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PROFITABILITY OF SWEET POTATO PRODUCTION IN DERIVED SAVANNAH ZONE OF OGUN STATE, NIGERIA

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ABSTRACT
This study examined profitability of sweet potato production in Odeda Local Government Area, Ogun State, Nigeria. The study was based on primary data collected from 82 sweet potato farmers through multistage sampling technique; analysed using descriptive statistics and budgetary techniques. The result revealed that about 90% of the farmers were male with a mean age of 35 years and 22 years of sweet potato farming experience; 87.8% were married and 65% had a household size of 8 persons. About 82% had no formal education, 96% sourced sweet potato vine from previous harvest, 96% acquired land through leasehold while only 13.4% does not belonged to any farmers' cooperative society. Furthermore, 96.3% and 98.8% of the farmers used less than 100kg inorganic and organic fertilizer respectively while 96.3% and 73.1% of the farmers used less than 2litres insecticide and herbicide respectively. Major production constraints were insufficient land (66%), insufficient labour (51%), pest and diseases (82%) as well as mechanization (98%). Budgetary analysis revealed that, on the average, sampled respondents incurred NG₦41,374.59 on total cost items, earned a revenue of NG₦131,645 and profit of NG₦90,270.41 per production season. Sweet potato production had a rate of return on investment of 2.88. Thus, sweet potato production was found to be a profitable enterprise considering the profit realized by farmers in the study area. The study recommended that constraints identified be tackled to enhance greater output. Policies should be implemented by government to provide assistance to farmers in order to expand and access adequate farm resources.

Keywords: potato, producers, profitability, resources, constraints

INTRODUCTION
Sweet potato (*Ipomea batatas L.*) is one of the world's most important food crops due to its high yield and nutritive value (Raemaekers, 2001). It belongs to the family of *Convolvulaceae*, it originated from South America where it was introduced to Europe between 1565 and 1573AD (Adekoya *et al*, 2010). It is a short duration (3 - 4 months) crop that could be cultivated more than once in the year (Nwauzor *et al*, 2005; Adekoya *et al*, 2010). It is extensively cultivated in the tropics (e. g North-central and Southwest Nigeria) usually requiring low inputs and less management and does well on marginal soils, thereby giving a reasonable yield than most other root crops (Raemaekers, 2001). However, according to FAO, (2008) and Adekoya *et al.*, (2010), Nigeria is the largest producer of sweet potato in Africa.

Sweet potato currently ranks as the fifth most important food crop after rice, wheat, maize and cassava in developing countries (e.g. Nigeria) and it is also the seventh most important food crop in the world in terms of production (Nwauzor *et al*, 2005; Adekoya *et al*,

2010). The adapted local varieties of sweet potato from the early introductions by colonial masters and early Christian missionaries before the advent of improved varieties can be found all over Nigeria (Ogbonna *et al*, 2009). Improved varieties were developed by National Root Crops Research Institute (NRCRI), Umudike and International Institute for Tropical Agriculture (IITA), Ibadan. In spite of these improved varieties that were developed with desirable traits such as high yielding potential, most rural farmers in Nigeria are conservative and still cultivate the local varieties (Woolfe, 1992; Ogbonna *et al*, 2009).

The importance of sweet potato is increasing in Nigeria's farming and food systems because its production has recorded good profit margin and is suitable for income generation. It has the potential for food security as well as serving as a cash crop (Adekoya *et al*, 2010). It has edible tubers which can be eaten boiled, fried, or baked. The tubers can be consumed by man while the leaves and stems can provide important fodder sources for domesticated animals. Spent fields of sweet potato have been widely noted as supplementary pig forage (Yen, 1991). The leaves and roots of sweet potato are used as animal feed to support a growing demand for animal protein (Adekoya *et al*, 2010). The leaves are also consumed as vegetables because its leaf contains (on dry matter basis) about 8% starch, 4% sugar, 27% protein and 10% ash (Adekoya *et al*, 2010). The leaves are much richer (than the root) in protein, minerals and vitamins and therefore are more nutritious (Adewunmi and Adebayo, 2008). The leaves are usually eaten boiled, or incorporated into soup and stews.

