economic Potentials of Leafy Vegetable: A Case Study of Farmers in Akoko South West Local Government Area of Ondo State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study analysed the economic potentials of leafy vegetable among farmers in Akoko South West Local Government Area of Ondo State, Nigeria. Primary data were used for this study with a well- structured questionnaire and personal interview for the collection of the data with a sample

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size of 150 farmers. The data were analyzed using descriptive statistics, budgetary technique and multiple regression analysis. The analysis of the data showed that about two-third of the farmers were male,74.7% married and the majority (58.7%) of the respondents were in their economic active age (41-50 years). Majority (94%) of the farmers were educated with the average farming experience of 14 years. The results also revealed that the major types of vegetables available in the study area were; Africa spinach, Pumpkin, water leaf, jute leaf and bitter leaf. The result on return on investment was 2.31, implying that for every N1 invested on vegetable production, there is a return of N2.31kobo which is an indication that the business is worthwhile. The study also revealed the gender, age of farmers, marital status, level of education and household size were the factors that significantly and positively influence leafy vegetable output in the area. The most serious problems encountered by the vegetable farmers were; inadequate capital, unstable price of vegetables, the incidence of pest, pilfering and theft and inadequate information. Thus, it is recommended that agricultural credit should be provided for vegetable farmers to boost vegetable production.

Keywords: Budgetary technique; leafy vegetable; production; profitability; socioeconomics; Nigeria.

1. INTRODUCTION

"Vegetable crops such as Africa Spinach (*Amaranthus cruentus*), Pumpkin leaf (*Telfaria occidentalis*), Water leaf (*Talinum triangulare*), Jute leaf (*Corchorus oitorius*), Bitter leaf (*Vernomia amygdalina*) are produced in different agro-ecological zones by commercial as well as small scale farmers both as a source of income as well as food. Vegetable is one of the important diets in Nigeria, traditional meal without it is assumed to be incomplete" [1]. "Vegetables crop are grown in many part of the world contributing significantly to income, security and the nutritive value of many households. In Nigeria, vegetable production has been on-going for decades, providing employment and income for the increasing population especially during the long dry season. However, production is constrained by inadequate infrastructure, agronomic and socioeconomic variables" [2,3]. Vegetable crops are grown in many parts of the world contributing significantly to income security and the nutritive diet of many households. According to Olutumise [1]; Ejoh et al. [4], "vegetable production is of great economic importance in the agricultural sector as its value chain can provide income and reduces poverty and unemployment" [5,6]. Vegetable production has the potential to increase food security [7,8] and create employment [9]. "Small holders' farmers made up large number of vegetable producers in Nigeria. Insufficient intake of fruits and vegetables is estimated to cause around 14% of gastrointestinal cancer deaths, about 11% of ischemic heart disease deaths and about 9% of strokes death" [10]. "The World Health Organization recommended consumption of 400g of fruits and vegetables daily to maintain good health" [11]. Nigeria has a high potential and positive comparative advantage for vegetable production. Considerable evidence suggest that serious bottlenecks exist in the functioning of the production system in Nigeria. Adegoroye et al. [3]; Ndlovu and Ndlovu [12] attributed "this situation to socioeconomic constraint surrounding the key actors in the vegetable value chain". "Vegetables are also highly perishable as they start to lose their quality right after harvest and continued throughout the process until it is consumed" [13]. "Nigeria has a high potential and positive comparative advantage for vegetable production. In Nigeria, vegetable is among the most important crops, but poor seed supply, inefficient marketing system, and low investment have limited its production" [1,14]. In view of these factors, it is important to understand the farmers' levels of production and its relationship with factors which can greatly improve the production of vegetable. Thus, this can be achieved through investigating into performance and the socioeconomics of leafy vegetable farmers and other factors influencing vegetable production. The specific objectives for this study were to describe the socioeconomic characteristics of the leafy vegetable farmers in the study area; identify the major types of leafy vegetables available in the study area; determine profitability of leafy vegetable production in the study area; examine the factors affecting leafy vegetable production in the study area; and identify the major constraints militating leafy vegetable production in the study area.

