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PROFITABILITY ANALYSIS OF SESAME PRODUCTION AMONG SMALL-SCALE FARMERS IN SOME SELECTED LOCAL GOVERNMENT AREAS OF KANO STATE, NIGERIA

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Abstract
This study assessed the profitability of sesame production among small-scale farmers in 2 selected local government areas of Kano State, Nigeria. Multi-stage sampling techniques were used and randomly selected 116 small-scale sesame farmers, 2 blocks of each local government were selected which makes a total of 4 agricultural blocks in the local governments. Primary data was collected using structured questionnaires with the aid of well-trained enumerators and data collected were analysed using gross margin and regression. The study revealed that the average total cost of operation was ₦72, 989.26 and gross margin was ₦121, 146.5, while the net margin was ₦48, 146.53 per hectare. The study revealed that the average return per naira invested was 67 Kobo, which implies that for every ₦1 invested in sesame farming, there was a return of 67 Kobo and the operation ratio was 0.60. The findings indicated that household size, farm size, and access to credit facilities were the factors influencing sesame farmers' profitability while age and cooperative membership were significant but negatively related to sesame farmers' profitability. Therefore, it could be concluded that sesame production in the study areas may be profitable thus the state's extension service has to be re-established since it will help farmers stay up to date on the latest sesame-producing methods, which will increase their yield and profit.
Keywords: Farm, Meal, Margin, Price, Protein, Seed.

Introduction

The world's greatest producer of this ancient oilseed crop is India, which grows sesame (*Sesamum indicum* L.). Sesamum (*Sesamum indicum* L.) are flowering plants that are grown extensively for their edible seeds in tropical climates. Due to the superior oil quality of sesame, it is referred to be the queen of oilseed crops (Insert the authority). It has the most dietary calories (6355k calkg^{-1}) and the highest oil content (46–64%). All around the world, it is a highly frequent element in meals. Sesame crops can be cultivated in a variety of climates, including semi-arid tropical and subtropical areas. It is mostly grown in rainfed circumstances on marginal and sub-marginal areas with insufficient fertilizer application rates and inadequate management techniques. Sesame is produced in regions with temperatures above 27^{0}C and rainfall between 625 and 1100mm (Amit *et al.* 2020). The crop can withstand dry conditions but not water logging (Amit *et al.* 2020). On an estimated 9,983,165 hectares of land, 5,531,948 tonnes of sesame were produced globally in 2017. Sesame is primarily produced in Asia (56.4%), with Africa (39.3%) and America (4.4%) following. Nigeria (192,295.96 tonnes) is the eighth-largest producer of sesame out of the top ten countries in the world, after China (616,004.96 tonnes) and India (665,566.67 tonnes) (FAOSTAT, 2018).

According to the Nigeria Export Promotion Council (NEPC, 2014), the top sesame-producing states in Nigeria are Nasarawa, Jigawa, Benue, Yobe, Kano, Katsina, Kogi, Gombe, and Plateau States. Nigeria is the continent's top producer of sesame seeds and majority (approximately 90%) of sesame seeds produced there are exported. In the first quarter of 2018, it was reported that sesame was the most exported non-oil commodity, contributing 0.57% to the total export value and 36.39% of agricultural exports (Pro share, 2018). Nigeria

has the highest untapped potential from sesame export estimated to be $170 million (NEPC, 2018). Sesame is grown mainly for its seeds that contain approximately 50% oil and 25% protein (Burden, 2005). According to FAO (2012), over 158,000 metric tonnes of sesame is being exported from Nigeria to mainly Asian countries. This account for over 70% of sesame produced in the country. In monetary terms, sesame raked in $ 139,000,000 in 2010 in foreign exchange earnings making it the third largest export commodity after oil and cocoa both in terms of quantity and value (FAO, 2012). Sesame seed has over 15% margin in terms of value added compared to other cash crops such as sheanuts and palm kernels (Nyiatagher and Ocholi, 2015). Sesame seeds, they said, are principally utilized as a source of cooking oil; young leaves may also be consumed in stews; and dried stems may be burned as fuel with the ash used for producing local soap. However, it was claimed that these applications are completely secondary to seed production. Protein may be found in sesame seeds, and that protein is rich in critical amino acids like methionine, with a surplus of up to 34%. For the majority of plant proteins, this is rare. Unwanted pigments are not present in the de-hulled seed meal that is prepared by default. Sesame is an excellent source of protein to supplement other plant proteins like soybean, peanut, and others that lack enough methionine to boost their nutritional qualities (RMRDC, 2004).

