

# Awareness of Value Addition of Sweet Potato (*Ipomoea batatas* (L.) Lam) In Osun State, Nigeria

A. M. Omoare, E. O. Fakoya, O. E. Fapojuwo, W. O. Oyediran

**Abstract**—Awareness of value addition of sweet potato has received comparatively little attention in Nigeria despite its potential to reduce perishability and enhanced utilization of the crop in diverse products forms. This study assessed the awareness of value addition of sweet potato in Osun State, Nigeria. Multi-stage random sampling technique was used to select 120 respondents for the study. Data obtained were analyzed using descriptive statistics and multiple regression analysis. Findings showed that most (75.00%) of the respondents were male with mean age of 42.10 years and 96.70% of the respondents had formal education. The mean farm size was 2.30 hectares. Majority (75.00%) of the respondents had more than 10 years farming experience. Awareness of value addition of sweet potato was very low among the respondents. It was recommended that sweet potato farmers should be empowered through effective and efficient extension training on the use of modern processing techniques in order to enhance value addition of sweet potato.

**Keywords**—Awareness, value addition, sweet potato, perishability.

## I. INTRODUCTION

IN Nigeria, meeting the food and nutrition needs of the ever-increasing population has been a huge task for every successful government, how well this objective is achieved is often used to judge the performance of any government. Nigeria is one of the largest producers of sweet potato in sub-Saharan African (SSA) with annual production estimated at 3.46 million tons per year [1]. Sweet potato is a major crop that suffered serious neglect in the past but now occupies global position as a source of food and industrial raw material [2].

The high nutritive value and performance under resource-poor condition make it attractive to farmers and households [2]. Sweet potato has a high yield potential that may be realized within a relatively short growing season and it can adapt to a wide range of ecological conditions. Currently, sweet potato is being utilized in various forms in other parts of the world. These uses can be adapted in the country to boost production and consumption of the crop [3]. Sweet potato is an excellent source of carbohydrates, vitamins A and can

produce more edible energy per hectare than wheat and rice [4]. It has been used in Africa to combat a widespread vitamin A deficiency that results in blindness and even death for 25,000 – 500,000 African children a year [4]. Despite this, the crop has received comparatively little attention in the country, perhaps because of low prioritization by the government due to a paucity of basic information on the potential of the crop. Its bulkiness and perishability with a low shelf life after harvesting limit its economic viability [5]. Hence, it is both desirable and necessary to process sweet potato into storable products forms to add value to the crop in order to contribute significantly to food security, nutrition, income generation and enhanced livelihoods for the farmers [6]. However, the limited range of ways and availability of adapted processing technologies in which sweet potato is utilized in Nigeria seriously undermine the potential benefits of the crop to farmers, consumers and other chain actors [7]. This study thereby intends to assess the awareness of value addition of sweet potato (*Ipomoea batatas* (L.) Lam) in Osun State, Nigeria. Specific objectives of this study were to:

1. describe the socio-economic characteristics of the respondents in the study area
2. identify the varieties of sweet potato cultivated in the study area
3. determine the level of awareness of value addition of sweet potato in the study area
4. identify the constraints militating against sweet potato production and value addition in the study area

The hypothesis of this study was stated in null forms:

H<sub>01</sub>: There is no significant relationship between socio-economic characteristics of the respondents and level of awareness of sweet potato value addition in the study area.

## II. MATERIALS AND METHOD

This study was carried out in Osun State, Nigeria. Osun State was carved out of Oyo State on the 27<sup>th</sup> of August 1991. It lies between latitude 4°30'E and longitude 7°30'N. The population of Osun State is estimated at 3.4 million [8]. The state occupies a land mass of approximately 8,602km<sup>2</sup>. Major ethnic group in Osun State is the Yorubas with sub-ethnic groups such as Ife, Ijesha, Oyo, Ibolo and Igbomina. The state is divided into Thirty (30) Local Government Areas (LGAs). There are 3 agricultural zones (Iwo, Osogbo, and Ife/Ijesha). The study area has a bimodal rainfall pattern which reaches its peak in July and September, it comprises of mostly agrarian communities which engage in farming activities. Crops grown in the State include yam, sweet potato, maize, cassava, cocoyam, cowpea, tobacco, palm produce etc. Multistage

A. M. Omoare is with Department of Agricultural Education, Federal College of Education, Abeokuta, Ogun State (+2348034741976; e-mail: ayodejiomoare@yahoo.com).

