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## ECONOMICS OF IRISH POTATO PRODUCTION: A CASE OF SARDAUNA LOCAL GOVERNMENT AREA OF TARABA STATE, NIGERIA

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### Abstract

The study analysed the economics of Irish potato production in Sardauna Local Government Area of Taraba State, Nigeria. Specifically, described socio-economics characteristics of the farmers, estimated input-output relationship, estimated costs and return, determined the resource - use efficiency and identified the constraints associated with Irish potato production in the study area. Primary data were collected from 60 Irish potato farmers using random sampling technique. The data were analysed using descriptive statistics, gross margin and multiple regression analysis. The result revealed that majority (63%) of the respondents were in their active age of 31-40 years, 83% were male and 60% were married. Most (77%) of them were literate while 86.7% of the respondents were small holder farmers. The result on the costs and return revealed that Irish potato farming in the study area is profitable with a profit of ₦ 914,000.00 per hectare. The result of the input-output relationship revealed that seeds, fertilizer, chemicals, hired labour, family labour and farm size of the respondents were the main variables that influenced output. The resource use efficiency result indicated that seed, land size, and fertilizer were under- utilized while family labour, hired labour and chemicals were over utilized. The major constraints affecting Irish potato production in the study area were inadequate finance, high costs of input, transportation and labour among others. Irish potato farmers in the study area are encouraged to form cooperative societies to enable them access credit facilities with ease.

**Keywords:** Irish potato, Resource-Use Efficiency, Input-output Relationship, Taraba State, Nigeria

### INTRODUCTION

Irish potato also known as white potato has become a staple crop in Africa since its introduction in to the continent by the Europeans in

the 16<sup>th</sup> century. Today it is cultivated in many countries in Africa, mostly by the smallholder farmers for both domestic consumption and export (Food and Agriculture Organization, FAO, 2023). Irish

potato (*Solanum tuberosum*) is the world's fourth largest food crop cultivated in many countries. It was first cultivated in South America and now it is cultivated in many parts of the world (Zhang *et al.*, 2016). It is substituted for cereals in many developing countries, making Irish potato very crucial for food security. Global output of Irish potato is about 388 million metric tonnes with a yield per hectare of 20,110.8kg/ha, in 2018. Over half of the global output is produced in developing countries where almost one third of the output is harvested in China and India alone. China is the leading producer in the world with 99 million metric tonnes in 2018 (Food and Agriculture Organization Statistics, FAOSTAT, 2019).

Irish potato produced in Africa is estimated at 27.5 million metric tonnes in 2019 (FAO, 2021). The average yield per hectare of Irish potato production in Africa varies depending on the production system, technology, and the level of expertise. However, advancement in the agricultural techniques improved yields. According to FAO (2023) Nigeria is currently the largest producer of potato in Africa with an estimated output of 3.9 million metric tonnes as at 2021, followed by Ethiopia (2.9 million metric tonnes) and Egypt (1.5 million metric tonnes). The per capita consumption of potato in Africa is estimated to be 15 – 20 kg per year on the average, which is lower than the global average of around 33kg per year.

Nigeria is a country endowed with a large expanse of arable crop land and with enormous potential and favourable climate for production of tuber crops and other food crops that are used as staple foods and serve as raw material to our agro-industries, of which Irish potato is one (Sallau *et al.*, 2010).

Irish potato is a major root crop in Nigeria and it is by far the most efficient tuber crop in terms of tuber yield and days of maturity. It matures in about 80-90 days as compared to 9-12 months for yam and cassava (Sanusi and Babatunde, 2017). The crop has become marketable crop used for different purposes. It is consumed majorly fresh as cooked vegetable, processed in to other potato food products (snacks, fried crisp) and used as food ingredients. Non-food uses include starch for industry, and feed glue and re-used as seed tubers (Ojo, 2013). Due to the increasing number of uses to which Irish potato can be put, production activities have been increasing, profitability is the main objective of production and it is important to every farmer, as it will improve farmer's income and livelihood (Ashley-Dejo *et al.*, 2016).