2. METHODOLOGY

The study was carried out in Akoko South West Local Government in Ondo State, in the South-Western part of Nigeria. Akoko generally, is a

large Yoruba cultural sub-group in the north eastern part of Yoruba land, Akoko land extends from Ondo State to Edo State. It has a population of about 815360, with a land area of 1,283,443 km^2 and with the coordinates of 7^0 28^0 North and 5^0 44^0 East. Akoko land takes a large percentage of the Local Government in Ondo state; it takes 4 out of the 18 local government areas in the state. The local Government Areas include; Akoko North East, Akoko South West, Akoko North West and Akoko South East. The major occupation there is farming and majority of the people in the district engage in small and large-scale farming with major arable crops cultivated. Some of the crops grown include; groundnut, vegetable, tomatoes, maize, cocoa, cassava, yam, plantain etc.

Primary data were used for this study. The data were collected from the field survey through the administration of a well-structured questionnaire. The questionnaire was divided into two sections, the first section included questions related to the socioeconomic characteristics of the respondents, while second sections involved questions related to the production of vegetables. A multistage sampling techniques was used for the study. The first stage involved purposive selection of Akoko South West Local Government Area out of the 18 Local Government Areas in Ondo State based on the preponderance of vegetable farmers. The second stage involved the random selection of five (5) communities from Akoko South Local Government Area. At the third stage, thirty (30) respondents were randomly selected from each of the five (5) Local Government Areas. Thus, giving a sample size of 150 vegetable farmers for the study. Data obtained from the field were subjected to descriptive and inferential statistics such as budgetary techniques and multivariate regression.

2.1 Model Specification

Budgetary techniques involved method of calculating gross margin, profit and Return on Investment (ROI) of vegetable production in Akoko South West Ondo State. The gross margin analysis was employed to estimate costs and returns of vegetable production in the study area. Gross Margin (GM) is defined as the difference between total revenue and total variable cost.

Mathematically, it is usually expressed as;

$$GM=TR - TVC$$

Where;

TR = Total revenue on vegetable production (₦)
TVC = Total variable cost incurred on vegetable production (₦)

Total Revenue (TR) is the product of output and the price of vegetable while the Total Variable Cost (TVC) is the aggregation of the costs of land preparation, planting materials, vegetable seeds, planting, weeding, harvesting and other cost incurred in the production. Return on Investment was obtained by dividing the Total revenue (TR) over Total cost.

$$\text{Return on Investment (ROI)} = \frac{Total\ Revenue}{Total\ Cost}$$

Again, the production function was estimated using the Ordinary Least Square Regression Techniques. The Multiple regression analysis was used to identify socio-economic factors that affect vegetable production in the study area. The four functional forms were tried for the production function and the one that best satisfy the theoretical, statistical and economic criteria was selected as lead equation. The functional forms were Linear, Double, Logarithm, Semi logarithm and Exponential.

The regression model in implicit form is given as:

$$Y= (X_1\ X_2\ X_3\ X_4\ X_5\ X_6\ X_7\ X_8\ X_9)$$

Explicitly, the models were represented as following.

Linear function: $Yi = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_{7+} b_8X_8 + b_9X_{9+} Ui$

Semi-Log: $Yi = b_0 + b_{1log}X_1 + b_{2log}X_2 + b_{3log}X_3 + b_{4log}X_4 + b_{5log}X_5 + b_{6log}X_6 + b_{7log}X_{7+} b_{8log}X_8 + b_{9log}X_{9+} Ui$

Exponentials: $Log\ Yi= b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_{7+} b_8X_8 + b_9X_{9+} Ui$

Double log: $Log\ Yi = b_0 + b_{1log}X_1 + b_{2log}X_2 + b_{3log}X_3 + b_{4log}X_4 + b_{5log}X_5 + b_{6log}X_6 + b_{7log}X_{7+} b_{8log}X_8 + b_{9log}X_{9+} Ui$

Where:

Y= Vegetable Output (Naira)
X_1 = Sex (male = 1; female = 0)
X_2= Age (years)

X_3 = Marital status (married = 1 and 0, otherwise)
X_4 = Household size (number)
X_5 = Education (1 = educated, 0 = otherwise)
X_6 = Access to credit (yes = 1 and 0, otherwise)
X_7 = Farmer size (ha)
X_8 = Experience (Years)
X_9 = Income from non farm activities (Naira)

