Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 23, Issue 4, 2023
PRINT ISSN 2284-7995, E-ISSN 2285-3952

DIFFERENCES IN AGRICULTURAL RETURNS IN SESAME PRODUCTION: AN EMPIRICAL EVIDENCE OF EFFICIENCY IN FACTOR INPUT ALLOCATION IN RINGIM LOCAL GOVERNMENT AREA, JIGAWA STATE, NIGERIA

Tohib Oyeyode OBALOLA, Abdullahi Abbas YAKUBU

Usmanu Danfodiyo University, Department of Agricultural Economics, Sokoto, Nigeria, E-mails: oyeyodeobalola@yahoo.com; aayakubu13@gmail.com

Corresponding author: oyeyodeobalola@yahoo.com; obalola.oyeyode@udusok.edu.ng

Abstract

The study looked into the use of input in sesame production with the view on seeing the returns to its production in Ringim Local Government Area, Jigawa State, Nigeria. Data were obtained from 100 randomly selected farmers using the multistage sampling technique. Descriptive statistics, net farm income and regression model were used in data analysis. The result showed that the mean age of the respondents was 38 years with secondary education been most popularly attained. The respondents had a household size of 3 persons cultivating a farm size of 3.5ha with experience of 8 years on average in sesame production. The results also reveal net farm income and return on naira invested of ₦ 46,190.59 and 1.54 respectively, an indication of a profitable enterprise. The semi-log functional form gave the best fit based on the normal econometric criteria with coefficient of multiple determination of 0.312 implying that about 31 percent of the variation in yield of sesame was explained by the specified explanatory variables. It also revealed that there was under utilization of all the production inputs under consideration. It is therefore encouraged that more of the limiting factors (farm size, quantity of seed and quantity of organic manure) observed be put into cultivation.

Key words: *sesame, profitability, efficiency, resource use*

INTRODUCTION

Prior to independence, sesame was a major foreign exchange source to Nigeria. The annual exports of sesame from Nigeria are valued at about US$35 million from an estimated world trade of US$600 million in 2005 [1]. However, after the discovery of petroleum in the late 50s and its exploitation and export in the early 70s, the economic scenario changed in favor of crude oil as the chief revenue source for the nation [4, 12].

In 2022, according to the National Bureau of Statistics (NBS), the sesame seeds export value accounted for ₦139. 85 billion, representing 23.34 % of Nigeria's total agricultural exports [16].

In 2021, Nigeria came on the 5th position among the top exporters of Sesamum seeds in the world after India ($425M), Sudan ($402M), Niger ($344M), Ethiopia ($291M), and Nigeria ($256M) [14].

Sesame is grown essentially for sale and therefore it can be regarded as an economic enterprise organized exclusively for the pursuit of economic returns [8]. Sesame output was extremely poor, according to Jigawa State Agricultural and Rural Development Authority, ranging from 168 to 314 kg/ha [7]. However, if resources are employed effectively, enhanced sesame cultivars can generate over 1,000 kg/ha [9]. Sesame output in Jigawa State decreases on a figure of about 38,000 metric tons (MT) to about 10,000 MT from 2000 to 2004 [15].

The differences between observed yields and frontier yields are substantial despite the intensive study on sesame, a significant source of foreign exchange before independence, and various initiatives to increase sesame production in recent decades. Farmers' yields ranged from 168 to 1,066 kg/ha, and this might be enhanced by more effectively utilizing the agricultural inputs [5].

A study of sesame yields between Ringim and its neighboring local government areas reveals a significant difference in output, with respective values for Ringim, Taura, and Garki of 47,847 kg, 1,436,919 kg, and 1,821,739 kg in 2011 [6].

In view of the afore mentioned, efficiency in resource and technology use by farmers becomes a top goal for research. In order to increase production and efficiency in resource usage among sesame growers, it is crucial to enhance the aforementioned scenario. It is in the light of the forgoing that the research addressed the following objectives:

(i)Describe the socio-economic characteristics of the farmers

(ii)Determine the costs and returns to sesame production

(iii)Determine the resource use efficiency of sesame farmers

MATERIALS AND METHODS

Study area

Ringim Local Government Area is located on latitudes 12^0 17'N and longitudes 9^0 28'E. It has a total land mass of 1,057 km^2 and population of 192,024 [10].