Despite the efforts by various administrations on the Irish potato programme, particularly in Kuru, Plateau State Nigeria, activities such as training and capacity building, supply of improved seed varieties, market linkages, monitoring and evaluation, value addition and processing, access to inputs need to be improved in the production of potato in Nigeria. These activities collectively aim to improve productivity, income, and livelihood of Irish Potato farmers in Kuru Local Government Area of Plateau State and other parts of the state and the country at large. The production of Irish potato in the study area plays an important role in both economy and lives of the people, that is, it contributes to the economy through employment generation, trade, and food processing, and also contributes to the income generation and livelihood support of farmers and individuals involved in the potato value chain such as farmers, traders, processors and retailers. It therefore becomes very necessary to analyse the economics of Irish production in Sardauna Local Government Area of Taraba, Nigeria. Thus, the study described the socio-economic characteristics of Irish potato

farmers in Sardauna Local Government Area, estimated the costs and return associated with Irish potato production, examined the input - output relationship of Irish potato production, determined the resource use efficiency of Irish potato production and identified the major constraints of Irish potato in the study area.

## MATERIALS AND METHODS

The study was conducted in Sardauna Local Government Area of Taraba State, Nigeria, It is located between latitude 6°43' and 7° 15' North and Longitude 11° 15' and 12°30' east of Greenwich meridian. The Local Government Area is bounded by Gashaka Local Government Area to the North-east, Kurmi Local Government Area to the West and Cameroon Republic to the East and South. It is one of the highly elevated towns in Nigeria. It has a total land area of about 3,885km<sup>2</sup> and an estimated population of 224,437 and the present projected population of 2022 is 352,900 (National Population Census, 2006), The Local Government Area stands on an altitude of about 1850 meter above the sea level . This makes the area the only territory with the highest altitude in Nigeria. The area has mountainous vegetation characterized with short grasses and forest trees scattered all over the area. Crops such as tea, coffee, pea, banana, Irish potato, pepper, pineapple as well as vegetable such as *Kumbi* is grown on the plateau (Musa *et al.*, 2012). Cattle, sheep, poultry and goat are reared in large numbers.

The climate of the study area is marked by dry and wet season. The wet season starts in March and ends in October. It has an average annual rainfall of between 1,866 mm to 3000 mm. The dry season starts from November and ends in February with the temperature variation of 15°C to 20°C. Most tribal spread within the area include, Fulani, Mambilla, Kaka, Panso and Kambu, among others (Musa *et al.*, 2012).

Primary and secondary data were used for the study. The primary data were collected through the use of structured questionnaire that were used to obtain information from the respondents. Secondary data were obtained from published materials like books, journal reports, and Gazette, unpublished project and also from the internet.

Five wards prominent for production of Irish potato were selected from the 11 wards of the local Government Area. Namely *Gembu A, Gembu B, Kakara, Mayo-Ndaga* and *Ndum-yaji*. From each of the wards 12 respondents were randomly selected from the sampling frame which comprised of the names of Irish potato farmers that was obtained from the Irish Potato Farmers Association, giving a sample size of 60 respondents.

The analytical techniques used include descriptive statistics, Gross Margin, and Multiple Regression Analysis. Descriptive statistics used include frequency, percentage and mean. These were used to describe the socio-economic characteristics of the farmers and the constraints associated with Irish potato production.

### Gross Margin

Gross margin analysis was used to determine the costs and return associated with Irish potato production in the study area. The model is expressed as;

$$GM = GR - TVC = \sum P_i Q_i - \sum C_i X_i$$

Where

GM = Gross margin

GR =  $\sum P_i Q_i$  = Gross Revenue

TVC =  $\sum C_i X_i$  = Total Variable Cost

i = 1 - n = number of respondents

This model was used under the assumption that fixed cost of production is negligible. If the outcome is positive, it means Irish potato production is profitable.

### Multiple Regression Analysis

Multiple regression was used to determine the Input-Output relationship and Resource Use Efficiency. The regression model is explicitly expressed as:

$$\text{Log } Y = b_0 + b_1 \text{Log}X_1 + b_2 \text{Log}X_2 + b_3 \text{Log}X_3 + b_4 \text{Log}X_4 + b_5 \text{Log}X_5 + b_6 \text{Log}X_6 + U$$

Where

LogY = Output of Irish potato (kg/ha).

$X_1$  to  $X_n$  are the inputs used in Irish potato production.

