Original Research

Volume 06, Issue 01, pp. 159-167, June 2024

ACHIEVERS JOURNAL OF SCIENTIFIC RESEARCH

Open Access Publications of Achievers University, Owo

Available Online at www.achieversjournalofscience.org

Estimating the Profitability Analysis and Problems of Small-Scale Potato Production in Some Selected LGAs In Plateau State

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Submitted: April 20, 2024; Revised: May 28, 2024; Accepted: June 1, 2024; Published: June 29, 2024

DOI: 10.5281/zenodo.13306579

Abstract

This study was conducted to estimate costs and returns from production and examined profitability and problems of small-scale potato production in Plateau state. Research on cost and returns analysis can provide valuable insights into the factors affecting the profitability of potato farming in Nigeria. Policymakers can use this information to design effective policies and interventions to support the agricultural sector and improve the livelihoods of potato farmers. A four-stage random sampling technique was employed to obtain primary data from 120 respondents with a well-structured questionnaire. Data were analyzed using descriptive and inferential statistics such as mean, frequency count, percentages, gross margin, and multiple regression analysis. The study revealed that small-scale potato production in the area was profitable as the estimation of cost and profitability of the farmers in the area under study confirmed that with a NFI of ₦ 117,015.02 per hectare and labor constitute 62.73 % of the total cost. Farmers in the study area face constraints such as poor/inadequate storage facilities, high post-harvest losses, high costs of inputs etc. The study recommends that proper storage measures/facilities should be made available to these small- scale farmers at affordable prices, credit facilities should be given to these small-scale potato producers in the area to increase output, and policy interventions to protect local producers should be put in place.

Keywords: Costing; Farmers; Irish Potato; Production; Profitability; Returns.

1. Introduction

Potato (*Solanum tuberosum L.*), is the most commonly cultivated tuber crop and the fourth most important food crop in the world, after wheat, rice and maize (Haan and Rodriguez 2016). The world's population is expected to exceed nine billion by 2050

(United Nations, 2019). In most of the developing countries, and more specifically in urban areas, increasing levels of income are driving a "nutrition transition" toward more energy rich foods and processed food products. Potato is annually cultivated in about 20 million hectares with approximate production of 320 million tones globally (Poczai *et al*., 2010). The potato production has rapidly overtaken all other food crops in Africa and Asia since the early 1960s, potato production in the world is undergoing major change. Potato is short-duration crop and fits well in different multiple and intercropping systems. Potatoes are grown in wide range of soil (alluvial, hill, black, red and laterite) having pH in the range of 5 to 7.5 (Thamburaj and Narendra 2016). Well drained coarse or sandy loam to loamy soils is good for the growth of roots, stolons and tubers as they supply sufficient oxygen. Soils with high organic matter are perfect for potato cultivation. Good crop growth is observed when days are sunny and nights are cool with temperature not more than 23^{o} C. Tuber formation starts from 20 to 25 days after planting. Highest tuber formation takes place when day temperature 20^{o}C and night temperature 14^{o}C (Choudary *et al*., 2009).

Over 85% of the potato production in Nigeria are done by small-scale farmers and they carry out their operations manually with traditional farm implement like hoes, machetes etc. The land is cleared of the debris and the thrash burnt. Ridges or flats are made depending on weather it is rain-fed or irrigated potato production. Only about 36% of farmers use tractors (Okonkwo, *et al*., 2009). Potato requires high altitude about 1000 - 1800 meters above sea level, and low temperature of 15°C or less. Furthermore, in Nigeria the crop is grown in Jos and Manbilla Plateau, with altitude of at least 1400 meters above sea level and a temperature about 10-20°C. Asumugha *et al*., (2006) reported that potato is produced in several northern states such as in Borno, Kaduna, Kano and Sokoto during the colds and dry periods. However production is concentrated in Jos plateau and accounted for over 75% of the total production in Nigeria. According to a 2012 study, an estimated 300,000 households in Nigeria engage in potato production, which translates to an average planted area of 1 hectare (2.5 acres) per household each year. The country's main potato-planting region is the Plateau State (Barkin Ladi, Jos South, Riyom, Bokkos, and Mangu) which accounts for almost 90% of the national potato yield. Plateau State potato production capacity hits 960,000 metric tons annually, the Plateau State Value Chain Support Project has disclosed that the capacity of potatoes production by farmers in the state has hit 960,000 metric tons annually. Other potato-producing areas include Obudu in Cross River and Mambilla in Taraba State. Additionally, some low level of production takes place in Kaduna and Kano states during the harmattan months of November to January. Potato production takes place in both the wet season (April till September) and the dry season (October till March).