Its common borders with Gabasawa Local Government Area, Taura Local Government, Garki and Taura Local Government, and Dutse, Jahun, and Ajingi Local Government are on the west, east, north, and south, respectively. The region has a flat, plain landscape with several distinct land features. The mean daily maximum and minimum temperatures are 35°C and 19°C, respectively, with 700 mm of rainfall on average a year [7]. Over 90% of the labor force depends on agriculture for a living, making it the mainstay of the State's economy as well as the economy of the Ringim local government. The bulk of the population also works in marketing in addition to farming. Sesame, cowpea, and groundnut are the state's three most important economic crops.

Sampling Procedure and Sample Size

Multi- stage sampling techniques was employed in the selection of the respondents for the study. Ringim Local Government Area has five districts namely; Ringim, Yandutse, Sankara, Dabi and Chai-Chai districts. The first stage involves the purposive selection of three (3) important sesame producing districts. In the second stage, two (2) villages were randomly selected from each of the three (3) selected districts. This gave a total number of six (6) villages for the study. The third stage involved a proportionate random sampling of 100 respondents from the sampling frame of 345 sesame farmers.

Method of data collection

Data were collected from primary source. This was obtained through the use of structured questionnaire that were administered to the selected 100 sesame farmers in Ringim Local Government Area.

Methods of Data Analysis

Descriptive and inferential statistics were used in analyzing the data. Descriptive statistics such as frequency, means and percentages were used to describe the socio-economic characteristics of sesame farmers in the area and also to identify the constraints to sesame production. Multiple regression analysis was used in the determination of efficiency of resource utilization by the sesame farmers in the study area.

Net Farm Income

The difference between gross income and all production costs is known as net farm income. According to [2, 11], it is expressed as:

$$NFI = GFI - TC \qquad (1)$$

where:
NFI = Net Farm Income (₦);
GFI = Gross Farm Income (₦);
TC = Total Cost (₦)
Since

$$TC = TVC + TFC \qquad (2)$$

Therefore, equation (1) can be re-written as:

$$NFI = GFI - TVC - TFC \qquad (3)$$

where:
TVC = Total Variable Costs of production (₦);
TFC = Total Fixed Costs of production (₦);

Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 23, Issue 4, 2023
PRINT ISSN 2284-7995, E-ISSN 2285-3952

Other variables are as previously defined.

Production function model

Ensuing [13], the model used was specified implicitly as:

$$Y = f\ (X_1, X_2, X_3, X_4, X_5, X_6, e) \quad (4)$$

where:

Y= Output of sesame of the i[th] farmer (kg)
X_1 = Farm size (ha)
X_2 = Quantity of seeds (kg)
X_3 = Labour (Man-Days)
X_4= Quantity of organic manure (kg)
X_5 = Quantity of fertilizer (kg)
X_6 = Pesticides (ltrs)

However, four functional forms were fitted to the data. The functional forms in their explicit forms were as follows:

Linear

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + e \quad (5)$$

Double log (Cobb-Douglas)

$$InY = \text{In}\beta_0 + \beta_1 InX_1 + \beta_2 InX_2 + \beta_3 InX_3 + \beta_4 InX_4 + \beta_5 InX_5 + \beta_6 InX_6 + e \quad (6)$$

Exponential

$$InY = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + e \quad (7)$$

Semi – logarithmic

$$Y = \text{In}\beta_0 + \beta_1 InX_1 + \beta_2 InX_2 + \beta_3 InX_3 + \beta_4 InX_4 + \beta_5 InX_5 + \beta_6 InX_6 + e \quad (8)$$

β_o - β_6 = regression coefficients
In = natural logarithm
Other variables are as earlier defined

Resource Use Efficiency

To access the resource use by the farmers, the allocative index was calculated. To do this, each input's marginal value product (MVP) is equated to its price or marginal factor cost (MFC). According to [13], it is expressed directly as:

$$MVP = P_{xi} = MFC_{xi} \quad (9)$$
$$MVP_{xi} = MPP_{xi} \cdot P_y \quad (10)$$
$$MPP_{xi} = \frac{dy}{dx_i} \quad (11)$$

