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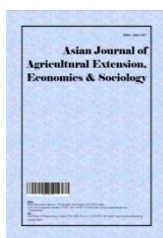
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Costs and Returns Analysis of Sesame Production in Northern Cross River State, Nigeria

M. O. Oniah^{1*} and T. O. Edem¹

¹Department of Agricultural Economics/Extension, University of Cross River State, Obubra Campus, Nigeria.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The study examined costs and returns in sesame production in Northern Agricultural Zone of Cross River State, Nigeria during the 2020 cropping season. Multistage sampling technique was used to select 140 respondents using purposive and random selection. A well-structured questionnaire was the main tool for data collection. Descriptive statistics was used to describe the socio-economic characteristics of the farmers, gross margin analysis was used to determine gross returns per hectare of sesame production. Results showed that males were dominant (61.4%) in sesame production in the area and some (39.3%) were between 41-50 years. Majority of the farmers (75.5%) were married, 50.7% had no formal education while 42.9% had farming experience of 6-10 years. Also, the results found that majority (94.3%) sourced their farm capital from personal savings. The study revealed that a total of 116.7 hectares were put under sesame production in the 2020 cropping season by the respondents representing 2.5% of the total land area of the three Local Government Areas of the State. Constraints on sesame production were found to include lack of credit facility, high cost of labour, low yielding varieties, and high cost of planting seeds.

Keywords: *Costs and returns; Sesame and production.*

**Corresponding author: E-mail: oniahmon@yahoo.com*

1. INTRODUCTION

Agriculture plays essential role in sustaining and driving the economies of the world. It is significant to the growth of Nigeria's economy especially, as it provides food for the populace, raw materials for industries, as well as a major source of revenues to government both locally and internationally [1]. The sector employs over 70% of Nigeria's active population and its contribution to the Gross Domestic Product (GDP) was 24.1% in 2020 (www.data.worldbank.org). More than 80% of the country's population lives in rural areas and is dependent on agriculture for their livelihood. Majority of the active population is employed in the agricultural sector and are living in the rural areas, the sector holds a major role to Nigeria's economic development [2].

Sesame (*Sesamum indicum*) also called "Benne Seed," belongs to the family of *Pedaliaceae* and is one of the oldest crops cultivated by man.

Sesame is known as "ridi", "Etuku" and "Isasa" by the Hausa's, Yoruba's and the Igbos irrespectively. African slaves are said to have brought the seeds of sesame to America where it became a popular ingredient of food recipes in South America [3], having been grown in the far east and Africa for over 5000 years for cooking and medicinal needs [4]. Sesame production in Nigeria started in the guinea savannah region of the country, especially in Benue State and later spread to other parts of the country where it is commonly grown by small holder farmers [5].

Major producing areas of sesame in Nigeria are Benue, Nasarawa, Jigawa, Yobe, Gombe, Kano, Plateau, Katsina and Kogi States [6, 7]. Other states where it is cultivated in small scale include Cross River, Adamawa, Bauchi, Taraba, Kano, Kebbi, Ebonyi, Niger, Zamfara and Borno States. However, over 80,000 hectares farmland planted with sesame across the Northern States are majorly for food and oil (Ikwaakam, *et al.*, 2016).

Sesame is a multi-purpose crop. It can be used for the production of margarine, canned sardine, corned beef, soap making, and ink [8]. Sesame seeds are rich in proteins including essential amino acids, fats, oil, carbohydrates, minerals, and vitamins. It is used in confectioneries, as cooking oil, ingredients in cuisines, and feed for poultry/ livestock. Sesame oil can be used to cure ulcers and burns, it is also an important source of food for local families; the growing

leaves can be used in making local soups and eaten in stews. The dried stem can serve as a source of fuel with the ash, used for production of local soap [9].

Global production of sesame in 2019 was estimated to be 6.55m metric tons (MT) produced on 9.9m hectares of land with Africa and Asia producing nearly 90% of the world's total output. According to the 2019 data, the top 5 world sesame seed producers were Sudan (1.2m MT), Myanmar (744,498 MT), India (689,310 MT), United Republic of Tanzania (680,000 MT) and Nigeria (480,000 MT) [10]. Nigeria ranked the 5th sesame seed producer in the world in 2019 and the 2nd largest sesame seed producer in Africa after Sudan. Over 80% of sesame seeds produced in Nigeria are mainly exported to continents like Asia, Europe, and East American, which are major importers of sesame [11].