Empirical studies on the profitability of potato and other tuber crops in other States of Nigeria, apart from Plateau State, exist (Muhammad *et al*., 2016; Adekanye and Oyekale, 2015; Ogunleye and Adeyemo, 2017) while only Jwanya *et al*., (2014) was found to assess profitability of Irish potato in Plateau State, with the finding that it is a profitable enterprise. Most studies assessed the determinants of production and efficiency rather than the profitability of potato (Jatbong *et al*., 2018; Gebru *et al*., 2017; Tolno *et al*., 2016; Adekanye and Oyekale, 2015). Determinants of Irish potato profitability were therefore inferred from these empirical studies to include: education, sex, age, farm experience, farm size, agrochemicals,

household size, marital status, type of land ownership and cooperative membership.

Proper management plays an essential role in farming production, Olukosi and Erhabor, (2006) described farm management as both the science and art with primary concerned with the organization of factors of production and operation of farm firms so as to achieve certain predetermined objectives such as profit maximization. The manager coordinates other factors of production which if he fails; the farm also fails, thereby resulting to non-attainment of objectives. However, Eyoh and Igben (2002) observed that farm management as a practical aspect of the applied science of agricultural economics as it enhances the application of physical and biological science in keeping with the farm net income. Also, the availability and ease of acquisition of land will determine farm size which results in profitability; the size of the farm does not necessarily determine profitability but contributes to it. Furthermore, Capital is a limiting factor that determines the size of an enterprise. According to Eyoh and Igben (2002) capital is considered as total investment available for use in the farm operation and can also be defined as anything produced which is used to increase the effectiveness of current activity that is not immediately consumed. Lipsey (1995), defined cost as all those man-made effort to further production which is used up in the process of making other goods and services rather than being consumed for their own sake. However, profitability of any enterprise depends on capital. Lipsey (1995), defined labour as all productive human resources mental and physical, both inherited and acquired. Small scale farmers utilize family labour very efficiently and monetary values may be difficult to attach to them so much so that the total cost incurred may exclude labour. Obasi and Agu (2000) showed that labour in small scale farming is often limited to household due to small size of the business and considering the fact that hired labour may be costly and wasteful maximizing them in other productive ventures.

A combination of various factors seems to have triggered the structural increase in potato consumption over the years with consumption broadening across all socio-economic classes, including the poor. Rising demand is as a result of increasing population growth and income level (Global Agricultural Information Network, 2012) coupled with the ease of its preparation and storage. Between 55 and 60% of subsistence farmers' output provides incomes and forms the basis of many households' diets in rural and urban areas (Balami *et al*., 2011). Potato production in Nigeria faces many constraints, including disease and pest, unavailability of good-quality potato seeds, poor storage methods, insufficient education on farming methods and pest control, inadequate research and development, and inadequate farming equipment. Over the years, potato farmers in Nigeria were exposed to many threats including those who contemplated suicide because of potato failure due to late blight infestation but that two years of research on addressing the pest and diseases threats, the team was confident that succor has finally come for farmers in the country. For many decades now, policies for agriculture, trade, research and development, education, training and advice have been strong influences on the choice of technology, the level of agricultural production and farm practices (Girei *et al*., 2020). Nigeria ranks seventh among potato-producing countries in Africa and fourth in Sub-Saharan Africa, with an annual production yield of around 843,000 tonnes (830,000 long tons; 929,000 short tons) and an actual planted area of 270,000 hectares (670,000 acres). In spite of that, the average yield in Nigeria of 3.1 tonnes/ha is among the world’s lowest. This study focuses on the

cost and returns profitability of the small-scale potato farmers as well as the problems facing the famers in some selected local government areas of Plateau State. Overall, researching cost and returns profitability analysis and problems confronting potato small-scale farmers in Plateau State is essential for sustainable agricultural development, informed policymaking, agricultural extension services and improved farmers' livelihoods.

2. METHODOLOGY

2.1 Study Area

Plateau State is among the twelve largest Nigerian state, its location is near the center of Nigeria and has a range of hills surrounding the Jos Plateau, which is its capital, and the entire plateau itself. Plateau State is described as "The Home of Peace and Tourism". With natural rock formations, hills and waterfalls, it derives its name from the Jos Plateau and has a population of approximately 4.7 million people. Plateau State is located in the North Central Zone out of the six geopolitical zones of Nigeria. With an area of 26,899 square kilometres (10,386 square metre), the state has an estimated population of about three million people. It is located between latitude 8°24' N and 10°30' N and longitude 8°32' E and 10°38' E. The state has a mountainous area in the north of the state with rock formations. Bare rocks are scattered across the grasslands, which cover the plateau. It has an altitude range of around 1,200 metres (3,900 ft) to a peak of 1,829 metres (6,001 ft) above sea level in the Shere Hills range near Jos. Years of tin and columbite mining have left the area strewn with deep gorges and lakes (Ogheneruemu and Dominic, 2020).