3. RESULTS AND DISCUSSION

3.1 Socioeconomic Characteristics of Vegetable Farmers

This section deals with the socioeconomic characteristics of the leafy vegetable farmers in the area (Table 1). "The results showed that male farmers (60%) are more than female counterparts. Sex determines the ability to perform some physical work. It is generally believed that men are more efficient in activities than women" [3,15,16]. "Perhaps is because they are more energetic and can handle more tedious work than their female counterpart. This is in fact, the basis for comparing the sex of the farmers. By implication, there were more male involved in vegetable production in the study area than female" [1]. The higher the age of the respondents the higher their experience in farming (all things being equal) and this translates to more encounter with risks among older farmers than among younger farmers. The majority (58.7%) of the respondents were in their economic active age 41-50years, about 3.3% of them were 40 and below, while 38% of them were 51years and above. This is in support of the findings of Nwaiwu and Esiobu [17] who noted that majority of vegetable farmers fall between their active age, which in turn enhance accurate, prompt and effective decision making. The result revealed that the population of the respondents that were married had the highest (74.7%) while single and widowed respondents accounted for 22.7% and 2.6%, respectively. "This is because a married farmer has more responsibilities in terms of taking care of the consumption needs of family and that of himself, unlike a single person whose income is for his maintenance and consumption" [18,19]. "Also, the use of informal insurance measures in managing risk is of more importance to the married farmers who may not like to take the formal risk in his production to avoid failure. The results revealed that the household size of vegetable producers ranged from 1 to 10 with a mean of 6. Furthermore, about 2.7% of the farmers had an household size between 1 and 3 members, about 83.3% of them ranged between 4-6 members. While, 14.0% have a household member between 7-10. However, the mean household size of 6 individuals was beyond the national average of 5 reported by National Bureau of Statistics (NBS)" [20]. "High number of household size could be due to the fact that vegetable producers in the study area practice polygamy and having large household size is a source of pride and a compelling force to produce more output by the household head in the farms "[21]. Adeoye [22]; Ajayi and Olutumise [23] reported that "production efficiency increases with increase in household size Formal education is a widely known avenue for improving knowledge and rate of skill acquisition". "Formal education is also important in agricultural business because it determines the degree of adoption of innovation and new technologies" [8,24]. Educational attainment of farmers does not only raise agricultural productivity but also enhances farmers' ability to understand and evaluate information on new techniques and processes. Majority of the farmers were fairly educated. Only 6.0% had no any form of education. This means that the farmers had minimum level of education that could enable them to adopt modern agricultural technology and participate in food crop transformation agenda despite the fact that they are aging. The result is in line with the findings of Osuji et al. [25] who revealed that "vegetable farmers are fairly educated in his study carried out in Imo State, Nigeria. The result further revealed that majority of the farmers had between 1 and 2 acres of farm land in the study area. The mean farm size was 1.5acres". "A farmer's experience in farming determines the rate of his exposure to risks and use of risk management strategy" [26]. "A farmer who has spent many years in farming will have more experience than a farmer who have spent less time in farming. The average number of years spent by all the farmers was 14years. About 34.0% of the farmers had experience less than 10years, 39.3% also have experience ranging from 11-15years. Also, 19.3% of the vegetable farmers had between 16 and 20-years' experience, while only 7.3% had 21 or more years of experience. The years of farming experience shows that the farmers are relatively experienced and there is some level of specialization which would help in cost minimization and achieving greater efficiency" [23,27].

Table 1. Socioeconomic characteristics of the respondents

Variables	Frequency	Percentage	Mean
Gender			
Male	90	60.0	
Female	60	40.0	
Total	150	100.0	
Marital Status			
Single	34	22.7	
Married	112	74.7	
Widowed	4	2.6	
Total	150	100.0	
Age			
≤ 40	5	3.3	
41-50	88	58.7	
51-60	39	26.0	
> 61	18	12.0	
Total	150	100	
Educational Status			
No formal education	9	6.0	
Primary school education	59	39.3	
Secondary school education	67	44.7	
Tertiary education	15	10.0	
Total	150	100	
Household Size			
≤ 3	4	2.7	
4-6	125	83.3	
≥ 7	21	14.0	
Total	150	100.0	
Experience			
≤ 10	51	34.0	
11-15	59	39.3	14
16-20	29	19.3	
>20	11	7.3	
Total	150	100.0	
Farm Size			
≤ 2	100	39.2	
2.1- 4.0	40	34.2	1.5
4.1- 6.0	8	16.7	
> 6.0	2	10.0	
Total	150	100.0	