There has been a tremendous increase in Nigeria's foreign exchange earnings from sesame production in the last decades. Available data shows that its production rose from \$19m in 2003 to about \$139m in 2010 with an estimated \$170m earnings from sesame seed export in 2018 (Nigerian Export Promotion Council, NEPC, 2018 cited in Jonah *et al.*, 2020). According to data from National Bureau of Statistics (NBS), Nigeria earned ~~N~~49.1 billion from the export of sesame seed products during the first quarter of 2020, making it the most traded agricultural products in the country (Nigerian Investment Promotion Commission, NIPC) [12]. Sesame is a popular cash crop among farmers due to its good local and international markets potentials (Ikwaakam, *et al.*, 2016). Given that there is available large arable land and conducive climatic conditions alongside with the increasing demand for sesame, the country has the potential for earning additional foreign exchange if opportunities in the European Union could be exploited.

2. STATEMENT OF THE PROBLEM

Sesame is one of the cash crops grown in the Northern part of Cross River State, Nigeria. It is a very popular crop among the rural farmers. The crop is grown by the farmers for human consumption, medicinal purposes and with just a little for income. Musa, *et al.*, [7] reported that sesame production in Dutsin-Ma Local Government Area of Katsina State of Nigeria is profitable as sesame farmers obtained

3.02 for every one naira invested in sesame enterprise.

However, despite the significance of sesame in raising the farmer's farm incomes, there is little or no study that analyzed costs and returns of the crops as well as challenges associated with the production of sesame in the study area. Farmers need to be aware of the cost of factors of production used in sesame; they may choose to engage in sesame enterprise to increase their farm incomes and thus reduced poverty, which could in turn help raise the standard of living of the people in the area. Given this gap, it is imperative to empirically investigate and analyze the costs and returns of sesame production in the area with a view to encourage the teeming youth and other investors to engage in the sector in Cross River State, Nigeria.

Accordingly, the study generally analyze the cost and returns of sesame production in Northern Cross River State, Nigeria. Specifically the study described the socio-economic characteristics of sesame farmers in the study area; examined the average output per hectare of sesame production in the study area; determined the average cost per hectare and returns to factors of production in the study area; assessed the gross margin per hectare of sesame production. And finally, identified some peculiar constraints in sesame production in the study area.

3. METHODOLOGY

Study was conducted in northern agricultural zone of Cross River State, Nigeria. The state is one of the Niger Delta states and shares boundaries with Benue state on the north, Ebonyi on the west, Akwa Ibom on the southwest. It is bordered on the east by Cameroun Republic and fronts the bright of Biafra on the south. Five (5) local Government Areas (L G As) constitutes the zone namely, Bekwarra, Obanliku, Obudu, Ogoja and Yala. The land area of the zone is estimated at 4527km², about 22 % of the state's total land mass (20,156km²). It lies between latitudes 5° 45'N of the Equator and Longitude 8 30'E of the Greenwich Meridian. The region has an estimated population of about 1,015,300 [12]. The topography of the zone is generally low lying, ranging from below 80 - 140mm [13]. Northern Cross River have a humid tropical climate of 1250 - 1300mm rainfall with a mean Annual temperature of 30°C. The people of the zone are agrarian in nature. The major types of crop grown in the area include yam, cassava,

rice, maize, guinea corn, potato, okro, oil palm, cashew, beniseed, groundnut, mango, orange and pears [14].

3.1 Sampling Technique

A multistage sampling technique was employed for the study. The first stage involved the purposive selection of three (3) Sesame growing Local Government Areas from the five Local Government Areas that make up the Northern Agricultural zone of the State. These are Bekwarra, Obudu and Yala. The three Local Governments Areas were selected based on their high level of involvement in sesame production. These three Local Government Areas in the last five years have contributed over 20% of the total sesame in Cross River State (Cross River State Ministry of Agriculture, 2020). The second stage involved the random selection of five major Sesame producing villages from the selected LGA based on the intensity of sesame farming practiced in the areas. A total of 140 farmers from a list of 1400 sesame farmers were randomly selected using random numbers, thus, representing ten per cent (10%) of the sample frame.

3.2 Source of Data

The data were collected from both primary and secondary sources. Primary data were gathered through the use of structured questionnaire, containing information such as the socio economic characteristics of the respondents (age, gender, marital status, education level, farming experience and sources of income. Data were equally collected on cost of farm labour, farm size, and output per hectare and the market price per Kg of sesame production as well as the constraints associated with sesame production from the farmers in the area. Secondary information was obtained from journals, Central Bank of Nigeria Annual report, Raw Materials Research and Development Council (RMRDC) report [15] and websites (www.naerls.gov.ng/extmat/bulletins/Beniseed, www.nipcr.gov.ng and <http://www.tridge.com/intelligences/sesameseed/NG/production>).