The top brands of sesame oil are comparable in quality to olive oil. Refined sesame oil has no smell. It tastes great and has a straw-like colour. Sesame oil produces high-quality ink and is frequently used to make margarine and canned sardines (NAERLS, 2010). Sesame de-hulling, the creation of adequate oil extraction techniques, the protein enrichment of food employing press cake (in new-born weaning foods), and the design of biofuels were all the subject of extensive research in Nigeria (fabrication of processing machines at the Federal Institute of Industrial Research, Oshodi). NAERLS (2010) described how sesame can be used to manufacture flour, sesame snacks, sesame sweets, and sesame biscuits. It can also be used to make sesame tiger nut meal, maize sesame/soybean meal, and sesame soups (such as sesame leaf soup and sesame/egusi soup). Sesame spread is also used to prepare feed and agricultural waste, as well as for bread, cake, buns, doughnuts, and chin-chin (NAERLS, 2010).

Small-scale farmers in Northern Kano State find it to be a highly popular crop. However, a variety of issues, both natural and artificial, hinder the production of these economically valuable crops, resulting in relatively poor productivity. Traditional production methods, the effects of climate change, insect pests and diseases, domestic and international market fluctuations, and a lack of expert knowledge and competence are some of the biggest obstacles to sesame production worldwide (Yakubu, 2020). Notwithstanding the good local and international market for its seed and oil, its production system is generally characterized by the use of traditional techniques.

Despite all efforts to enhance sesame production in Nigeria, particularly in the study region, the typical farmer still only produces enough for subsistence utilizing a conventional agricultural system and low-yielding varieties. This is because better sesame production methods are accessible in research institutes but have not effectively reached sesame farmers and extension services have not been very effective (Sharon, 2016).

There is a dearth of important study findings on how profitable sesame farming is in the Northern Kano State and to pinpoint the elements impacting it. Research has been conducted on other crops including maize, rice, yam, and groundnut among others. There are few studies that examine the profitability of the crops and the drivers of the profitability connected with their production in the research area, despite the importance of sesame in raising the farm incomes of its producers. It is crucial to find out whether sesame production is still lucrative in the LGAs of Bichi and Dambatta, as well as what factors influence this profitability. Therefore, it is crucial to analyse the profitability of sesame production in the local governments of Bichi and Bagwai so that appropriate actions can be taken to improve crop production. This could help to increase farmer incomes, which in turn could help to raise the living standards of farmers and other residents of the local governments and its

surroundings. To fill the knowledge vacuum on the contextual factors affecting the profitability of sesame farmers in the research region, the current study is an attempt to analyse the economics of sesame farmers in the area. The aims of this study were to estimate the costs and returns in sesame production and determine the factors influencing the profitability of sesame production in the study area.

Methodology

Study Area

The study was conducted in Kano State, Nigeria, which lies between latitude 11^0 58'37'N to $12^0$0.5'26'N of the equator and longitude $8^0$29'48' E and $8^0$33'45'E (Kano State, 2013). It shares boundary with Jigawa state to the North East, Katsina State to the North West and Kaduna to the South. The state is administratively divided into 44 local government areas. It has population of 9,383,682 with annual growth rate of 3.3% (NPC, 2006). Based on this annual growth rate, the present population of Kano state would have grown to 11,551,314 million as at 2014. The annual rainfall is between 420 and 1,000mm and temperature is averagely warm throughout at about 32 - 34^0C (KNARDA, 2006). Agriculture is the major backbone of Kano State economy followed by commerce. Agriculture which is the major employer of labour in Kano State where about 70% of the farmers engaged in subsistence farming for household consumption (NPC, 2006). The major upland crops commonly grown are sesame, maize, cowpeas, sorghum, millet, and groundnut. While the lowland crops commonly grown are rice, tomatoes, onion, pepper, sweet potato, and wheat are grown in the flood plains and irrigation areas.

Data Collection

Multi-stage sampling techniques were used to select sesame farmers for this study. In the first stage, purposive sampling techniques was used and selected two local governments from agricultural zone 1 in the state, which were Bichi and Bagwai Local Governments. The selection of the local government areas was based on the fact that they are the most prominent sesame producing areas in the state. Secondly, two agricultural blocks were randomly selected from each of the two selected local government areas through the names in a hat simple random sampling techniques, which makes a total of four blocks. In the third stage, farmers were randomly selected from each of the four blocks selected using the Roaosoft calculator, which was set at a margin error of 11%, 99% confidence level, and a population size of 759 sesame farmers, with a response distribution of 45%, which gave a total sample size of 116 for the study. With the aid of trained enumerators, primary data was collected using a well-structured questionnaire. The information collected includes both quantitative and qualitative data. The data collected includes the age of the farmers, gender, marital status, farming experience, household size, educational status, monthly income, extension contacts, and cooperative membership, as well as information related to the cost and returns of sesame production in the study area.