Source: Field Survey,2023

3.2 Major Type of Leafy Vegetables in the Area

The results in Table 2 revealed the distribution of the major types of vegetables available in the study area. The most common vegetable was Africa spinach (*Amaranthus cruentus*). This was followed by Pumpkin leaf (*Telfaria occidentalis*), which was ranked the second type of vegetable available in the area. About 73.3% of the farmers agreed Water leaf (*Talinum triangulare*) was available, 63.3% ranked Jute leaf (*Corchorus olitorius*) as the 4th, while Bitter leaf (*Vernonia amygdalina*) was ranked the least type of vegetable available in the study area.

3.3 Estimation of Leafy Vegetable Performance in the Area

The results in Table 3 showed that the cost-return structure of the smallholder leafy vegetable farmers in the study area. The net profit, which is the difference between total revenue and total cost was used to determine the profit (₦58,600.39) of the farmers in the study area. Vegetable's farmers incurred several costs

in the course of production. In the short run, these costs include both variable and fixed costs of production [28]. The total variable costs (₦21,770.60) involved in vegetables production include labour, vegetable seed, fertilizer, transportation, herbicides, insecticides and seed costs. The fixed cost (₦3,634.12) items were made up of depreciation values on farm equipment (e.g., knapsack sprayer, cutlass, sack). The overall cost structure for an average vegetable's amounted to ₦25404.72. A positive Net Farm Income (NFI) showed that an enterprise is a profitable one and worth continuing [29]. The result on return on investment was 2.31, implying that for every ₦1 invested on leafy vegetable production, there is a return of ₦2.31kobo obtained which is an indication that the business is worthwhile.

3.4 Socioeconomic Factors Affecting Vegetable Production in the Area

The regression results as presented in Table 4 showed the socioeconomic factors affecting vegetable production. Out of the 9 variables 5 were significant and they were gender, age, marital status, education and non-farm income which contributed significantly and positively to the vegetable' production. Looking at the values of R-squared (0.76), the explanatory variables all together explained about 76% of the variation in vegetable production implying that the model has a good-fit.

The coefficient X_1 (Gender) had a statistical and positive influence on productivity, implying that the probability of being a male farmer will likely increase the farmer's production. This is in line with the findings of Olutumise et al. [1]; Oparinde et al. [30], who revealed that there is a direct relationship between being a male farmers and productivity. Furthermore, the coefficient X_2 (Age) had a positive and significant influence on the farmer's production in the study area. That is, an increase in the farmer's age, will increase his production *ceteris paribus.* This was also noticed in the study of Adegoroye et al. [7]. The coefficient of the respondent marital status was significant and also positive at 1% probability level, implying the chance of being married increase production. The possible reason for this is that, being married tend to increase labour, thereby increasing production as reported by Olutumise et al. [31]. Furthermore, farmers level of education had a positive effect and significant at 1% probability level, implying that and increase in education of the respondent will likely increase his production *ceteris paribus*. Lastly, the non-farm income which is the money generated from non-farm activities or from secondary occupation also had a positive and significant effect on the vegetable farmers production. The result implies that a naira increase in income will increase vegetable production by the coefficient of 4.75.

3.5 Constraints to Vegetable Production in the Study Area

Table 5 revealed the distribution of constraints the farmers faced during their production. Inadequate capital stagnates the growth prospects of any business [6,32]. Inadequate capital was ranked 1st major challenge. Unstable price of vegetables was ranked second. It was revealed that more than two-thirds agreed that price fluctuation has been their major issue and has been limiting their production as well as their profitability. The third major constraint was the incidence of pests and diseases. In Africa, pilfering of farm produce has been identified as one of the challenges hampering the development of agriculture [2,33]. Incidence of pests and theft was ranked the fourth major challenge. This is also reported from the findings of Shaik et al. [34] on crop yield prediction using machine learning. Inadequate market information, unfavorable climatic condition and poor supply of vegetable seeds was ranked the fifth, sixth and seventh challenge respectively.