3.3 Analytical Technique

The data for this study were analyzed using descriptive and inferential statistics. The descriptive statistics was used to describe the socioeconomic characteristics of Sesame

farmers in the study area. While Gross Margin Analysis was used to determine the total variable costs (TVC) incurred in the course of production of one hectare of sesame from the total revenue (TR) from sesame production. The total variable costs of production are the cost of labour, fertilizers, agro-chemicals, and other expenses. The Gross Margin (GM) analysis was expressed as:

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

where;

GM = Gross margin

TR = Total revenue

TVC = Total variable cost

The higher the GM, the more likely a farm was considered to be profitable and the smaller the GM, the lesser the profit possibility.

4. RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of the Respondent

The results of the analyzed data on socioeconomic characteristics of sesame farmers in the study area are presented in Table 1.

Table 1. Socio-economic characteristics of the respondents

Variables	Frequency	Percentage	Mean
Sex			
Male	86	61.4%	
Female	54	38.6%	
	140	100	
Marital status			
Single	22	15.7	
Married	106	75.7	
Widowed	4	2.9	
Widower	5	3.6	
Divorced	3	2.1	
	140	100	
Age			
10 – 20	1	0.7	
21 – 30	20	14.3	
31 – 40	45	32.1	45
41 – 50	55	39.3	
51 and above	19	13.6	
	140	100	
Level of education			
No formal education	71	50.7	
Primary school	18	12.9	
Senior secondary school	25	17.9	
Higher institution (NCE/OND/HND/B.Sc.)	26	18.6	
	140	100	
Years of farming experience			
1 – 5	46	32.9	
6 – 10	60	42.9	
11 – 15	26	18.6	10.5
16 – 20	6	4.3	
21 and above	2	1.4	
	140	100	
Source of income			
Personal savings	132	94.3	
Access to formal loans	2	1.4	
Friends and family	3	2.1	
Money lenders	3	2.1	
	140	100	

Source: Field data, 2020

4.1.1 Gender

The result in Table 1 shows that majority 61.4% of the sesame farmers were males while 38.6% were females, implying that men were more involved in sesame production than females in the study area. This finding agrees with the findings of Musa, et al. [7] and Meleaku, et al. [16] who reported that most of the sesame farmers they sample were males.

4.1.2 Age

Table 1 shows that 39.3% of the sesame farmers fall within the age range of 41 - 50 years. This shows that most sesame farmers in the study area are within their economically active ages; which could be able to translate into improve productivity of sesame production in the area. The mean age of the farmers in the study area was found to be 45 years and agrees with the findings of Meleaku, et al. [16] who reported an average of 44.83 years for sesame farmers in their study area. This result further agrees with Yusuf [17] ascension that farmers within their active age can make positive contribution to agricultural production. It is slightly higher than that of Tukura and Ashindo, [2] who reported the mean age of sesame farmers to be 42.6 years in Taraba State, Nigeria. This result disagrees with the findings of Ikwuakam, et al., Lawal, et al. and Suraj, et al. who reported the mean age of 38, 32 and 36 years for sesame farmers in Nigeria. The small number of people within the age of 20-30 years in the study area was as a result of youth migration to the urban centers where they expect to find better conditions of life.

4.1.3 Marital status

The results in table further reveals that 75.5% of sesame farmers in the study area were married and only 15.7% were single. The high proportion of the respondents who are married implies that family labour could be available for sesame farmers in the study area. This study agrees to the findings of Lawal, et al., [10] and Suraj, et al. [4] who reported 84% and 86.7 % of sesame farmers in Nigeria were married. Meleaku, et al. [3] also had similar result in Tigray, Ethiopia (75%).

4.1.4 Educational level

The result in Table 1 shows that majority of the farmers 50.7% had no formal education while 12.9%, 17.9% and 18.6% had primary,

secondary, and tertiary education respectively. In aggregate, the proportion of sesame farmers who had no formal education in the study area was slightly higher than those who had had formal education (49.3%). This result depicts that farmers in the study area may be slow or unable to adopt new and improved farming practices on sesame production as majority of the farmers still adopt the traditional methods of farming. This finding agrees with Ikwuakam et al., who reported that most of the sesame farmers in Katsina State, Nigeria did not acquire western education and only 32.80% were formally educated. However, formal education would enhance the farmer ability to understand and evaluate information on new techniques as well as the risk involved in farming.

