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ANALYSIS OF DRY SEASON VEGETABLE PRODUCTION AMONG KIRI DAM USERS IN ADAMAWA STATE, NIGERIA

[1]Robert, K., [2]Kara, H. A., [2]Adamu, M. M. and [2]Muhammad, Bala
[1]Department of Agricultural Economics,
Abubakar Tafawa Balewa University, Bauchi, Nigeria
[2]Department of Agricultural Economics and Extension,
Taraba State University Jalingo, Taraba State, Nigeria
Corresponding Author′s Email: abhamidkara@gmail.com **Tel.:** +2348038500480

ABSTRACT
This study analysed the dry season vegetable production in the study area with the objective of estimating the profit and factors that affect vegetable production among the users of Kiri Dam. The data used for the study was collected from 120 randomly selected farms during the 2019 dry farming season. Descriptive statistics, farm budgeting and OLS regression analysis were used to analyse the data. The empirical estimates from farm budgeting methodology showed ₦29,230/ha net farm income and Naira investment return was 0.32. The Double log functional form showed farm size ($P \leq 0.1$), seeds ($P \leq 0.05$), fertilizer ($P \leq 0.01$), age ($P \leq 0.05$), and education level ($P \leq 0.01$) had statistically significant effects on the vegetable production of the farmers in the study region. It was concluded that growing vegetables in the study area during the dry season was profitable. Therefore, it was suggested encouraged to educated youth who were not gainfully employed to join vegetable farming in the study area and supplying subsidized farm inputs such as seeds, fertilizer, and agrochemicals so as to lower production costs and increase profit.

Keywords: Budgeting, Production, Profitability, Regression, Vegetable.

INTRODUCTION
Vegetables are widely grown as a cheap and reliable source of protein, vitamins, zinc, and iron in most of sub-Sahara Africa (Osei *et al*., 2017). In resource-poor diets, they make up between 30% and 50% of iron and Vitamin A (Mofeke *et al.*, 2003). In Nigeria, vegetables such as tomatoes, okra, pepper, cabbage among others are widely grown along the banks of the river which stretch across villages, towns, and cities mostly by small scale farmers. This practice has been going on for decades, providing employment and income particularly during the long dry season to the growing population. However, inadequate resources, socio-economic and agricultural production variables restrict the growth of vegetable production (Osei *et al.*, 2017; Sabo and Zira, 2009). Mofeke *et al*. (2003) claim that vegetable production is characterized by the use of poor machinery, non-availability of input, illiteracy, inexpensive technology such as the use of cutlass, hoe and irrigation boxes for irrigation of farms.

Vegetable cultivation is accompanied by the use of agrochemicals. This is mainly due to poor soils, and indigenous crop varieties have almost been replaced by improved high-yielding varieties such as cabbage, lettuce, pepper, onions, and carrots, which require a lot of nutrients (Laary, 2014). These vegetables are also susceptible to insect pests that may not only feed on them but also reproduce on them. And farmers have no alternative but to use agrochemicals to handle crops and protect them from insect pests and diseases. Insecticides, herbicides, fertilizers among others, are widely used agrochemicals in Nigeria.

Vegetables are highly perishable as they begin to lose their quality right after harvest and continue until eaten throughout the cycle (Kohl and Uhl, 1985). Production of vegetables is, therefore, a risky investment practice. Many factors beyond the command of the producers can be attributed to production risk. Biological factors may be correlated with plant growth, pests, and disease occurrence, and weather factors such as drought and flood and price factors for example, sudden changes in input and output prices (Kara *et al.*, 2019). There is a difficulty in scheduling the supply of vegetables to demand due to the perishable and biological nature of the production process. With changing consumer demand and the condition of production, crops are exposed to high price and quantity risks (Kara *et al.*, 2019). Awareness of the attitude of small-scale crop producers towards risk is therefore critical when designing strategies and formulating agricultural development policies (Ayinde *et al*., 2008).