Although situated in the tropical zone, the higher altitude gives the state a near-temperate climate, with an average temperature between 13 and 22 °C. Harmattan winds cause the coldest weather between December and February, with the warmest temperatures usually in the dry season months of March and April. The mean annual rainfall varies between 1,317 mm (52 in) in the southern part to 1,460 mm (57 in) on the plateau, with the highest rainfall during the wet season in July and August. The cooler climate has led to a reduced incidence of some tropical diseases such as malaria. The Jos Plateau is the source of many rivers in northern Nigeria, including, Gongola, Hadeja and Damaturu rivers.

The Jos Plateau is thought to be an area of younger granite which was intruded through an area of older granite rock, making up the surrounding states. These "younger" granites are thought to be about 160 million years old. This creates the unusual scenery of the Jos Plateau. There are numerous hillocks with gentle slopes emerging from the ground like mushrooms scattered with huge boulders. Also, volcanic activity 50 million years ago created numerous volcanoes and vast basaltic plateaus formed from lava flows. This also produces regions of mainly narrow and deep valleys and pediments (surfaces made smooth by erosion) from the middle of rounded hills with sheer rock faces. The phases of volcanic activities involved in the formation of Plateau State have made it one of the mineral rich states in the country.

Figure 1: Map of Plateau State showing different local government areas

2.2 Method of Data Collection

Data for the study were elicited from primary sources. A structured questionnaire was used to collect the primary data in the study area, which was complemented with interview schedules. Data collected include the farmers' social characteristics such as age, marital status, educational level, household size, land ownership status, extension contact, credit access, and cooperative society membership. Input-output data were also collected; these include area devoted to rice cultivation, quantity of fertilizer used, labor input and capital inputs. A multistage technique was used to get a representative sample and achieve the stated objectives of the study. Firstly, four (4) Local Government Areas (LGA_s) in Plateau state, namely: Barkin Ladi, Bokkos, Jos South and Mangu purposively selected. The choice was based on the preponderance of Irish Potato farmers in these LGA_s. This was followed by a random selection of three (3) villages from each LGA as follows: Bokkos (Bokkos *et al.*),Barkin Ladi, Jos South, Mangu (Mangu et al.). Lastly, ten% of respondents were chosen from the sampling frame in each village. The researcher collected data, and it lasted from June to October, 2022.

2.3 Analytical Technique

Net farm income (NFI) Net farm income is the difference between gross margin (GM) and the total fixed cost (TFC) of production.

$$NFI = GM - TFC \quad (1)$$

The fixed cost which is depreciated on farm tool, equipment's and land rent is calculated using declining balance method to arrive at the scrap value after which the straight line method is used to ascertain the annual depreciation rate.

2.3.1 Measures of farm financial success

The gross margin and net farm income may sometimes be misleading because they may not give the true reflection of the capital position of the farm. Therefore, the need for measures of farm financial success is of great importance in assessing the profitability level of the farm. The three ratios commonly used are gross ratio (GR), operating ratio (OR) and fixed ratio (FR) The gross ratio is the total

farm expense (TFE) divided by the gross income (GI). This ratio expresses the percentage of the gross income observed by the total cost (Sankhayn, 1988) and is thus calculated thus:

$$GM = Revenue - Cost\ of\ Goods / Revenue \quad (2)$$

The ratio represents the proportion observed by operation out of the gross profit. In addition, gross ratio measures the ultimate solvency and success of the farm business. A ratio of less than 1 is desirable for any business. The operating ratio is the total operating cost (TOC) divided by the gross income. The ratio represents the proportion absorbed by operating expenses out of the gross profit. The operating cost is directly related to the farm variable input usage. If operating ratio is one it means that, the gross income barely covers the expenses on the variable inputs used on the farm (Olukosi and Erhabhor, 1989). The fixed ratio is the total fixed cost (TFC) divided by the gross income. If the fixed ratio is less than one, some of the fixed resources are either not used or underutilized

3.0 RESULTS AND DISCUSSION

Table 1: Costs and Returns Analysis of Small-scale Irish Potato Production per hectare

Cost	**Cost/ha (₦)**	**Percentage**
Variable Costs Items		
Labour	123,449.82	62.73
Fertilizer	26,332.52	13.73
Seeds	22,820.87	11.67
Transportation cost	8,061.36	3.61
Purchase of empty bags	2,384.00	1.80
Herbicides	1,384.32	1.05
Total Variable Cost (TVC)	**196,795.51**	**94.59**
Total Fixed Cost (TFC)	**11,241.65**	**5.41**
Total cost of production	**208,037.16**	**100.00**
Gross Farm Income (GFI)	**325,052.18**	
Net Farm Income (NFI)	**117,015.02**	

Source: Field Survey and Author's Computation, 2022

3.2 Measurement of farm financial success

The net farm income may not be a good reflection of the amount of capital, labour and management involved in the production process. It is therefore necessary to examine other measures of financial success. Table 2 showed the measures of farm financial success, since the ratios obtained were less than 1, it then showed that all the inputs were profitably utilized.