4.1.5 Farming experience

The result in Table 1 reveals that majority 42.9% of the sesame farmers had 6-10 years of experience in sesame production, implying that farmers in the study area are well experienced in sesame production and indicates a good signal for higher productivity. This is in line with Abu et al. [18] that farming experience determines the ability of the farmer to make good farm management decisions effectively with regards to inputs combinations. The mean farm experience in sesame farming was found to be 10.5 years. This is in line with the findings of Musa et al., [7] and Tukura and Ashindo, [2] they reported the average years of experience of 10 years for sesame farmers in Nigeria. It disagrees with the findings of Nyiatagher and Ocholi [19] in Benue state, who reported that the average experience of farmers in sesame production was 27 years.

4.1.6 Sources of income

The table shows that most of the respondents (94.3%) reported personal saving as their source of capital while only 1.4% reported banks as their source of capital. This implies that farmers in the study area have very little or no contact with financial institutions and may be due to the bureaucratic processes involved in accessing credit facilities as well as the exorbitant interest rate charged by financial institutions. Makama, et al. [3] stated that linking farmers with the financial institutions would solve some of the problems associated with inadequate capital of farmers. This result agrees with Makama, et al. [3] that 88.54% of the sesame farmers in Jigawa State have personal savings as their source of capital. It also conforms to the findings of Katanga et al.

who reported that 57.5% of sesame farmers acquired capital through personal savings.

Table 2. Average output per hectare of sesame production in the study area

S/N	Variables	Total
1	Total farm size (hectare)	116.7
2.	Total output (Kg)	27,144kg
3.	Average output	232.6kg/ha

Source: Field data, 2020

4.2 Output of Sesame Production Per Hectare

Table 2 shows the average output of sesame production in the study area. The study revealed that sesame farmers in the area realize an average yield of 232.6kg/ha. This result does not agree with RMRDC [15] cited in Nyiatagher and Ocholi [19] that sesame seed yields on farmers' fields in Nigeria are between 500kg-750kg per ha. It also differs from the average yield of 300kg/ha reported by NAERL [20]. The low yield per hectare could be attributed to a number of factors namely, poor innovative practices resulting from lack of information on current farming practice, planting of low yielding varieties, as well as lack of credit facilities through formal banking institutions.

4.3 Average Variable Costs Per Hectare and Returns of Sesame Production

Table 3 below shows the percentage of variable costs and average cost per hectare of sesame production in the area while table 5 shows returns per variable factors of sesame production and gross returns of sesame production in the study area respectively.

The result depicts that family and hired labour accounted for 75.3% of the total cost of production (5,246,850) and seed cost accounted for 7.5% while rent on land and transportation cost accounted for 6% and 5% respectively. Other costs such as fertilizer, herbicides, and toll accounted for 3.3%, 1.2% and 1.83% respectively. The average cost per hectare for producing sesame in the area was found to be 29,968.5k/ha. This result shows that labour is the highest cost of factors of production by farmers in the production process and agrees with Makama, et al. [3] that labour cost accounted for 54.61% of the total cost of sesame production in their study area. Nyiatagher and Ocholi and Iorlamen et al. [21] also found labour cost to be highest among

other costs in sesame farming in Benue state, Nigeria. This shows that the farmers spent more on labour than other inputs. Tukura and Ashindo [2] also had similar results.

The returns to variable factors of production, indicates that for every one naira spent on seed, a gross return of 57.5k will be made. Labour had a gross return of 5.7k indicating that for every naira spent on labour, additional income of 5.7k will be generated as gross returns. Similarly, herbicides, rent on land, transportation, fertilizer and toll had a gross returns of 371.8k, 71.5k, 86.6k, 129.6k, and 233.8k respectively, implying that for every one naira spent on herbicides, rent on land, transportation, fertilizer and toll an additional 371.8k, 71.5k, 86.6k, 129.6k, and 233.8k is made respectively. This shows that sesame production in the area is profitable.

4.4 Gross Margin Analysis of Sesame Production in the Study Area

A total of 29,932,150 was realized as respondents total gross returns with a Gross margin of 22,961,470 and a gross return of 196,756.38k per hectare of sesame production in the study area. This implies that the positive and large revenue indicated that total return is higher than the cost. Return per Naira Invested was 3.29 implying that for every one naira invested in sesame enterprise during the production season. This shows that sesame production in the area is profitable and can be cultivated by the teaming youths to raise income and reduce poverty. The result is in line with the findings of Musa, et al. [7] who reported that sesame production in DutsinMa Local Government Area, Katsina State of Nigeria had 3.02 for every naira invested in sesame enterprise. It differs from that of Makama, et al. [3] and Tukura and Ashindo [2] who reported a 1.93 and 1.80 respectively for every naira invested in sesame enterprise.