Analytical Technique

The analytical tools that was used for this research work includes gross margin and regression Analysis only.

Gross Margin Analysis

The gross margin analysis is a model that is used to estimate the costs, returns, profitability or loss per hectare. The total revenue represents the value of the output from the farm (e.g. physical quantity of the crop multiplied by the unit price). The total cost, on the other hand, is the sum of all variable costs incurred during the production process. Variable cost also called specific costs which vary directly with the level of production and included expenditure on seeds, fertilizer, agro-chemicals, sack bags, hired labour, (Godwin *et al.,* 2011). The gross margin analysis of sesame in Kano state was expressed as:

$GM = \Sigma pi.qi - \Sigma rjxj$……..…1
Where: GM = Farm gross margin (₦/ha);
p = Unit price of output (Sesame seed) (₦);
q = Quantity of output (kg);
r = Cost of variable input (₦);
x = Quantity of variable input (kg);
i = 1, 2… n number of outputs used in sesame seed production;
j = 1, 2… n number of inputs used in sesame (Samuel, *et al.* 2020)
GM = Total revenue from sesame production minus total variable costs incurred in the course of production of one hectare of sesame. This estimation will serve as a profit index of sesame farmers in the study area. The higher the GM the more likely a farm is considered to be profitable and the smaller the GM, the lesser the profit possibility (Godwin *et al.* 2011).

Multiple Regression Model
Multiple regressions were used to determine the factors that influence the profitability of sesame production. The Cobb-Douglas production function was selected and estimate the contribution of key variables for the sesame production in the study area, the specific of the Cobb-Douglass production function for sesame farming is as follows;
Implicitly, the model is specified as
$Ei = \alpha_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9$…… (2)
Four functional forms were employed to select the best fit equation. The following form of the equation is shown below.

Linear Function:
Ei=b0+b1X1+b2X2+……..b6X6+Ui……. (3)
Exponential Function
LnEi=b0+b1X1+b2X2……..b6X6+Ui …….. (4)
Semi-Logarithm Function:
$Ei=b_0+LnX_1+b_2LnX_2$……b_6LnX_6+Ui ……... (5)
Double Logarithm Function:
$LnEi=Lnb_0+b_1LnX_1+b_2LnX_2$…..$b_6LnX_6$+Ui …….. (6)
Where
Explicitly, the model is specified as:
LnEi = is the net profitability of i^{th} sesame farm.
α_0 is the intercept
X_1 = Age of sesame farmers in year (yrs.).
X_2 = gender of the sesame farmers
X_3 = sesame farmers marital status (dummy: 1=single, 2=married,
3= divorced/separated, 4= widow/widower)
X_4 = Household size of the sesame farmers (numbers)
X_5 = sesame farmers education levels (level/yrs.).
Non-formal Education = 1 Primary = 2
Secondary = 3 Tertiary = 4
Never attend school =5
X_6= sesame farmers experience in years (yrs.)
X_7 = Level of monthly income sesame farmers (₦/)
X_8 = farm size (ha)
and β_1, β_2, β_3, β_4, β_5, β_6, β_7, and β_8 are the regression parameters to be estimated
α= constant
ui = Error term.

Result and Discussion

Cost and Returns Analysis for Sesame Production Average per Hectare in the Study Area

The result of cost and returns analysis in table 1 revealed that the average price of sesame output per bag was ₦35, 152.16, the average yield was 338.80 kg per hectare, and the average number of bags per hectare was 3.40 bags. The total average gross margin was ₦121, 136.5 and the net margin was accounted for at ₦48, 146.53, while the return per naira invested was 0.67 kobo. This implies that for every naira invested in sesame production in the study area, 67 kobo will be generated. Based on the decision rule of return per naira invested, it states that if the return per naira invested value is greater than 1, the business yields profit, and it yields a loss if it is less than 1. On the other hand, if the return per naira invested value is equal to 1, the enterprise is said to be at breakeven. This indicates that, based on this decision rule, the sesame business may be profitable in the study area and the operation ratio was 0.60. Similar results were reported by Makama *et al.* (2011) and Adole (2016), that sesame production is a profitable venture. This finding contradicts Musa *et al.* (2019) findings who stated that profitability analysis of sesame production in the Dutsin-ma Local Government Area, Katsina State, Nigeria, was ₦124,665.92 average net farm income per hectare.