Sweet potato has also been used in Africa to fight against wide spread incidence of vitamin A deficiency that result in blindness and even death of about 25,000 - 500,000 African children per year (CIP, 2009). The leaves contain vitamin A with sufficient quantities of a precursor known as *beta-carotene***.** Vitamin A deficiency is a particular problem with children under five and for pregnant and lactating women. Serious vitamin A deficiency can weaken the immune system leaving them susceptible to diseases such as measles, malaria and diarrhea and can also lead to blindness.

In view of the above, any boost in (market) supply of sweet potato through improved production as well as consequent utilization will not only assist in Nigerian households' food security but also health security from proper nutrition (Odebode *et al*, 2008). Sweet potato is facing a lot of production and post-harvest challenges (Odedode *et al*, 2008). For instance, sweet potato weevil (*Cylas spp*) often affects crops planted between October and December especially during the dry season, grasshoppers and rats are also common pests that attack sweet potato when it is planted late leading to a reduction in the profit margin if proper care is not taken (Ojeniyi *et al*, 2003). Transportation is demanding because of its bulkiness leading to high cost of and labour used in transportation. Most of the farmers employ labour at exorbitant rate even in the rural areas simply because the few labourers that are available are expensive to hire (Ojeniyi *et al*, 2003). Therefore, the aim of this study is to evaluate the profitability of sweet potato production in the study area which is an emerging zone of sweet potato production in Nigeria.

Objectives

The broad objective of the study is to evaluate the profitability of sweet potato production in Odeda Local Government Area of Ogun State, Nigeria. The specific objectives are to:

i. describe the socio-economic characteristics of sweet potato farmers in the study area;
ii. estimate the profitability of sweet potato production in the study area;
iii. assess the constraints associated with sweet potato production in the study area.

METHODOLOGY

Study Area

This study was carried out in Odeda Local Government Area (LGA) of Ogun State in the south-western part of Nigeria. Odeda is one of the twenty LGAs in the State with headquarters at Odeda town which is located along Abeokuta-Ibadan highway; about 20 kilometers from the State capital (Abeokuta). The LGA lies within latitude $7^{o}13"$ North and longitude of $3^{o}31"$ East with a land mass of 1,560km^2 (or a land area of 126,341ha) and a population of 109,449 people (NBS, 2009). It shares boundary with Ido LGA of Oyo State and Abeokuta-South LGA in Ogun State and has an average temperature of 30^{0}C but humidity could be as high as 95% and the raining season is from April to October while the dry season is between November and March (OGADEP, 2010). The dominant tribal group in the area is the *Yoruba* with some *Hausas* and *Igbo* traders as settlers. In the LGA, there are 25 semi-urban settlements and 860 villages and hamlets (OGADEP, 2010). Some of the arable crops grown in the area are yam, sweet potato, maize, cassava, vegetables and cowpea while cocoa is the major cash crop and the major livestock include goats, pigs, poultry, sheep and cattle (NBS, 2009).

Method of Data Collection

Primary data were used for the study. These were obtained through the administration of a pre-tested questionnaire to sweet potato farmers in the study area. The questionnaire was used to obtain information on production, farming practices, inputs and outputs as well as some socio-economic characteristics of sweet potato producers.

Sampling Techniques and Procedure

A multistage sampling technique was used to select eighty-two (82) sweet potato farmers in the study area. The first stage involved the purposive selection of Abeokuta agricultural zone due to the extensive cultivation of arable crops particularly sweet potato and the presence of numerous farm settlements in the zone according to Ogun State Agricultural Development Programme (OGADEP). The second stage also involved the purposive selection of Orile-Ilugun out of the six blocks under this zone because this block is known for sweet potato production according to OGADEP. The third stage involved the selection of three cells (Orile-Ilugun, Kila and Osiele) out of the eight cells under this block which was also selected purposively because these three cells have the largest number of sweet potato farmers according to OGADEP. The fourth stage involved a simple random sampling of 90 sweet potato farmers from 150 members of farmers' organizations in the selected cells who were then interviewed with the aid of the pre-tested questionnaire. However, data from 82 sweet potato farmers were analysed while 8 others were discarded for incompleteness and non-response from the selected farmers. This represents 60% of the total data sampled.

ANALYTICAL TECHNIQUES

The following analytical tools were employed in the analysis.