$X_1$  = Farm Size (Hectare)

$X_2$  = Family Labour (hrs/day)

$X_3$  = Hired Labour (₦)

$X_4$  = Chemicals (liters)

$X_5$  = Fertilizer (kg)

$X_6$  = Quantity of Seeds (kg)

$b_0$  = Constant

$b_1$ - $b_6$  = coefficients of the variables

U = random term

It is expected *A priori* that majority of the inputs would have positive relationship with the output.

### Resource-Use Efficiency

The regression coefficient estimates were used to calculate the Marginal Value Product of the inputs and it is expressed as: MVP = MPP x PU

Where:

MVP = Marginal Value Product of the Resources

MPP = Marginal Physical Product (Regression Coefficient of the Resources.)

PU = Mean Unit Price of Output (₦)

The Marginal Value Product (MVP) for each input is calculated by multiplying Marginal Physical Product (MPP) by the mean price of the output (PU).

$$\text{MFC} = \text{MPP} \times \text{Px}$$

Where:

MFC = Marginal Factor Cost

Marginal Physical Product (Regression Coefficient of the Resources.)

Px = Unit Price of the Input

The MVP/MFC ratio used in calculating the resource use efficiency.

$$r = \text{MVP}/\text{MFC}$$

Decision rule, if:

$r = 1$  resources are efficiently utilized;

$r > 1$  resources are under-utilized; and

$r < 1$  resources are over utilized.

## RESULTS AND DISCUSSION

### Socio - Economic Characteristics of the Farmers

Socio - economic characteristics of farmers such as age, gender, educational level and farming experience were examined. The results are presented on Table 1 to 8.

### Gender of Respondents

**Table 1: Gender of the respondents**

Gender	Frequency	Percentage
Male	50	83.3%
Female	10	16.7%
Total	60	100%

Source: Field Survey, 2023.

Table 1 shows that majority (83.3%) of the respondents were male while (16.7%) were female. This shows that male participate more in Irish potato production than female. This is probably due to the fact that Irish potato farming is labour intensive venture which only men are capable of doing. This is contrary to the findings of Charles (2022) who studied economic analysis of cabbage production in Plateau State Nigeria, and found that 62% were men while 38% were women.

### Age of Respondents

**Table 2: Age of the Respondents**

Age	Frequency	Percentage
20-30	10	16%
31-40	21	35%
41-50	17	28%
51-60	8	13.3%
60 and above	4	6.7%
Total	60	100%

Source: Field Survey, 2023.

Table 2 shows that majority (63%) of the respondents were between the ages of 31-50 years. Only 6.7% were above 60 years. This implies that majority of the farmers in the study area were young and active and are capable to undertake Irish potato production and they are likely to utilize their resources more efficiently. This is similar to the finding of Idiong *et al.* (2006) on Comparative Analysis of Technical Efficiency in Irish potato Production in Plateau State, Nigeria, who reported that most of the farmers are in their active and productive age and thus can put in their best for optimum productivity.

### Household Size of Respondents

**Table 3: Household of the Respondents**

Household size	Frequency	Percentage
1-5	12	20%
6-10	32	53.3%
11-15	14	23.3%
16 and above	02	3.3%
Total	60	100

Source: Field Survey, 2023.

Table 3 above presents the distribution of the respondents based on household size. The result showed that about 53.3% of the respondents had a family size ranging between 6 – 10 members with the average household size of 8 persons. Family labour is

observed to be a significant production input in small holder agriculture which can influence productivity through increase in efficiency. If the family is solely dependent on income generated from the farm, then large households are likely to be motivated to strive for greater productivity and efficiency of input use. Rupasena *et al.* (2019) worked on economic analysis of irrigated Irish potato production in Plateau state, Nigeria, and observed that 90% of the farmers had large family size ranging from six to more than ten household members. According to them, large family size implies availability of free family labour, thereby reducing the cost of labour in production.

#### Level of Education of Respondents

**Table 4: Level of Education of Respondents**

Educational Qualification	Frequency	Percentage
Primary	2	3.3%
Secondary	11	18.3%
Tertiary	16	51%
Informal	31	2.7%
<b>Total</b>	<b>60</b>	<b>100%</b>

Source: Field Survey, 2023.