E. O. Fakoya is with Department of Agricultural Extension and Rural Development, Federal University of Agriculture, Abeokuta, Ogun State.

O. E. Fapojuwo is with Department of Agricultural Administration, Federal University of Agriculture, Abeokuta, Ogun State.

W. O. Oyediran is with Department of Agricultural Extension and Rural Development, Federal University of Agriculture, Abeokuta, Ogun State (+2348034048099; e-mail: oyediran\_wasiu@yahoo.com).

sampling technique was used in the selection of respondents for this study. The first stage was the purposive selection of two (2) zones from the three zones in Osun State (Osogbo and Ife/Ijesa). These zones were purposively selected based on the prevalence of sweet potato production by virtually every household in the communities. Twenty-five percent (25%) of the blocks was selected from the chosen zones, this gave an equivalent to five (5) blocks from Osogbo and Ife/Ijesa zones and six (6) blocks from zones A and B. Furthermore, twenty percent (20%) of the cells from the chosen blocks were selected this gave rise to 43 cells; the last stage involved the selection of 10% of the registered sweet potato farmers from the chosen cells. Thus, a total of 120 respondents were interviewed for this study.

#### *A. Data Collection*

Data for this study were collected through the use of a well-structured interview guide. The instrument was subjected to face validity involving experts in Agricultural Extension and Rural Development and Agricultural Administration Department, their criticisms and suggestions were positively utilized for a more valid instrument. The reliability test for the instrument was conducted using test re-test method. Administration of the instrument was done for Twenty (20) sweet potato farmers who were not included in the actual study sample.

#### *B. Measurement of Variables*

Age, household size, farm size and farming experience were measured at interval level while sex, educational level and marital status were measured at nominal level. Respondents were asked to indicate the cultivated varieties of sweet potato in the study area. Level of awareness of value addition of sweet potato in products forms was measured as Aware (1) and Not aware (0) and the score obtained was later categorized into High level of awareness and Low level of awareness of value addition. Constraints to value addition of sweet potato were ranked in order of severity as Very serious, Moderately serious and Not serious with a score of 3, 2, and 1 respectively.

#### *C. Data Analysis*

Descriptive statistics such as frequency distribution, percentages and mean were used for objectives while multiple regression analysis was used for the hypothesis of this study.

### III. RESULTS AND DISCUSSION

#### *A. Socio-Economic Characteristics of the Respondents*

Result in Table I showed that the mean age of the respondents was 42.10 years. Most (85.00%) of the respondents were less than 50 years of age, thus revealing the presence of respondents that are economically active. This is also in line with [9] who states that most Nigerian farmers are within this age group and they are the economically active part of the population. Majority (75.00%) of the respondents were males while few (25.00%) were females. This shows the dominance of the male farmers in sweet potato production.

This finding indicates that since most farming work or activities is energy demanding, hence men tend to be more involved in production while marketing and processing of food crops are often the chores of women [10]. Most (83.40%) of the respondents were married while 5.80% were single and 10.80% were separated. Almost all (96.70%) the respondents had one form of formal education or the other, while only a relatively small proportion (3.30%) of the respondents had no formal education. This shows that a good number of the respondents are literate and this will affect the rate of their adoption of new innovations on sweet potato production, marketing, processing and ultimately value addition of the crop. The findings of this study further showed that 60.00% of the sweet potato farmers had between 6 – 8 people in their household while 29.20% had less than 5 people and 10.80% had above 9 persons in their household. This indicates that the household size of respondents was relatively large. Large household size is in agreement with the earlier findings of [11], that sweet potato farmers control large household size which gave them advantages of employing them in different farming operations. The mean year of farming experience for sweet potato was 10.00 years. The result also indicated that 62.50% of the respondents had been into sweet potato farming for less than 10 years while 12.50% of the respondents had been in sweet potato farming for more than 20 years. This further shows that sweet potato production is not a new enterprise to the farmers in the study area. The mean farm size was 2.30 hectares. Most (93.30%) of the respondents cultivated less than 4 hectares while 6.70% cultivated above 5 hectares of farm land. The implication of this is that sweet potato farmers in the study area operated mostly on a small scale. The result supports the findings of [12] which states that many sweet potato farmers cultivate less than 3 hectares of land in Offa, Kwara State, Nigeria. Majority (65.80) of the respondents were into full-time sweet potato farming while 34.20% of the respondents were part-time sweet potato farmers.