In Nigeria and the globe at large, small scale irrigation systems have gone a long way to support dry season farming of crops, especially vegetables. However, irrigation is relatively small in Nigeria and Africa as a whole, with irrigation estimated at only 6% of the total cultivated area, compared to 37% in Asia and 14% in Latin America (Ugalahi *et al*., 2016). With limited resources, socio-economic and infrastructural challenges, vegetable farmers need to know whether they are making a profit or not. They equally need to identify the factors influencing their output, this will help increase their income. Thus, this study aims at estimating profit and factors influencing vegetable production among the users of Kiri Dam Project in Adamawa state of Nigeria.

MATERIALS AND METHODS

The Study Area

The study was conducted in Shelleng Local Government Area (LGA) of Adamawa State, Nigeria. The LGA is located in the Southern part of Adamawa State. It lies between latitude $9^{0}20^{I}$ and $10^{0}22^{I}$N and longitude $8^{0}10^{I}$ and $12^{0}5^{I}$E. The study area shares common boundaries with Gombi and Song LGAs in the east, Numan and Demsa LGAs in the south, Guyuk LGA in the west and Borno State in the north. Shelleng LGA has a land area of 2,150km^2, made up of five (5) districts; these are Kiri, Bakta, Libbo, Shelleng and Bodwai with the population of 159, 043 people (Junior Staff Management Committee [JSMC], 2006). The Kiri Dam project is located in Kiri district, one of the five districts in Shelleng Local Government Area. It is 1.2km long with a capacity of 615 million m^3 reservoir, and 20m high. The Dam reservoir which covers an area of 5626km^2 on the river Gongola course and was built in 1982 to provide irrigation for the Savannah Sugar Company. The Dam has six spill gateways otherwise known as flood gates and each of the gates discharges 4000 cubic meters of water per second. It has also three scours that are used to periodically channel water to the canal that takes it to the fertile alluvial plains' irrigation, sugar cane plantations around Numan, Ngbalang and lamurde environment. Fishing activity is also carried out around the dam area.

The climatic condition of the area is characterized by two distinct seasons, dry and wet seasons. The wet season lasts from April to October, while the dry seasons begins from November and ends in March. The annual rainfall ranges between 1000mm and 1600mm. The maximum and minimum temperatures are about 39.7^{0}C and 10.5^{0}C, respectively. The main occupation of the people is dry season farming. Food and cash crops are also produced in both seasons.

Sampling Procedure and Sample Size

The target population for this study was the vegetable producers in Kiri Dam Shelleng Local Government Area of Adamawa State. They are 10 villages surrounding the Kiri Dam. Using a household list of vegetable farmers compiled by extension agents in the study area, this study followed Yamane (1967) to determine its sample size at a 95% level of precision arriving at 120 respondents as the total sample size. Simple random sampling relative to the

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proportion of vegetable farmers in each of these 10 villages was followed to draw 120 respondents and were interviewed using a structured questionnaire. The questionnaire focused on the socio-economic characteristics of the respondents, their costs and returns, and the factors influencing vegetable production in the study area. The study used data collected from a survey that was conducted from February 2019 until March 2019.

Analytical Techniques

Descriptive statistics, farm budgeting techniques and OLS regression were used to analyse the data. The budgeting analysis involves the estimation of gross income (GI) or total revenue (TR) and total cost (TC) for the same production period using input-output data (Harsh *et al*., 1981). The TR is a function of the total physical output (TPP or Y) and the unit price of the output. It is expressed as:

$$TR = Y \times P_Y \qquad \ldots(1)$$

where;

TR = Total revenue, Y = Total output of vegetable and P_Y is the unit price of output. For planning and decision purposes, Total costs are made up of Fixed Costs (FC) and the variable costs (VC). It is expressed as:

$$TC = FC + VC \qquad \ldots(2)$$

where;

TC = the total costs, FC = the fixed costs, and VC = the variable costs. The fixed costs in this study were the costs of land, tools such as hoes, machete and watering cans used in vegetable production, while depreciation on fixed costs was computed using the straight-line method (Eakins, 1999). The variable costs consist of labour and consumable items like fertilizer, seeds, chemicals, fuels, and hiring of tractor. Both costs were computed and analysed on a per hectare basis.

Budgetary techniques estimate the profit (net benefit) of the farms by computing all costs and returns and it is expressed as:

$$\overline{II} = \text{TR-3C} \qquad \ldots(3)$$

where; $\overline{II}$ is the profit, TR is the yield value, and TC is the total costs of inputs.