Table 2. Distribution of the major types of vegetable available in the study area

Vegetables	Frequency	Percentage	Ranked
Africa spinach (*Amaranthus cruentus*)	131	87.3	1st
Pumpkin leaf (*Telfaria occidentalis*)	129	86.0	2nd
Water leaf (*Talinum triangulare*)	110	73.3	3rd
Jute leaf (*Corchorus olitorius*)	95	63.3	4th
Bitter leaf (*Vernonia amygdalina*)	79	52.7	5th

Source: Field Survey, 2023

Table 3. Cost and return of the vegetable farmers

Items	Value (₦)	Percentage of Total Cost
Variable		
Seed	2,023.20	7.96
Transportation	2,432.45	9.57
Fertilizer	2,839.12	11.18
Labour	12,535.60	49.34
Agrochemicals	1,940.23	7.64
(A) Total Variable Cost	**21,770.60**	**85.70**
Depreciation on Fixed Items		
Farm Equipment's	480.12	1.89
Land	3,154.00	12.42
(B) Total Fixed Cost	**3,634.12**	**14.30**
(C) Total Cost (A+B)	**25,404.72**	**100.00**
(D) Revenue	**84,005.11**	
(E) Net Revenue (D-C)	**58,600.39**	
Gross Margin (D-A)	**62,234.51**	
Return on Investment (E/C)	**2.31**	

Source: Field Survey, 2023

Table 4. Regression result showing the factors affecting leafy vegetable production

Variables	Coefficient	Std error	T-value	P-value
(Constant)	94043.106	26502.445	3.548	.001**
Gender	13592.259	6054.357	-2.245	.027**
Age	3538.300	643.953	-5.495	.001***
Marital status	81415.996	13166.775	6.183	.010***
Household size	-4003.563	2938.016	-1.363	.175
Educational Status	28809.300	4457.495	6.463	.005***
Access to Credit	-12635.537	7785.367	-1.623	.107
Farm size	-19.152	25.106	-.763	.447
Experience	476.412	772.799	.616	.539
Income	4.735	1.246	3.801	.001***
R^2 = 0.79				
F-value = 15.53				
Dependent variable = Leafy vegetable output in Naira				

**** = significant at 1%; ** = significant at 5%*

Table 5. Distribution of the respondent based on their constraint

Constraint	Very serious		Serious		Mild		Not at all		Mean	Ranked
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc		
Inadequate Capital	75	50.0	46	30.7	12	8.0	17	11.3	3.19	1st
Unstable price of vegetable	33	22.0	71	47.3	29	19.3	17	11.3	2.80	2nd
Incidence of pest and disease	11	7.3	72	48.0	52	34.7	15	10.0	2.53	3rd
Incidence of pilfering and theft	4	2.7	80	53.3	51	34.0	15	10.0	2.49	4th
Inadequate market information	0	0.0	90	60.0	34	22.7	26	17.3	2.43	5th
Unfavorable climatic condition	4	2.7	63	42.0	66	44.0	17	11.3	2.36	6th
Poor supply of vegetable seeds	1	0.7	66	44.0	57	38.0	26	17.3	2.28	7th

Source: Field Survey, 2023

4. CONCLUSION AND RECOMMENDATIONS

The result of this study concluded that gender, age, marital status, education and household income significantly and positively influence leafy vegetables output in the area. Furthermore, vegetable farming is noted to be a profitable venture in the area with a return to investment of 2.31. The study also indicates that input costs like fertilizer cost and labour cost comprise large share of the total variable costs involved in vegetable. Even though farmers in the study area realized a profit in vegetable production, especially in the study area, they still encounter various types of production, marketing, and financial problems. Accordingly, on the basis of one of the research questions regarding problems encountered by vegetable farmers, the most serious of these include: inadequate capital, unstable price of vegetables, the incidence of pests, pilfering and theft, and inadequate information. Therefore it is recommended that agricultural credit should be provided for vegetable farmers to boost production. The government can as well establish policy that will stabilize the prices of vegetables in the market and also subside the prices of farm inputs such as agrochemical and fertilizers. This will boost production and accrue more income for the farmers. Also, more females and youths could be encouraged by giving incentives and creating conducive environment for production. Since education contributes significantly to the production of leafy vegetables in the area, it will be advised if government through extension agents educate the farmers on vegetable production through workshops, training and demonstration. This will help farmers to adopt innovations and technologies in their farming activities.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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