TABLE I  
DISTRIBUTION OF RESPONDENTS BY THEIR SOCIO-ECONOMIC  
CHARACTERISTICS (N = 120)

Variables	Frequency	Percentage	Mean
<b>Age (years)</b>			
Below 30	9	7.50	42.10
30 – 39	23	19.20	
40 – 49	70	58.30	
50 above	18	15.00	
<b>Sex</b>			
Male	90	75.00	
Female	30	25.00	
<b>Marital status</b>			
Single	7	5.80	
Married	100	83.40	
Separated	13	10.80	
<b>Educational status</b>			
No formal education	4	3.30	
Primary Education	35	29.20	
Secondary education	68	56.70	
Tertiary	13	10.80	
<b>Household size</b>			
Less than 5	35	29.20	6.00
6 – 8	72	60.00	
9 above	13	10.80	
<b>Farm size (ha)</b>			
1 – 2	92	76.70	2.30
3 – 4	20	16.60	
5 above	8	6.70	
<b>Farming experience</b>			
Less than 10	30	25.00	10.00
10 – 19	75	62.50	
20 above	15	12.50	
<b>Farming status</b>			
Full time	79	65.80	
Part-time	41	34.20	

Source: Field Survey, 2012

### B. Varieties of Sweet Potato Cultivated

Sweet potato varieties exist in many colours of skin and flesh, ranging from white to deep purple, although cream and orange flesh are the most common [13]. Table II indicated that majority (69.20%) of the respondents' cultivated cream flesh and orange flesh sweet potato varieties. Beta-carotene-rich sweet potato (also known as orange-fleshed sweet potato) is one of a few new crops, which is both an excellent source of energy and important nutritive substances that can contribute to improve the nutrient status of the community dwellers [14]. Also (25.80%) of the respondents grew cream and purple flesh varieties of sweet potatoes do so because of the readily availability of their vines, resistance to drought, pest and diseases, and it is equally less fibrous in nature.

TABLE II  
VARIETIES OF SWEET POTATO CULTIVATED BY THE RESPONDENTS (N = 120)

Variables	Frequency	Percentage (%)
Cream flesh + Orange flesh	83	69.20
Cream flesh + purple flesh	31	25.80
White flesh + purple flesh	6	5.00

Source: Field Survey, 2012

### C. Awareness of Sweet Potato Value Addition

Bulkiness and perishability affect production and post-harvest system of sweet potato because the crop has a very short shelf life after harvesting, hence it is both desirable and necessary to process sweet potato into storable products forms [5]. The result in Table IIIB showed the level of awareness of sweet potato value addition in the study area. The findings revealed that majority of sweet potato farmers were aware of sweet potato sparri (79.20%), sweet potato chips (76.70%), sweet potato kunu (62.50%), sweet potato flour (51.70%), sweet potato animal feed (51.70%) and sweet potato vegetable (50.80%). The reason adduced for this is that the two products forms of sweet potato (sweet potato chips and sparri) can be easily prepared and processed using traditional processing techniques. Also, the preparation of a popular diet called *amala* could be another reason. In contrast, the result further showed that above 80.00% of the respondents were not aware of sweet potato cake, sweet potato puff-puff, industrial alcohol, sweet potato noodles, and sweet potato doughnut among others. The implication of this is that sweet potato farmers have access to limited sweet potato products such as (boiled, fried and roasted forms of sweet potato) which have lesser shelf lives and economic returns. Reference [15], stated that agro-processing is an important operation to reduce spoilage, waste and other losses in quantity and quality of farm produce between the time of harvesting and time of marketing/consumption. Packaging is the science, art, and technology of enclosing or protecting products for distribution, storage, sale, and use [16]. Product packaging not only protects the product during transit from the manufacturer to the retailer, but it also prevents damage while the product sits on retail shelves. Majority (76.70%) of the respondents were aware of the use of transparent polythene to pack sweet potato products. Meanwhile, bottling (95.00%) and canning (90.00%) had very low awareness in the study area. This may be attributed to the fact that sweet potato is still regarded as a *poor man's* food and neglected crop with little or no government support and is thus rated low in food priority listing because its processing and packaging are limited to traditional techniques [17]. This goes a long way to indicate that much value is not placed on sweet potato production. Result in IIIB showed that level of sweet potato value addition was very low (91.70%) in the study area.