The multiple regression model was used to determine the factors influencing the vegetable output of the farmers. Three functional forms were fitted into the inputs and output data these include: the linear functional form, Semi-log, and the Double-log functional forms. The Double-log functional form was the best-fitted model on the bases of economic and statistical criteria. The model was specified as:

$$LogY = \beta_0 + \beta_1 logX_1 + \beta_2 logX_2 + \beta_3 logX_3 + \beta_4 logX_4 + \beta_5 logX_5 + \beta_6 logX_6 + \beta_7 logX_7 + \varepsilon_i \qquad \ldots(4)$$

where;

LogY = the logarithmic of vegetable total output, log $X_1 - X_7$ = logarithmic of explanatory variables included in the model, $\beta_1 - \beta_7$ = the regression coefficients, β_0 = the intercept, and ε_i = error term.

RESULTS AND DISCUSSION

The total costs of production incurred by the farmers were ₦ 90,003.2 per hectare (Table 1). The farm budget analysis showed that variable costs accounted for 86.96% of the total costs of vegetable production incurred by the farmers in the study area. This finding agreed with Kara *et al.* (2014) and Tsoho and Salau (2012), however, disagree with Bamire *et al.* (2004). Also, the cost of labour input alone accounted for 45.1% of the total costs of production. This shows that labour is the costliest variable input used in the study area. The average vegetable yield was found to be 3355.7 kilograms per hectare and the price per kilogram was ₦35.53175. The average total revenue per hectare was ₦ 119233.9 and the profit margin was found to be 24.52% (Table 1).

Table 1: Average Costs and Returns of Vegetable Production

Cost and returns	Amount (₦)/ha	Percentage
Variable costs (VC):		
Fertilizer	13588.43	15.1
Seeds	3061.24	3.40
Chemicals	5448.26	6.05
Fuel/repairs	9007.54	10.0
Tractor hiring	5727.65	6.36
Labour	40596.40	45.1
Irrigation water	857.14	0.95
Total variable cost (TVC)	**78286.37**	**86.96**
Fixed costs (FC):		
Land	3007.14	3.34
Depreciation on farm tools And machinery	8709.69	9.70
Total fixed costs (TFC)	**11716.83**	**13.04**
Total costs of production (TC)	**9003.20**	**100**
Yield	3355.7 (Kg/Ha)	
Price	35.53175/Kg	
Total revenue (TR)	**119,233.90**	
Gross margin (GM)	40,947.53	
Net farm income (NFI)	29,230.70	
Profit margin ($NFI/TR \times 100$)		24.52
Gross ratio (GR)		0.75
Operating ratio (OP)		0.66
Fixed ratio (FR)		0.1
Return on Naira Invested		0.32

Source: Field survey, 2019.

From Table 1 results, profit margin could be raised if farmers could cut down on variable cost, increase the quantity of output per hectare, or obtain a reasonable price per kilogram of vegetables. The returns on naira invested per hectare were ₦0.32, meaning that for every one naira that farmers invested in vegetable production they get a gain of 0.32 Naira accordingly.

The average vegetable output of the respondents was 3355.7 kg/ha with the standard deviation of 1133 (Table 2). The result shows there is a large variation in vegetable output of the sampled respondents. The mean farm size was 1.75 hectares with the minimum and maximum of 0.5 and 4.2 hectares, respectively. Small landholdings result in a low profit that makes vegetable farmers remain at subsistence level. The average seeds and fertilizer used by the farmers were 75 kg/ha and 275 kg/ha with a standard deviation of 24.5 and 70, respectively. This implies that there is no much difference in the use of seeds and fertilizer among the respondents because their standard deviation is less than one-third of the mean (Yamane, 1967). The average age of the farmers was 41.6 years with the mean household size of 11 people. This shows that the farmers are in their productive years and are very active and resourceful in carrying out various farm operations. Similarly, their large household size may provide cheap family labour (Ogundari, 2014), this would increase farmers' net return. However, Ahmad

(2011) opines that large household size is related to increased consumption expenditure of the household which reduces the capital that could be invested in farm production. The farmers are averagely educated (14 years) with the minimum and maximum of 4 and 16 years respectively. Within the period of production, the farmers had contacts with extension agents 2 times on the average (Table 2).