Where,
MVP_{xi} = Marginal value product of the i[th] input;
P_{xi} = Unit price of the i[th] input;
MFC_{xi} = Marginal factor cost of the i[th] input;
P_y = Unit price of output;
MPP_{xi} = Marginal physical product of the i[th] input;
X_i = Mean quantity of input;
Y = Mean weight of output

However, the following conditions are obtainable;
MVP_{xi} >MFC_{xi} = Underutilization of resource X_i;
MVP_{xi} < MFC_{xi} = Overutilization of resource X_i;
MVP_{xi} = MFC_{xi} = Optimum utilization of resource X_i [13].

For the semi-logarithmic function, the elasticity with respect to the production input was computed using the formula:

$$E = \frac{\beta}{\bar{Y}} \quad (12)$$

where:
β = Coefficient of i[th] input
$\bar{Y}$ = Geometric mean of output

RESULTS AND DISCUSSIONS

The socioeconomic characteristics on sesame farmers showed that the farmers were young and still in their prime working years, with a mean age of 38 years. This backs up the argument made by [3]. The majority of farmers (72.34%) are married. The proportion of farmers with secondary education was higher. The farmers (23.40%) without a formal education came next. However, 22.34% of farmers had completed primary school, and 18.06% had completed tertiary education. A 3.5ha farm was cultivated by an average household of 3 farmers.

Table 1. Socioeconomic characteristics of the sesame farmers

Variable	Frequency	Percentage
Age (years)		
21-30	24	25.53
31-40	30	31.91
41-50	28	29.79
51 and Above	12	12.77
MEAN = 38		
Marital status		
Married	68	72.34
Single	16	17.02
Divorced	10	10.64
Education		
No formal education	22	23.40
Primary education	21	22.34
Secondary education	34	36.20
Tertiary education	17	18.06
Household size (number)		
1-5	53	56.38
6-10	26	27.66
11-15	12	12.77
16-20	3	3.19
MEAN = 3		
Farm size (hectare)		
1-2	41	43.62
3-4	23	24.45
5-6	19	20.21
7 and above	11	11.70
MEAN = 3.5		
Farming experience (years)		
1-5	33	35.11
6-10	30	31.91
11-15	18	19.15
16-20	10	10.64
21 and above	3	3.19
MEAN = 8		

Source: Field Survey, 2019.

The farmers had an average of 8 years of experience producing sesame. This was quite low and possibly explains the farmers' declining sesame production (Table 1).

Production costs and returns

The Net farm income (NFI) and return on naira invested was used to determine the profitability of the enterprise.

The total cost of production which comprises both the total variable cost and total fixed cost were considered.

The total variable cost per hectare was ₦ 23,763.60 and this account for 79.10% of the total cost.

From the total variable cost component, it was recorded that labour cost covers 60.45% of the total cost of production.

Accordingly, this was followed by cost incurred on fertilizer and seeds.

Similarly, the values of the fixed cost constitute only 20.9% of the total cost of production indicating small scale operation of the enterprise.

On the part of the fixed cost, depreciation gulped 10.91% of the total cost while rent on land amount to 9.99%.

Table 2. Average Costs and Returns to Sesame Production in Ringim Local Government Area

Production variables	(₦/ha)	Percentage
A. Variable cost		
Seed	750	2.50
Labour	18,159.93	60.45
Fertilizer	3,544.88	11.80
Pesticides	247.50	0.82
Transportation	532.33	1.77
Empty sacks	528.96	1.76
Total variable cost (TVC)	**23,763.60**	
B. Fixed cost		
Depreciation	3,278.34	10.91
Rent on land	3,000	9.99
Total fixed cost (TFC)	**6,278.34**	
Total cost of production (A+B)	**30,041.94**	**100.00**
C. Returns		
Revenue	**76,232.53**	
Gross margin (GM)	**52,468.93**	
Net farm income (NFI)	**46,190.59**	
Return on naira invested (NFI/TC)	**1.54**	

Source: Field Survey, 2019.