TABLE IIIA  
RESPONDENTS AWARENESS OF SWEET POTATO VALUE ADDITION IN  
PRODUCTS FORMS (N = 120)

Products forms	Awareness	
	Aware (1)	Not aware (0)
Sweet potato sparri (Sp. garri)	95(79.20)	25(20.80)
Sweet potato bread	42(35.00)	78(65.00)
Sweet potato chips	92(76.70)	28(23.30)
Sweet potato flour	62(51.70)	58(48.30)
Sweet potato meat pie	26(21.70)	94(78.30)
Sweet potato fruit juice	21(17.50)	99(82.5)
Sweet potato cake	10(8.30)	110(91.70)
Sweet potato chin-chin	39(32.5)	81(67.50)
Sweet potato vegetable	61(50.80)	59(49.20)
Sweet potato kunu	75(62.50)	45(37.50)
Sweet potato doughnut	18(15.00)	102(85.00)
Sweet potato animal feed	62(51.70)	58(48.30)
Sweet potato biscuits	12(10.00)	108(90.00)
Sweet potato puff-puff	25(20.80)	95(79.20)
Sweet potato noodles	17(14.20)	103(85.80)
Sweet potato industrial alcohol	14(11.70)	106(88.30)
<b>Packaging</b>		
Sealing of sweet potato in polythene bags	92(76.70)	28(23.30)
Branding and labeling	25(20.80)	95(79.20)
Canning of sweet potato	12(10.00)	108(90.00)
Bottling of sweet potato	06(5.00)	114(95.00)

Source: Field survey, 2012

Note: Values in parenthesis are in percentages

TABLE IIIB  
CATEGORIZATION OF RESPONDENTS LEVEL OF AWARENESS OF SWEET  
POTATO VALUE ADDITION (N = 120)

Category	Scores	Frequency	Percentage
High level of awareness	11-20	10	8.30
Low level of awareness	0-10	110	91.70

Source: Field survey, 2012

#### D. Constraints To Sweet Potato Production And Value Addition

Table IV showed that inadequate finance with a mean of 2.78 was ranked 1<sup>st</sup> as a major constraint confronting sweet potato farmers in the study area. This constraint greatly limits the sweet potato production to a small scale level, thus impede the value addition of sweet potato. This result corroborates the findings of [18], [19] that credit is an important input for expansion of agriculture. Low knowledge on sweet potato value addition had a mean of 2.76 and ranked as 2<sup>nd</sup> major constraint to sweet potato value addition. This finding is in agreement with [12] who reported that inadequate government aid is a major problem to sweet potato production. Too much focus/attention on other roots and tuber crops (2.66), high cost of sweet potato processing equipment (2.66), and bulkiness and perishable nature of sweet potato (2.66) were ranked as 3<sup>rd</sup> major constraints to sweet potato value addition. Similarly, respondents identified inadequate extension service support as 4<sup>th</sup> challenge to the sweet potato production and value addition with mean of 2.63. This is in line with findings of [19] that limited extension service support affects crop output and farmers' income.

TABLE IV  
DISTRIBUTION BASED ON CONSTRAINTS TO SWEET POTATO PRODUCTION AND VALUE ADDITION (N=120)

Variable	Very serious (3)	Moderately serious (2)	Not serious (1)	Mean	Rank
Inadequate finance for sweet potato production	98(81.70)	18(15.00)	04(3.30)	2.78	1 <sup>st</sup>
Low farmers knowledge on sweet potato value addition	96(80.00)	20(16.70)	04(3.30)	2.76	2 <sup>nd</sup>
High cost of sweet potato processing equipment	89(74.20)	22(18.30)	09(7.50)	2.66	3 <sup>rd</sup>
Bulkiness and perishable nature of sweet potato	86(71.70)	28(23.30)	06(5.00)	2.66	3 <sup>rd</sup>
Too much focus/attention on other roots and tuber crops	92(76.7)	16(13.30)	12(10.00)	2.66	3 <sup>rd</sup>
Inadequate extension service support	91(75.80)	14(11.70)	15(12.50)	2.63	4 <sup>th</sup>
Inadequate market information on sweet potato production	75(62.50)	35(29.20)	10(8.30)	2.54	5 <sup>th</sup>
Low consumer preference for sweet potato	73(60.80)	30(25.00)	17(14.20)	2.46	6 <sup>th</sup>
Non availability and accessibility of planting materials	65(54.20)	32(26.60)	23(19.20)	2.35	7 <sup>th</sup>
High cost of farm labour	60(50.00)	40 (33.30)	20(16.70)	2.33	8 <sup>th</sup>
Pest and diseases problems	58(48.30)	42(35.00)	20(16.70)	2.31	9 <sup>th</sup>
Problems of land tenure system	36(30.00)	52(43.30)	32(26.70)	2.03	10 <sup>th</sup>