(i) ***Descriptive statistics:*** the use of tables of frequency distributions and percentages as well as mean distributions was adopted to describe the socio-economic characteristics of sweet potato farmers in the study area.

(ii) ***Budgetary Techniques:*** Analysis of costs and returns was used to estimate the profitability of and rate of return on investment to sweet potato production in the study area.

Costs are expenses incurred in the operations of a production unit. Variable cost items included sweet potato vines and labour, cost of fertilizer, herbicides and pesticides. The fixed cost items included hoes, cutlasses and land. The depreciated values of the fixed cost items were also estimated. However, revenue is the price per unit output (P_y) multiplied by quantity of output (q). The gross margin of an enterprise gives the profit that is likely to be obtained from the production process.

Gross Margin (GM) = Total Revenue (TR) – Total Variable Cost (TVC)
Net Margin (π) = Total Revenue (TR) – Total Cost (TC) or Gross Margin (GM) – Total Fixed Cost (TFC)
Rate of Returns (ROI) = (TR/TC)
Rate of Return on Investment (RRI) = (π/TC)

RESULTS AND DISCUSSION

Socio-economic Characteristics of Sweet Potato Farmers

The study revealed that 36.5% of the sampled sweet potato farmers were within the age range of 31 to 40 years (Table 1). This age range falls within the economically active age group and the mean age of 35 years implies that majority of the sampled farmers were relatively young.
Also, majority (90.2%) of the sampled respondents were male while 9.8% were female. This implies that males dominated sweet potato production in the study area. This may be because majority of the women find attraction in combining home keeping with farming activities. This is in line with the findings of Abiola and Omoabugan (2001) of gender skewness in favour of male in sweet potato production in Nigerian rural areas. The study also reveal that majority (87.8%) of the respondents were married with a mean household size of 8 persons; since predominantly in the study area, family labour is an alternative source of labour for hired farmhands. This implied that more family labour will be employed in sweet potato production.

Furthermore, Table 1 also revealed that about 81.7% of the farmers had no formal education, 12.2% had primary education, 2.4% had secondary education and 3.7% had technical education. Hence, since education plays an important role in adoption rate and managerial skills in terms of effective decision making and good record keeping; majority of the sweet potato farmers in the study area will lack these performances enhancing attributes i.e. low level of innovation and technology adoption as well as inability to keep appropriate farm records (Adewunmi and Adebayo, 2008).

The study also revealed that many (54.9%) of the farmers had 20 years or more sweet potato farming experience. This result revealed that most of the sweet potato farmers are highly experienced in the cultivation of sweet potato since they had been planting sweet potato for a long period of time. This is an indication that the farmers possess a substantial wealth of experience which could improve sweet potato production in the study area.

Table1 further revealed that few of the sweet potato farmers (29.3%) had other occupation aside farming which served as an additional source of income while majority (70.7%) of the sweet potato farmers were into a full time cultivation of sweet potato. This study showed that many (59.8%) of the farmers were Christians, 25.6% of the sweet potato farmers practiced Islam while 12.2% of the farmers were traditional worshippers. This is an indication that there is no taboo in production of sweet potato.

Table 1: Distribution of Sweet Potato Farmers by Personal Characteristics

Characteristics	*Frequency*	*Percentage*	*Mean*
Age (years)			
≤ 20	3	3.7	
21- 30	19	23.2	
31- 40	30	36.5	
41- 50	19	23.2	
≥ 51	11	13.4	
Total	82	100.0	35.00
Gender			
Male	74	90.2	
Female	8	9.8	
Total	82	100.0	
Marital Status			
Single	10	12.2	
Married	72	87.8	
Total	82	100.0	
Household Size (No)			
≤ 4 persons	16	19.5	
5 - 8 persons	53	64.6	
9 - 12 persons	13	15.9	
Total	82	100.0	8.00
Level of Education			
No Formal Education	67	81.7	
Primary Education	10	12.2	
Secondary Education	2	2.4	
Technical Education	3	3.7	
Total	82	100.0	
Sweet Potato Farming Experience (Years)			
≤ 10	10	12.2	
11 – 19	27	32.9	
≥ 20	45	54.9	
Total	82	100.0	21.68
Secondary Occupation			
Yes	24	29.3	
No	58	70.7	
Total	82	100.0	
Religion			
Christianity	51	62.2	
Islam	21	25.6	
Traditional	10	12.2	
Total	82	100.0	