On the revenue, the average output and price from the study were 357.34kg and ₦ 213.33/kg respectively and amount to a revenue of ₦ 76,232.53/ha. However, the NFI was ₦ 46,190.59 (Table 2).

Return on naira invested was 1.54. This implies that sesame production is profitable in the area since return to naira invested was positive.

This finding is in line with that of [17] who reported, that sesame production is profitable in the study area (Table 2).

Production function analysis

According to conventional econometric standards, the semi-log functional form provided the best match. The coefficient of multiple determinations R^2 was 0.312, indicating that the explanatory variables specified were responsible for explaining around 31 percent of the variation in sesame yield. The coefficients of farm size, quantity of seeds and organic manure utilized were all found to be significant at the 10% and 1% levels, respectively.

The positive farm size coefficient indicates that, while maintaining other variables constant, an increase in farm size would result in an increase in production level. Ideally, *ceteris paribus*, increased land use would surely require more inputs, and as a result, under proper management, the output is anticipated to increase. The coefficients for the quantity of seed and organic manure used are also positive and significant at 1%. The output would therefore increase if these variables are used more frequently (Table 3).

Table 3. Results of the ordinary least square regression analysis for estimated sesame production

Variables	**Linear**		**Exponential**		**Double-log**		**Semi-log**	
Constant	1,684.606	0.503	3.564***	26.772	1.685*	1.888	-28,079.516	-1.234
Farm size (Ha)	1,013.547	1.349	0.290	0.959	0.236	1.493	7,664.906*	1.905
Quantity of Seed (Kg)	0.446***	3.147	1.67E-5***	2.960	0.309***	3.088	8,115.840***	3.178
Labour (Mandays)	0.008	0.172	158E-6	0.834	0.039	0.265	-2,195.265	-0.580
Quantity of Organic Manure (Kg)	12.722***	3.968	0.000***	3.643	0.383***	3.518	7,071.285***	3.442
Quantity of Fertilizer (Kg)	-3.158	-0.502	-910E-6	-0.036	0.031	0.178	-2,023.039	-0.449
Quantity of Agrochemical (Ltr)	-36.482	-0.217	-0.003	-0.517	0.006	0.409	3,424.875	0.815
R^2	0.332		0.289		0.287		0.312	
F- Value	6.039***		4.937***		4.894***		5.521***	

Source: Field Survey, 2019.
Note: *** significant at 1%, * Significant at 10%

Resource use efficiency

By calculating the ratio of the marginal value product (MVP) to the marginal factor cost (MFC), it was possible to analyze how effectively the resources were being used, as well as whether they were being used inefficiently, excessively, or both.

In order to get the elasticity for the computation of the allocative efficiency index, the coefficient from the semi-logarithmic output was divided by the geometric mean of the output. However, the result from Table 4 shows that all the resources were inefficiently utilized.

The allocative efficiency index with respect to farm size, quantity of seeds and quantity of organic manure were 1.52, 6.46 and 17.06 respectively and are greater than unity. This implies that these resources are underutilized. The under-utilization of farm size could be attributed to land fragmentation and the land tenure system. Since land appears to be a limiting factor, there is need to encourage farmers in the study area to bring more land under cultivation. Hence, the farmers are operating in stage 1 of the classical production function. More of the inputs should be employed in order to make the farmers efficient with their resource use (Table 4).

Table 4. Marginal analysis of input utilization of sesame producers

Resources	Elasticity(b)	P_y (N)	MVP	MFC	Allocative Efficiency Index (MVP/MFC)	Decision
Farm size (X_1)	21.45	213.33	4,575.93	3,000.00	1.52	Under utilized
Quantity of seeds (X_2)	22.71	213.33	4,844.72	750.00	6.46	Under utilized
Quantity of organic manure (X_4)	19.79	213.33	4,221.80	247.50	17.06	Under utilized

Source: Field Survey, 2019.
Unit price of output (P_y) = ₦213.33/kg
Mean of output = 357.34kg

CONCLUSIONS

From the study, it was shown that sesame farmers were functioning in stage I of the classical production function because they were underutilizing their production inputs. The enterprise's limiting factors were farm size, seeds, and manure. The farmer should boost input employment levels to function in stage II, the rational stage of production, in order to optimize output.