Source: Field Survey, 2012

Note: Values in parenthesis are in percentages

#### E. Relationship between Processing Pattern and Value Addition

H<sub>01</sub>: There is no significant relationship between socio-economic characteristics and level of awareness of sweet potato value addition in the study area.

Linear regression was chosen out of the four models (Linear, Semi-log, Double log, and Exponential) as the lead equation based on the *a priori* information. It had R-square of (0.23), which was the highest among the four models. It was at the same time had highest F-statistics (5.52) significant at 1%

level of significance just like the other models. It had been advised that choice of best fit model among competing models should not be based on the strength of R-square but rather on considerations of signs of the coefficients with respect to economic theory [20]. The linear model had highest signs of the coefficients. The R-Square (0.23) showed that 23.00% of the variation in the level of awareness of sweet potato value addition was brought about by variation in the explanatory variables used in the model. The coefficient of sex, household size and educational status were significant at 5% level of significance while farming experience was significant at 1%

level of significance. The negative sign of sex implies that men were not directly involved in processing and as such had low level of awareness of sweet potato value addition. However, sweet potato farmers with high level of education and farming experience had positive relationship with awareness of value addition. Thus, the null hypothesis that “there is no relationship between socio-economic and level of awareness of sweet potato value addition” is rejected while the alternate hypothesis is hereby accepted.

TABLE V  
RELATIONSHIP BETWEEN SOCIO-ECONOMIC CHARACTERISTICS AND  
AWARENESS OF SWEET POTATO VALUE ADDITION

Variables	Linear	Semi-log	Double log	Exponential
Constant	(2.74)** 0.01	(0.53)NS 0.59	(1.83)NS 0.70	(5.34)*** 0.00
Age	(1.66)NS 0.99	(1.50)NS 0.14	(1.34)NS 0.18	(1.49) 0.14
Sex	(-2.05)** 0.04	(-1.96)** 0.05	(-1.99)** 0.05	(-2.08)** 0.04
Household size	(-2.70)** 0.01	(-2.71)NS 0.08	(-1.93)NS 0.06	(-1.93)NS 0.56
Farm size	(0.24)NS 0.81	(0.26)NS 0.80	(0.10)NS 0.92	(0.09)NS 0.93
Years of experience	(4.28)*** 0.00	(3.99)*** 0.00	(3.05)*** 0.00	(3.30)*** 0.00
Educational status	(1.99)** 0.05	(1.96)** 0.05	(2.24)** 0.03	(2.19)** 0.03
<b>Model Fit Tests</b>				
R <sup>2</sup>	0.23	0.21	0.17	0.18
Adjusted R <sup>2</sup>	0.19	0.17	0.13	0.14
F-Statistics	5.52	5.09	3.93	4.26
Prob.(F-Statistics)	0.00	0.00	0.00	0.00

Source: Field Survey, 2012

Note: Values in parenthesis are t-values

S – Significant at  $p \leq 0.05$

#### IV. CONCLUSION

It can be concluded that awareness of value addition of sweet potato was very low and consequently had lesser economic returns per ha.

#### V. RECOMMENDATION

Based on the findings of this study it is hereby recommended that:

1. Farmers should be empowered to process sweet potato using modern processing techniques in terms of training on value addition of sweet potato.
2. Effective and efficient extension teaching/training and visit on sweet potato production and value addition.
3. Provision of improved processing facilities at subsidized rate by government to encourage farmers to process their raw harvested sweet potato.