4.5 Constraints to Sesame Production

There is no doubt that every human endeavor is usually plaque with problems. This is also the case with sesame farmers in Northern Cross River regarding their sesame production. The results in Table 6 reveals that no credit facilities (28.6%) ranked first among the constraints farmers are facing in sesame production in the study area. The result implies that sesame farmers in the area have little or no access to formal loans in the area. Without credit facilities, sesame farmers will find it difficult to carry out

production in large scale [22]. This is followed by high cost of labour (25.7%), low yielding varieties (15%), and high cost of planting seeds (10.7%) among others. The farmers in the area are bereft of low yielding varieties, implying that the farmers are producing below the expected output compared with other areas where sesame are grown. Because of high cost, adoption level could not be sustained. The result is in line with Akomaye, et al. [22] who reported that farmers in Taraba State were faced with the challenges of

inadequate capital and credit, high costs of agricultural inputs amongst others. Therefore, provision of credit facilities to these farmers would yield the desired results that would culminate in increased productivity from the area. Thus, solving the problems facing the sesame farmers will make sesame enterprise even more profitable and could encourage the farmers to produce more of the crop which would in turn help in improving the living standard of the farmers as well as marketers of the crop [23].

Table 3. Percentage variable cost and average costs per hectare of sesame produced

S/N	Variables	Amount	Percentage (%)
1.	Seeds	520,200	7.5
2.	Labour	5,246,850	75.3
3.	Herbicides	80,500	1.2
4.	Rent on Land	418,500	6.0
5.	Transportation	345,700	5.0
6.	Fertilizer	230,900	3.3
7.	Toll (Ticket and haulage)	128,030	1.83
		6,970,680	100
	Total Variable Cost (TVC)	6,970,680	
	Average cost per hectare (TVC ÷ Average output)	29,968.50	

Source: Field data, 2020

Table 4. Returns to variable factors of sesame production in the study area

S/N	Variables	Amount	Returns
1.	Gross returns	29,932,150	
2.	Variable cost		
	i. Seeds	520,200	₦57.5k
	ii. Labour	5,246,850	₦5.7k
	iii. Herbicides	80,500	₦371.8k
	iv. Rent on Land	418,500	₦71.5k
	v. Transportation	345,700	₦86.6k
	vi. Fertilizer	230,900	₦129.6k
	vii. Toll (Ticket and haulage)	128,030	₦233.8k
3.	Total Variable Cost (TVC)	6,970,680	

Source: Field data 2020

Table 5. Gross margin for sesame production in the area

S/N	Variables	Value
1.	Total variable cost (TVC)	₦6,970,680
2.	Total returns (TR)	₦29,932,150
3.	Gross margin (TR - TVC)	₦22,961,470
4.	Gross returns per hectare (GM ÷ Total farm size)	₦196,756.38k/ha

Source: Field data, 2020

Table 6. Constraints to sesame production

S/N	Constraints	Frequency	Percentage	Rank
1.	No credit facilities	40	28.6	1 st
2.	High cost of labour	36	25.7	2 nd
3.	Low yielding varieties	21	15	3 rd
4.	High cost of planting seed	15	10.7	4 th
5.	No information on current farming practices	9	6.3	5 th
6.	High cost of agro-chemicals	6	4.3	6 th
7.	Poor farm implements	5	3.6	7 th
8.	Drought/weather	4	2.9	8 th
9.	Price fluctuation	3	2.1	9 th
10	Low income from output	2	2	10 th
11	Problems of managing credit	0	0	11 th
Total		140	100	

Source: Field data, 2020

5. CONCLUSION

Based on the findings of this study, it is concluded that majority of the respondents are within the average age of 45 years. The average yield per hectare was 232.6kg. Sesame enterprise is profitable as the gross return was 196,756.38k per hectare and the average rate of return per naira invested was 3.29, implying that for every one Naira invested in Sesame production, 3.29k was realized in return. The major constraints to sesame production in the area were; lack of credit facility, high cost of labour, low yielding varieties, and high cost of planting seeds. Given these findings the production of sesame would be increased if the farmers are given opportunity to financial assistance to improve on their production techniques.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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