Source: Field Survey, 2013

Description of Sweet Potato Farmers according to Farm Related Variables

Table 2 revealed that most of the farmers (86.6%) were Members of Farmers' Group while 13.4% were non-members. Table 2 also shows that 42.2% out of the 86.6% of the sweet potato farmers that were Members of Farmers' Group belonged to Idunu Farmers' group while only 4.2% belonged to the Potatoes Farmers' Club. This is an indication that the respondents were actively involved in cooperative societies in the study area and this may be due to low membership charges thus having implication on the revenue accruable to the farmers.

Land is an essential factor in farming activities which determines the level of sweet potato produced. Table 2 revealed that a larger proportion (96.4%) of the sweet potato farmers acquired land through leasehold, 1.2% acquired land communally while 2.4% of the farmers acquired land by purchase. This implies that most of the sweet potato farmers did not have access to free usage of land which will lead to an extra cost on the part of the farmer. This tenure system (Fawole, 2007) usually does not encourage increased production as those interested in pure commercial production may not have access to land because of the extra cost attached to it.

Furthermore, Table 2 showed that majority of the sweet potato farmers (97.5%) sourced fund from personal savings while 2.5% of the farmers sourced fund from cooperatives. This indicated that the farmers did not have access to credit facilities in the banks and the government established projects/programmes such as Agricultural Development Programme (ADP)

Table 2: Distribution of Sweet Potato Farmers by Farm Related Variables

Characteristics	*Frequency*	*Percentage*
Membership of Farmers' Group		
Yes	71	86.6
No	11	13.4
Total	82	100.0
Farmers' Group Members		
Potatoes Farmers' Club	3	4.2
Agbeloba	19	26.8
Idunu Farmers	30	42.2
Potatoes Cooperative Society	19	26.8
Total	71	100.0
Land Acquisition		
Lease	79	96.4
Communal land	1	1.2
Purchase	2	2.4
Total	82	100.0
Source of Fund		
Own Savings	80	97.5
Cooperatives	2	2.5
Total	82	100.0

Source: Field Survey, 2013

Description of Sweet Potato Farmers according to Resource Employed in Production

Table 3 showed that most of the farmers (57.3%) used quantity of vines between 101-300 strands while 4.9% used above 500 strands of vines in cultivating sweet potato farm. Table 3 also showed that majority (96.4%) of the farmers sourced sweet potato vine from previous harvest while 2.4% and 1.2% sourced sweet potato vine from fellow farmer and research institute respectively. This implies that majority of the sweet potato farmers did not spend much money in getting their vines. This procurement pattern (Fawole, 2007) may not be the

best as it may encourage the spread of pests and diseases thus causing depression in yield and income levels. The result also revealed that 96.3% and 98.8% of the farmers used less than 100kg inorganic and organic fertilizer respectively while 96.3% and 73.1% of the farmers used less than 2litres of pesticide and herbicide respectively while 3.7% and 26.9% of the sweet potato farmers used more than 2 litres of pesticide and herbicide respectively. This implies that majority of the sweet potato farmers are aware of the implication of using inorganic and organic fertilizer as well as the use of pesticide and herbicide in sweet potato production.

Table 3: Distribution of Sweet Potato Farmers by Resource Employed in Production

Characteristics	*Frequency*	*Percentage*
Quantity of Sweet Potato Vine planted (strands)		
< 101	6	7.3
101 – 200	27	32.9
201 – 300	20	24.4
301 – 400	13	15.9
401 – 500	12	14.6
> 500	4	4.9
Total	82	100.0
Source of Sweet Potato Vine planted		
Fellow Farmer	2	2.4
Previous Harvest	79	96.4
Research Institute	1	1.2
Total	82	100.0
Quantity of Inorganic Fertilizer Used (kg)		
< 100	79	96.3
> 100	3	3.7
Total	82	100.0
Quantity of Organic Fertilizer Used (kg)		
< 100	81	98.8
> 100	1	1.2
Total	82	100.0
Quantity of pesticide Used (litres)		
< 2	79	96.3
> 2	3	3.7
Total	82	100.0
Quantity of Herbicide Used (litres)		
< 2	60	73.1
> 2	22	26.9
Total	82	100.0