Table 1: Cost and Returns Analysis for Sesame Production Average Per Hectare in the Study Area (n=116)

Cost and returns items	Cost (₦/ha)	Percentage
Seed (kg)	2, 969.483	4.06
Fertilizer	27, 531. 55	37.72
Manure	15, 191. 81	20.81
Agro-chemicals	8, 548.75	11.71
Sacks bags (no)	637.1121	0.87
Labour (man-days)	18, 111.26	24.81
Total cost of operation	72, 989.26	100.00
Returns		
Average price per bags	35, 152.16	
Average yield (kg/ha)	338.80	
Average bags per hectare	3.40	
Total gross margin	121, 136.5	
Net margin	48, 146.53	
Return per naira invested	0.67	
Operation ratio	0.60	

Source: Field survey data (2019)

Socio-Economic Factors Influencing Sesame Farmers' Profitability

The regression result of the factors influencing the sesame farmer's profitability in the study area is presented in table 2. The exponential production function was chosen as the lead equation based on the statistical criteria ranging from the sign of the coefficient, R^2 value, and number of significant variables. The value of the coefficient of determination R^2 was estimated at 0.883, which implies that about 88.3% of the variation in the profit from sesame production was explained by the explanatory variables included in the model, while the remaining 11.7% was as a result of omission of important explanatory variables as well as errors in estimation. The F-value of 16.023 indicates the overall significance of the model, thus confirming the appropriateness of the relationship between the dependent variable and the independent variables. The coefficient of household size was found to have a positive effect on the profit of the sesame farmers and was significant ($P<0.1$). The possible explanation for this finding is that as the number of households' increases, there is likelihood for the sesame farmers' profit to increase as a result of the reduction of the cost of hired labour by introducing family labour. It further suggests that family labour can be readily

available for expanding sesame farming. The coefficient of access to credit was found to have a positive effect on the profit of sesame farmers and it was significant at 10% level. This implies that an increase in the sesame farmers' access to credit, may lead to an increase in the profit of the sesame farmers. The coefficient of farm size use for sesame production was found to be positively related to the level of output at 1%, which may lead to an increase in the level of sesame farmers' profit. This implies that as the number of farm size used for sesame production increases, there will be an increase in the level of profit of sesame farmers in the study area. The coefficient of age was found to have a negative effect on the profit of sesame farmers and was significant at 10% level. This implies that an increase in the age of sesame farmers may lead to a decrease in the total profit of the sesame farmers. The possible explanation for this finding is that age has been found to have a negative relationship with the adoption of technology. This relationship is explained by Mauceri *et al.* (2005) and Adesina and Zinnah (1993), who found that as farmers grow older, there is an increase in risk aversion and a decreased interest in long-term investment in the farm. The coefficient of cooperative society was found to have a negative effect on the profit of sesame farmers and was significant at 10% level. This implies that an increase in the cooperative membership of sesame farmers, may lead to a decrease in the total profit of the sesame farmers. The possible explanation for this finding is that cooperative membership has been found to have a negative relationship with the adoption of technology.

Table 2: Socio-economic Factors Influencing Sesame Farmers' Profitability

Variables	Coefficient	t-value	Significant
Constant	-13029.606	-0.338	0.736
Marital status	0.015	0.362	0.718
Age	-0.164	-2.090	0.039*
Income	0.031	0.716	0.476
Level of education	0.000	-0.016	0.987
Household size	0.156	2.446	0.015*
Sesame farming experience	-0.008	-0.183	0.855
Farming experience	0.055	0.949	0.345
Cooperative membership	-0.124	-2.194	0.030*
Extension contact	0.052	0.874	0.384
Access to credit	0.091	2.019	0.046*
Farm size	0.936	23.532	0.000***
Type of seed	0.052	1.353	0.179
R^2	0.883		
R-adjusted	0.870		
F-value	65.023		

Source: Field survey data (2019) Note. ***significant at1% (P<0.01), *=significant at10% (P<0.1)

Conclusion and Recommendation

It could be concluded that sesame production in Bichi and Bagwai Local Government Areas may be profitable. Sesame farmers generated an average profit of ₦48, 146.53 from the business. As a result, the enterprise apparently assisted in increasing the farm incomes of rural small-scale farmers. Variable production costs occupied the highest proportion of the total cost. Among the variable costs, labour consumed the largest proportion of the expenses on variable inputs. A lot of factors influenced the net farm income obtained from sesame production. Unlike age and cooperative membership which has significant influence and a negative relationship with the farmers' net farm income, household size, farm size, and access to credit facilities had significant influence and a positive relationship with the profit of the sesame farmers.

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