Table 4 revealed that majority (51%) of the farmers had tertiary education while only 26% had non-formal education. This implies that majority of Irish potato farmers in the study area are literate. The level of formal education attained by an individual goes a long way in determining his attitude towards technology for improved productivity. Farmers with more years of formal education tend to be more efficient in production due to their ability to access and use technology and make good use of information about production. Joshua (2021) in a research on the socio-economic characteristics of farmer's response to agricultural extension service delivery on Irish potato production in Kaduna State, Nigeria, showed that less than half (34%) of the respondents attended secondary school. In general, about 97% of the respondents have some form of education and 3% do not have any form of education.

#### Land Size Distribution of the Respondents

**Table 5: Land Size Distribution of the Respondents**

Land Size	Frequency	Percentage
0.1 - 0.5	9	15%
0.6 - 1.0	20	33.3%
1.1 - 1.5	13	21.7%
1.6 - 2.0	10	16.7%
2.1 and above	8	13.3%
<b>Total</b>	<b>60</b>	<b>100%</b>

Source: Field Survey, 2023.

Table 5 shows that majority of the respondents (86.7%) of had farm size between 0.1 - 2.0 hectare while 13% had more than 2.1 hectares of land. It shows that majority of the respondents in the study area are small scale farmer and therefore may tend to efficiently use the available resources. The farm size of the respondents shows the level of scale of operation of the farmers.

#### Marital status

**Table 6: Marital status of the Respondents**

Marital status	Frequency	Percentage
Married	36	60%
Single	15	25%
Widow	9	15%
<b>Total</b>	<b>60</b>	<b>100%</b>

Source: Field survey, 2023.

Table 6 revealed that 60% of the respondents were married while 25% were single, and (15%) were widows. This result indicates that majority of the Irish potato farmers are married. This agrees the study of Charles (2020) who reported that majority of respondents involved in agricultural activities are married.

#### Farming Experience

**Table 7: Farming Experience of the Respondents**

Farming Experience (year)	Frequency	Percentage (%)
1- 10	10	16.6
11 - 20	28	46.6
21 - 30	14	23.3
Above 30	08	13.3
<b>Total</b>	<b>60</b>	<b>100</b>

Source: Field Survey, 2023.

The result on Table 7 above shows that majority (46.6%) of the respondents had 11–20 years' experience in Irish potato production. It is thus, reasonable to infer that farmers in the study area are well experienced in farming Irish and depicts good signal for higher productivity. Farming experience determines the ability of farmers to make farm management decisions effectively, not only by adhering to agronomic practices, but also with respect to input combination or resource allocation and are thus expected to run more efficient and profitable enterprises. This is similar to the findings of Simon (2021) who studied economic analysis of cucumber production in Plateau state, Nigeria, and found out that the farmers had an average experience of 17 years.

#### Source of Finance

**Table 8: Source of Finance of Respondents**

Source of Finance	Frequency	Percentage (%)
Personal	40	66.7
Credit	14	23.3
Others	06	10
<b>Total</b>	<b>60</b>	<b>100</b>

Source: Field Survey, 2023.

The result on Table 8 shows that majority (66.7%) of the respondents finance their farm from personal source. This result clearly shows that majority of the respondents in the study area utilized their personal resources to finance their agricultural activities. This is probably because the institutional sources were not easily accessed by the farmers.

### Input – Output Relationship

The input-output relationship in Irish potato production was estimated using multiple regression analysis (Ordinary Least Square Regression). Based on statistical and econometric criteria, the double-log function was chosen as the lead equation, because it gave the best fit.

**Table 9: Double – log Regression Estimates of Irish Potato Production**

Variables	Coefficients	Std. Error	T-Statistics	Probability
Constant	10.48771	1.66225	6.31	0.000***
Qty of seed(X <sub>1</sub> )	0.9801	0.0531	18.46	0.000***
Land size (X <sub>2</sub> )	0.4796	0.1479	3.26	0.002***
Family Labour (X <sub>3</sub> )	0.3619	0.0585	6.18	0.000***
Hired Labour (X <sub>4</sub> )	0.3910	0.0999	3.91	0.000***
Qty of Chemicals (X <sub>5</sub> )	0.2586	0.1324	1.95	0.035*
Qty of Fertilizer (X <sub>6</sub> )	0.5100	0.1968	2.59	0.011*
R <sup>2</sup> = 0.8428				
R <sup>2</sup> = 0.8391				
F- Statistics = 252.79				0.0000*

Source: Field survey data, 2023

\*\*\* = Significant at 1%

\*\* = Significant at 5%

\* = Significant at 10%

NS = Not Significant.