Source: Field Survey, 2013

The Cost and Returns of Sweet Potato Production in the Study Area

The costs and returns determine the profitability of any production process. Table 4 shows the analysis of average costs and returns to sweet potato production and the various cost of inputs used in sweet potato production in the study area. The sweet potato farmers (on the average) incurred a total cost of NG₦41,374.59 and earned a total revenue of NG₦131,645. The total variable cost and the gross margin were NG₦40,004.11 and NG₦91,640.89 on the

average per production season respectively. Consequently, the sweet potato farmer realized a profit of NG₦90,270.41 on the average.

Table 4: Average Cost and Return to Sweet Potato Production in Odeda LGA

Items	*NG (₦)*	*Percentage*
Revenue	***131,645***	
Inputs		
Vines	2,995.19	7.14
Inorganic Fertilizer	6,899.11	16.67
Organic Fertilizer	3,968.75	9.59
Pesticide	3,305.56	8.00
Herbicide	3,321.05	8.03
Total input cost	***20,449.66***	-
Farm operation		
Land Preparation	1,536.75	3.71
Heaping	5,980.00	14.45
Planting	1,641.43	3.97
Fertilizer Application	1,846.20	4.46
1st Weeding	1,846.20	4.46
2nd Weeding	1,858.86	4.49
Herbicide Spraying	1,450.01	3.51
Harvesting Cost	3,395.00	8.21
Total Operational Cost	***19,554.45***	-
Total Variable Cost	***40,004.11***	-
Equipment and Tools		
Hoes Depreciation	541.73	1.31
Cutlass Depreciation	828.75	2.00
Total Fixed Cost	***1,370.48***	-
Total Cost	***41,374.59***	-
Gross Margin	***91,640.89***	-
Net Margin	***90,270.41***	-

Source: Field Survey, 2013

Estimation of Revenue and Margins of Sweet Potato Production in Odeda LGA (per Hectare/Season)

Table 5 showed that 6.1% of the sweet potato farmers realized returns less than NG₦50,001.00 per hectare, 84.2% of the farmers realized returns between NG₦50,001.00 and NG₦150,000.00 per hectare while 9.7% had between NG₦150,001.00 and NG₦350,000.00 as returns per hectare. This implies that most of the farmers realized an average of NG₦101,416.64 per hectare as total revenue.

Table 5 also showed that 24.4% of the sweet potato farmers had gross margin per hectare that was less than NG₦50,001.00, 72% of the farmers had between NG₦50,001.00 and NG₦150,000.00 gross margin per hectare while 3.6% had between NG₦150,001.00 and NG₦250,000.00 gross margin per hectare. This implies that most of the farmers realized an average gross margin of NG₦76,424.01 per hectare.

Furthermore, Table 5 revealed that 24.4% of the sweet potato farmers had a net margin less than NG₦50,001.00 per hectare, 72% of the farmers had a net margin in the range of NG₦50,001.00 and NG₦150,000.00 per hectare while 3.6% had between NG₦150,001.00 and NG₦250,000.00 net margin per hectare. This implies that most of the farmers realized an average of NG₦75,303.89 as profit per hectare.

Measure of Returns on Investment in Sweet Potato Production per Hectare

Return on Investment ratios measure the profitability of a venture or enterprise. The Rate of Return on Investment (RRI) is calculated as the ratio of net margin to total cost (per hectare). The rate of return on investment value of 2.88 indicates that for every one naira i.e. NG₦1 invested in the production of sweet potato in the study area, NG₦2.88kobo was earned as profit per hectare. The Return on Investment (ROI) is calculated as the ratio of total revenue to total cost (per hectare). The return on investment value of 3.88 indicates that for every one naira i.e. NG₦1 invested in the production of sweet potato in the study area, NG₦3.88kobo was earned as returns per hectare.

The Price Ratio (PR) is calculated as the ratio of total revenue less total variable cost to total cost (per hectare). The price ratio value of 2.93 indicates that for every one naira i.e. NG₦1 invested in the production of sweet potato in the study area, the pricing of sweet potato (tubers) was efficient at NG₦2.93kobo. These values indicated that sweet potato production in the study area is very profitable.