#### REFERENCES

- [1] Food and Agricultural Organization Statistics (FAO), 2008. [www.fao.org](http://www.fao.org).
- [2] Njoku, J. C. Effect of Cultivar and Time of Harvest on Yield and Total Carotenoid Content of Carotene-Based Sweet potato Cultivars. *NRCRI, Annual Report, 2007: 45-53*.
- [3] Egeonu I. N. Characterizations of 35 sweet potato (*Ipomea batatas*) (L.) Lam) accessions in South Western Nig. MSc. Project Report. Dept. of Agronomy, University of Ibadan, 2004, 72p.
- [4] CIP (International Potato Centre) Lima Peru. Sweet potato: Treasure for the power in sweet potato, 2003. <http://www.cipotato.org>. Accessed on November 20<sup>th</sup>, 2012.
- [5] Abidin, P. E. Sweet potato breeding for Northeastern Uganda farmers varieties, farmer-participating selection, and stability of performance. PhD Thesis, Wageningen University, The Netherlands, 2004, 152p. ISBN 90 – 850-033-7.
- [6] Ndunguru, G. Thompson, M. Waida, R. Rwiza, E. and Wesby, A. Methods for examining the relationship between quality characteristics and economic value of marketed fresh sweet potato trop, Agric (Trinidad), 2008, Vol. (75(1): 129-133.
- [7] Mmasa, J. J., Elibariki, E. M. and Melchion, M. Performance of various marketing channels for sweet potato value added products. *Journal of Agricultural Economics and Development, 2013*, Vol. 2(2), pp. 065-076.
- [8] National Population Commission (NPC). [www.onlinenigeria.com](http://www.onlinenigeria.com). 2006. Accessed on 4<sup>th</sup> February 2012.
- [9] Oladoja, M. A., Adisa. B. O. and Ahmed-Akinola A. A. Effectiveness of communication methods used in information delivery to cocoa farmers in Oluyole LGA of Oyo State. *The Ogun Journal of Agricultural Science, 2006*, Vol. 4, pp. 78-88.
- [10] Adisa, B. O. and Okunade, E. O. Women-In-Agriculture and Rural Development. In: S. F., Adedoyin (ed). Agricultural Extension in Nigeria Agricultural Extension Society of Nigeria (AESON). c/o Agricultural and Rural Management Training Institute (ARMTI), Ilorin, 2005, 69-77.
- [11] Ezeano, C. I. On-farm Evaluation of the use of sweet potato as a weed control in Yam/Maize production in Enugu State. On-Farm Adaptive Research (OFAR) Trial-Enugu State Agricultural Development Programme (ENADEP), 2005.
- [12] Fawole, O. P. “Constraints to Production, Processing and Marketing of Sweet Potato in Selected Communities in Offa Local Government Area of Kwara State, Nigeria” 2007, *Journal of Human Ecol.* 22(1): 23-25.
- [13] Adam, K. L. Sweet potato: Organic production, 2005. Online Available from: <http://www.ncat.org/attra-pub/sweet-potato.html>. Retrieved on 19<sup>th</sup> November, 2012.
- [14] Burris, B. J. Evaluating sweet potato as an intervention food to prevent vitamin A deficiency. *Compr. Rev. Food Sci. Food Safety, 2011*. 10: 118-130.
- [15] Ofoh, M. C. (2009). Food security and mitigation of climate change through Ecosystem based Agriculture (13th inaugural lecture of the Federal University of Technology Owerri (FUTO). Imo State, P. 24.
- [16] Schneider, Y., Kluge, C., Weib, U. and Rohm, H. "Packaging Materials and Equipment". In: Barry Law, A. and Tamime, A. Y. *Technology of Cheese making: Second Edition*. Wiley-Blackwell. 2010, p.413, ISBN 978-1-4051-8298.
- [17] Wheatley, C., and Loechl, C. A critical review of sweetpotato processing research conducted by CIP and partners in Sub-Saharan Africa. Social Science Working Paper No. 2008-4.
- [18] Philip, D., Nkonya, E., Pender, J. and Oni, O. A. (2009). Constraints to increasing Agricultural productivity in Nigeria: A Review. *International Food Policy Research Institute Journal*. NSSP006.Email: ifpri-nigeria@cigar.org. [www.ifpri.org](http://www.ifpri.org).
- [19] Oyediran, W. O. Factors affecting melon (*Citrullus colocynthis*) production in Oyo state, Nigeria. Unpublished, M. Agric. Thesis, Department of Agricultural Extension and Rural Development, Federal University of Agriculture Abeokuta, 2013, Pp. 108-111.
- [20] Greene, W. H. Econometric Analysis, Fifth Edition Prentice Hall. New Jersey, 2008.