The result on Table 4.7 shows that all the variables are significant. The coefficients of all the variables are positive. This implies that increase in all the variables lead to increase in output of potato. Thus, these variables are the determinants of Irish potato production in the study area. Onuk *et al.* (2010) in the study of Economic Analysis of Cucumber production in Plateau State, Nigeria, found that all the variables in the model had positive regression coefficients indicating direct relationship between the inputs and output.

### Resource - Use Efficiency

Efficiency of resource use in Irish Potato production was estimated using the ratio of Marginal Value Products (MVP) and Marginal Factor Cost (MFC) of the resources.

**Table 4.3: Estimated MPP, MVP, MFC and r**

Variables	MPP	MVP	MFC	r (Efficiency)

Seed	0.54	22	19	1.37
Land Size	0.42	31	2000	1.01
Family Labour	0.26	13	200	0.07
Hired Labour	0.03	16.5	300	0.03
Chemical	0.07	3.5	450	0.03
Fertilizer	1.02	43.0	40	1.01

Source: Field survey data, 2023

Table 4.3 indicates that the inputs land size and fertilizer were optimally utilized while seed was under-utilized in the study area. The under-utilization of this input maybe as a result of the type of Irish potato seed used by the farmers for their production. It is observed that family labour, hired labour and chemical were over utilized as their efficiency ratios were less than one. The over-utilization of labour means that there were excess of family members and labourers who spend too much time on the farm. Farmers in the study area were excessively utilizing chemical which can lead to soil acidification as a result of decrease in organic matter in the soil.

### 4.4: Costs and Return

**Table 4.9 Costs and Return Associated with Irish Potato Production (n=60)**

Variable	Value N/ha
<b>Gross Revenue</b>	1,760,000
<b>Variable costs</b>	
Seed	105,000
Land	230,000
Chemical	110,000
Family Labour	100,000
Hired labour	176,000
Fertilizer	125,000
<b>Total Variable Costs</b>	<b>846,000</b>
<b>Gross Margin</b>	<b>914,000</b>

Source: Field survey data, 2023

Table 4.9 shows that the total variable cost per hectare for Irish potato production is

₦846,000. The gross margin per hectare was ₦914,000. Thus potato production in Sardauna Local Government Area is profitable. This conforms to the findings of Onuk *et al.* (2010) on Economic Analysis of Irish Potato Production in Plateau State, Nigeria, that Irish Potato production is a profitable venture.

### 4.5 Constraints Association with Irish Potato Production

Constraints Association with Irish Potato Production Constraint	Frequency *	Percentage	Ranking
Inadequate finance	48	80	1

High costs of inputs	41	68	2
High costs of transport	34	56	3
High costs of hired labour	31	51.7	4
Lack of storage facilities	29	48	5
Soil infertility	23	38	6

Source: Field survey data, 2023 \* Multiple responses existed

Table 4.5 shows that the major problems of the farmers were inadequate finance, high costs of inputs, high costs of transport and hired labour. The farmers lack the know-how of applying for loans from financial institutions, thus, their finance becomes inadequate. The high of costs inputs and transport is related to the recession in the country and increase in the pump price of petrol that has led to inflation and subsequent increase in the price of all commodities. The high cost of hired labour may be due to the fact that most young men that have the strength and agility to provide labour on the farms have migrated to urban cities in search of greener pastures while the few ones around are limited, and thus charge more than expected.

## CONCLUSION

It can be concluded that the Irish potato farmers in Sardauna Local Government Area of Taraba State, Nigeria, are young married literate men that used their personal savings to grow Irish potato on their small lands. Also Irish potato production is profitable and its production is determined by seed quantity, fertilizer used, land size, family labour, hired labour and quantity of other chemicals used. The resources land size and fertilizer were optimally utilized while seed was, under- utilized and family labour, hired labour and chemicals were over utilized. The major constraints are inadequate finance, high cost of inputs, transport and hired labour.

It is recommended that: The Irish potato farmers in the study area should be encouraged to form a farm cooperative society in order to access funds from the government and financial institutions to boost Irish potato production in the study area. Also, government should provide palliatives (inputs at subsidized rates) to the farmers and also subsidize the cost of petrol so as to reduce the cost of transportation and other items.

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