Table 2: Measures of farm financial success

Financial ratio	**Coefficient**
Gross ratio	0.65
Operating ratio	0.63
Fixed ratio	0.01

Source: Author's Computation, 2022

3.3 Problems confronting small-scale Irish potato

The results in Table 3 show that majority of the respondents interviewed complained of poor/inadequate storage facility in the study area. Out of 120 selected farmers for inquiry, 96.67% respondents; 116 farmers declared that poor/inadequate storage facilities is a major problem confronting them as these results to high rates of post-harvest losses. This problem was ranked as 1st most severe problem faced by farmers. This was because in the study area, most of the tubers were either stored in bags, basket or heaped on the floor of any convenient space in the farm stead because storage facilities are expensive. This leads to rotting of the tubers as a result of heat generated.

High rate of post-harvest losses ranked 2nd on the list of constraints faced by rice farmers in the study area. This occurs as a result of poor/inadequate storage facilities discussed above as 85.83 % of farmers in the study areas complained of this problem. High price/cost of inputs was ranked as 3rd biggest problem as 80.53 % respondents; 97 farmers pinpointed this issue faced by them during potato production process. The increased prices of seeds, chemicals (used for cleaning the seeds) and fertilizer were causing an increase in the cost of production; the farmers mentioned that everything was getting expensive. Due to the location i.e. Remote areas away from urban areas, the transportation cost charged by retailers and other channel members is also a source of increase in the prices of agricultural inputs. Incidence of pest and disease ranked 4th on the list of constraints faced by potato farmers in the study area. To keep the crop safe and to reduce the losses due to insects, farmers have to rely on pesticides/weedicides. The high prices and adulteration issues in pesticides and weedicides were considered by the farmers very common and 75.83% respondents; 91 farmers in the study area declared these issues as the most serious problems during crop protection process.

Lack of credit and finance problem was ranked as 5th biggest problem during potato production process as 74.17% respondents; 89 farmers reported this problem faced by them during production stage of potato crop production. The farmers were facing shortage of finance because of increased production cost and as a result they were depending upon the input dealers who were involved in the practices of selling fertilizer/pesticide and other material on credit basis and in return of provision of input on credit basis they receive additional money from farmers after harvesting the rice crop. Many farmers were depending upon the agents who extend the credit to farmers and in return purchase the rice crop at lower price than the price offered by market.

Table 3: Problems Confronting Rice Farmers in the Study Area

Number	**Problems**	**Frequency**	**Percentage**	**Rank**
1	Poor/Inadequate storage facilities	116	96.67	1
2	High rate of post-harvest losses	103	85.83	2
3	High cost of inputs	97	80.53	3

4	Incidence of pest and disease	91	75.83	4
5	Lack of access to credit	89	74.17	5
6	Unstable Market Price	77	64.24	6
7	Unavailability of farm input	73	60.83	7
8	Poor access roads and transport facilities	68	56.67	8
9	Soil Problem	68	56.67	8
10	Inadequate inputs	63	52.50	10

*Multiple response were recorded. Source: Field Survey, 2022

4.0 CONCLUSION AND RECOMMENDATIONS

It was concluded from findings of this study that the budgetary analysis revealed the total cost of production per hectare during the season was ₦ 208, 037.16 and the gross farm income per hectare was ₦ 325,052.18. Similarly, the net farm income per hectare was ₦ 117,015.02. The study revealed that total variable cost accounted for 94.59 % of the total cost while the total fixed cost accounted for the remaining 5.41%. Among the variable costs, labour input accounted for 62.73% of the total costs, while fertilizer, seeds, transportation cost, cost of empty and herbicides bags constituted 13.73%, 11.67%, 3.61%, 1.80% and 1.05% respectively. The measure of farm financial success shows that the gross ratio and operating ratio are less than 1 which implies that all the inputs were profitably utilized. Finally, poor/inadequate storage facilities, high rate of post- harvest losses and high cost of inputs are the three most mentioned problems confronting the potato farmers in the study area.

It is recommended from the findings of this study that measures to tackle post-harvest losses of Irish potato production should be considered as well as making adequate storage facility provision or durable potato processing measures. This would help to increase the losses of the farmers as well as make potato and potato product available all through the calendar year.

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