REFERENCES

[1]Ali, A., Salawu, A.J., Sani, R.M., 2015, Factors Influencing Sesame (*Sesamum indicum* L) Marketing in Jigawa State, Nigeria. Journal of Agricultural Extension, 19(2): 126-133. https://dx.doi.org/10.4314/jae.v19i2.11.

[2]Ayinde, O.E., Agboola, B.O., Obalola, T.O., 2023, Comparative Analysis of the Economic Performance of Shika Brown, Isa Brown and Harco Black Layers: An Experimental Approach. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 23(1): 49-56.

[3]Ayinde, O.E., Obalola, T.O., 2017, Effect of Socioeconomic Characteristics and Income Status on Onion Farmers Risk Attitude in Sokoto State, Nigeria. Agricultura Tropica Et Subtropica, 50(3): 141–146.

[4]Faborode, M.O., 2016, Optimal utilization of natural resources through research and development and technology adaptation. 4th RMRDC International Conference on Natural Resources Development and Utilization. Feb 8-9, 2016. Raw Material Research and Development Council (RMRDC), Federal Ministry of Science and Technology, Abuja, Nigeria.

[5]Jigawa Agricultural and Rural Development Authority (JARDA), 2010, Annual Crop Production Report. Agric. Services Unit.

[6]Jigawa Agricultural and Rural Development Authority (JARDA), 2011, Annual Report 2011.

[7]Jigawa Agricultural and Rural Development Authority (JARDA), 2005, Sesame Production Prospects and Marketing, 2005 Wet -Season Industrial Crops Production Programme. Jigawa State, Nigeria.

[8]Katanga, Y.N., Ginsau, N.I., Musa, S., 2021, Socioeconomic Analysis of Sesame Marketing in Hadejia L.G.A. of Jigawa State, Nigeria. Ife Journal of Agriculture, 33(1): 36-45.

[9]National Cereal Research Institute (NCRI) 2004, Report of the Base Line Survey on Beniseed Production and Utilization in Nasarawa State. Project commissioned by the Nasarawa State Government pp 23.

[10]National Population Commission (NPC) 2006, Population Figure: http://www.jstor.org. Accessed on 25/7/2023.

[11]Obalola, T.O., Agboola, B.O., Odum, E.B.E., 2017, Profitability and Constraints to Irrigated Onion Production in Wamakko and Kware Local Government Areas, Sokoto State, Nigeria. Journal of Global Agriculture and Ecology, 7(3): 106-110.

[12]Obalola, T.O., Likita, T., Aboaba, K.O., Olabode, E.J., 2020, Drivers of cassava and rice consumption in Nigeria: A vector error correction model approach. Agro Economist - An International Journal, 7(1): 01-11. https://dx.doi.org/10.30954/2394-8159.01.2020.1

[13]Obalola, T.O., Tanko, L., 2016, Comparative Economic Analysis of Irrigated and Rainfed Spinach (*Amaranthus cruentus*) Production in Minna Metropolis, Niger State, Nigeria. Journal of Agriculture, Food and Development, 16(1): 91- 98.

[14]OEC.world, https://oec.world/en/profile/hs/sesamum-

seeds#:~:text=Sesamum%20seeds%20are%20the%20world's,%2C%20and%20Nigeria%20(%24256M), Accessed on July 31, 2023.

[15]Raw Materials Research and Development Council (RMRDC) 2004, Report of Survey of Agro-Raw Materials in Nigeria: Beniseed Publisher Raw Material Research and Development Council, Garki Abuja.

[16]The Nation, 2023, Nigeria records marginal gains in sesame exports, https://thenationonlineng.net/nigeria-records-marginal-gains-in-sesame-exports/, Accessed on July 31, 2023.

[17]Umar, H.S., Okoye, C.U., Mamman, B.D., 2010, Resource use efficiency in sesame (*Sesamum indicum* L.) production under organic and inorganic fertilizers application in Keana Local Government Area of Nasarawa State, Nigeria. Journal of Agriculture and Biological Sciences, 6 (4): 466-467.