Table 2: Summary Statistics of the Factors Influencing Vegetable Output (n = 120)

Variable	Unit	Mean	Minimum	Maximum	Std. Dev.
Output (Y)					
Vegetable	Kg/ha	3355.7	1231.0	4665.0	1133.0
Inputs (X's)					
Farm size (X_1)	Ha	1.75	0.5	4.2	0.63
Seeds (X_2)	Kg/ha	75	50	175	24.5
Fertilizer (X_3)	Kg/ha	275	125	350	75
Age (X_4)	Years	41.6	19	68	11.6
Household size (X_5)	Numbers	11	3.0	22	4.0
Education level(X_6)	Years	13	4.0	16	3.0
Extension contact (X_7)	Numbers	2.0	0.0	3.0	1.2

Source: Field survey, 2019.

Estimates of the factors influencing vegetable output are presented in Table 3 below. The result demonstrated that all the input variables except household size and extension contact influenced vegetable production significantly. Farm size is very important as it determines to a large extent to which other resources can be employed on the farm and consequently the quantity of harvest. Farm size was found to be statistically significant at a 10% probability. The implication is that holding other factors constant, a 1% increase in farm size would increase vegetable output substantially in the study area. Similarly, seeds were also significant at 5% probability meaning that an increase in the use of seed by 1% holding other factors constant would increase vegetable output by 0.0035%. Fertilizer was statistically significant at 1% probability. This means that if all else, a 1% increase in the use of fertilizer would increase output by 0.3987%. The findings of farms size agree with Rahman *et al*. (2002), while seed and fertilizer agree with Xaba and Masuku (2013), Ibrahim and Omotesho (2013). The age of the farmer to a large extent affects their labour productivity and output.

Table 3: Estimates of the Factors Influencing Vegetable Output of the Respondents

Variable	Parameter	Estimate	Std. Error	t- statistics
Constant	β_0	0.8754***	0.1545	5.6660
Farm size	β_1	0.0053*	0.0032	1.6563
Seeds	β_2	0.0035**	0.0016	2.1875
Fertilizer	β_3	0.3987***	0.1013	3.9358
Age	β_4	0.1146**	0.0536	2.1381
Household size	β_5	0.0837	0.0785	1.0662
Education level	β_6	0.3867***	0.1231	3.1413
Extension contact	β_7	0.0568	0.0418	1.3589
R^2		0.8110		
Prob(F-statistics)		0.0000		

Note: ***, **,** and ***** are significance levels at 10%, 5% and 1%, respectively.
Source: Field survey data, 2019.

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Table 3 further show that the age of the vegetable farmers is statistically influencing their output at a 5% probability. Similarly, Table 2 showed that the mean age of the farmers was 41years 6 Months. According to Nandi *et al*. (2011) farmers that are within the age of 30 to 59 years are more productive than those who are 60 years and above who are less active and unenergetic. However, some researchers, for example, Rahman *et al*. (2002) and Mulinga (2013) reported that age is directly related to experience hence, as farmers become older their level of inefficiency in farming becomes lower. The result in Table 3 also shows that the education levels of the farmers were significantly influencing their output at a 1% probability. This implies that an increase in farmers' level of education by 1% would increase vegetable output by 0.3867%. Oranusi and Dahunsi (2015) opine that increase in the farmers' levels of education would increase their understanding and use of improve crop production practices. The coefficient of determination was found to be 0.8110 (Table 3) implying that 81.1% variation in vegetable output was explained by the explanatory variables included in the model for the analysis.

CONCLUSION AND RECOMMENDATIONS

The study estimated the costs and returns of vegetable production and determined the factors influencing the vegetable output of the farmers in the study area. The finding revealed that the farmers are making a profit. Increasing farmers' landholdings will further increase the per capita production of vegetables and improve income. Providing seeds and fertilizer at the subsidized rate have the prospect to increase vegetable output in the study area, this would improve the income of the farmers as well. Engaging young educated farmers into vegetable production would enhance vegetable output and improve farmers' net income in the study area.

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