Table 5: Sweet Potato Revenue and Margins in Odeda LGA (per Hectare)

NG (₦)	***Frequency***	***Percentage (%)***
Total Revenue per ha (TR)		
< 50,001	5	6.1
50,001 - 150,000	69	84.2
150,001 - 250,000	7	8.5
250,001 - 350,000	1	1.2
Total	*82*	*100.0*
Mean (101,416.64)	-	-
Gross Margin		
< 50,001	20	24.4
50,001 - 150,000	59	72.0
150,001 - 250,000	3	3.6
Total	*82*	*100.0*
Mean (76,424.01)	-	-
Net Margin (π)		
< 50,001	20	24.4
50,001 - 150,000	59	72.0
150,001 - 250,000	3	3.6
Total	*82*	*100.0*
Mean (75,303.89)	-	-
TVC per ha (24,992.64)	-	-
TC per ha (26,112.76)	-	-
RRI (π/TC)	-	-
ROI (TR/TC)	-	-
PR (TR - TVC)/TC	-	-

Source: Field Survey, 2013

Description of Sweet Potato Farmers according to Constraints Associated with Sweet Potato Production

Table 6 shows that majority (65.9%) of the farmers had insufficient land to cultivate sweet potato while 34.1% of the farmers had sufficient land to cultivate the crop. This implies that majority of the sweet potato farmers were not able to practise commercial sweet potato production since arable land that could facilitate this was not available. Most (51.2%) of the farmers had insufficient labour especially hired labour to produce sweet potato while 48.8% of the farmers had sufficient labour. A larger proportion (97.5%) of the farmers had insufficient capital to use in sweet potato production while only 2.5% of the farmers had sufficient capital for sweet potato production. This may be that majority of the farmers had no access to credit facilities to finance the production of sweet potato and the productivity/output of sweet potato can be lowered. Majority (82.9%) of the farmers experienced pests and diseases attack while producing sweet potato on the farm and 17.1% of the farmers did not experience pests and diseases attack in sweet potato production. This can reduce the quality and quantity of the output produced. This implies that there will be reduction in yield and income accruable to the sweet potato farmers if this problem is not tackled.

Furthermore, some (48.8%) of the farmers had problems obtaining vines to produce sweet potato while most (51.2%) of the farmers encountered no constraint obtaining vines to use in cultivating sweet potato. This could be that the sweet potato farmers on the average do have challenges in getting sweet potato vines especially during the dry season when the vines would have dried up and the output to be produced is limited. Majority (97.5%) of the farmers had no access to mechanization to produce sweet potato while 2.5% of the farmers had access to mechanization in producing sweet potato. This indicates that most of the sweet potato farmers in the study area had no access to modern farm machineries. About 87% of the farmers had no contact with extension agents while 13% of the farmers had contact with extension agents. This implies that there can be reduced adoption rate of modern technology in sweet potato cultivation by a larger proportion of the farmers in Odeda LGA.

Table 6: Distribution of Sweet Potato Farmers by Production Constraints

Constraints	*Frequency*	*Percentage*
Land		
Yes	54	65.9
No	28	34.1
Total	82	100.0
Labour		
Yes	42	51.2
No	40	48.8
Total	82	100.0
Capital		
Yes	80	97.5
No	2	2.5
Total	82	100.0
Pests and Diseases		
Yes	68	82.9
No	14	17.1
Total	82	100.0
Vines		
Yes	40	48.8
No	42	51.2

Total	82	100.0
Mechanization		
Yes	80	97.5
No	2	2.5
Total	82	100.0
Extension Services		
Yes	71	86.5
No	11	13.5
Total	82	100.0

Source: Field Survey, 2013

CONCLUSION AND RECOMMENDATION

Sweet potato farming is a profitable enterprise in the study area considering the profit realized by the farmers as indicated by the returns on investment (ROI) value of 3.88 which indicates that every NG₦1 invested in sweet potato farming in the study area returns a profit per hectare of NG₦3.88kobo to the farmer despite the various constraints being faced by the farmers. Furthermore, the problems identified by the farmers had adverse effect on the profitability of sweet potato production. Policies should be devised and implemented by the State Government to provide financial assistance, so that farmers can access adequate farm resources and expand the existing scale of production.

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