ISSN 0189-0514
*J. Anim. Prod. Res. (2016) 28(2):321-331*

National Animal Production Research Institute
Ahmadu Bello University
P.M.B 1096, Shika-Zaria,
Kaduna State, Nigeria.
Email: japr@napri-ng.org Website: www.naprijapr.org

# ASSESSMENT OF THE IMPACT OF ANIMAL TRACTION TECHNOLOGY USAGE ON CROP FARMERS' INCOME IN NORTHWESTERN NIGERIA

***[1]Owolabi, J. O., [2]Adeniji, O. B., [2]Ojo, M. O. and [2]Olaleye, R. S.**
**[1]Department of Agricultural Economics and Rural Sociology, Faculty of Agriculture/Institute for Agricultural Research, Ahmadu Bello University, P.M.B. 1044, Samaru, Zaria.*
*[2] Department of Agricultural Economics and Extension Technology, School of Agriculture and Agricultural Technology, Federal University of Technology, PMB 65, Minna*
**Email: owolabijo@gmail.com Tel: +234 (0) 8065618795*

## ABSTRACT

This study assessed the impact of Animal Traction Technology (ATT) usage on crop farmers' income in Northwestern Nigeria. The States covered were Kaduna, Zamfara and Kano States. Primary data were collected through the use of a structured questionnaire. A multistage sampling procedure and interview schedule were used to select two categories of respondents. The study employed survey method to select 140 farmers using ATT and 170 farmers who were non ATT users to serve as control group. Data were analyzed by means of descriptive statistics such as mean, frequency distribution and percentages, and propensity score matching statistics. The result showed that there was no significant difference between the ages of the users and non-users of animal traction technology. The study also revealed that about 39% of respondents were within the age 40-49 years with an average age of 46 years. The study also revealed that average household size of the respondents was 6 members. The result also indicates a difference in the incomes of both users (396,778) and non-users (233,473.5) of ATT, thus, about 63% increase in crop farmers' income was achieved as a result of their using animal traction technology. The result of regression analysis shows the use of annual traction technology to have a positive impact on respondents' income and was significant at $P < 0.01$. Measures such as intensification of new input technology usage in farming at an affordable cost to the farmers should be implemented. In order to promote ATT usage, it is recommended that further research and extension on ATT be replicated in other zones of the country.

**Keywords:** Animal traction technology, usage**,** farmer, Income, Northern, Nigeria.

## INTRODUCTION

Agricultural mechanisation has been described as one of the great achievements of the 20th century among the technologies that have contributed significantly to agricultural production practices through the more efficient use of labor, the timeliness of operations, and more efficient input management (NAE, 2000). Animal Traction Technology (ATT), a branch of agricultural mechanisation had for a long time been in use as a method of cultivation, plowing, harrowing, weeding and transportation in many developing countries including Nigeria (Musa, 1988). The use of animal traction for different farm and non-farm operations dates back to pre-historic period in some parts of the world. In sub-Saharan Africa (SSA), however, the use of the technology is believed to be less than a century old (Thomas, 1990; Omotayo, 1996) however, argues that there are several constraints in diversifying uses of work animals and list some

conditions to be satisfied in applying animal traction to a wide range of uses. These, according to them are:

(b) the presence of suitably trained and nourished animals;

(c) the availability of equipment to inter-connect the animal and the processes to be driven; and

(d) an overall favorable economic balance after the extra costs of equipment and feeding have been set against labour savings.

According to Alderman and Linnemayr (2009), vast majority of rural people particularly in northern Nigeria depend on animal power for cultivation, weeding, threshing and transportation and provides the power for the cultivation of nearly 50% of the smallholder farmers and the hauling of 25 % carts. Thus, as a source of energy supply, animal traction is one of the inputs required for crop production and play role in ensuring availability of food which is a panacea to food security. Although, there was often a tendency to regard animal power as an archaic concept, to be replaced with fossil fuel-power device as soon as possible, this reflects disregard and lack of understanding of the role of animal traction in the rural setting of developing countries. According to Tsegai and Kormawa (2002), efforts to improve availability, accessibility and efficiency of animal power have been negligible in programmes to boost crop production (Simonyan and Omolehin, 2012). However, in a recent study by Suri *et al.* (2009), the authors opine that it is being increasingly recognized that animal power will remain important in many developing countries Nigeria inclusive for years to come (Babatunde *et al*., 2007).

The empirical studies by Akpoko, 1999; Musa 2004 and ILCA, 2004 shows that research on mechanization of agricultural activities with animal-drawn implements shows that there is a significant savings in labour and time over hand weeding. For instance, Musa (1988), stated that while it takes between 4 - 8 hours per hectare to complete weeding with oxen-traction, it takes a man about 40 - 150 hours to accomplish the same task (Musa, 1990). Although it is argued that animal traction can be applied to many more farm level operations such as planting, spraying, fertilizer application, and groundnut lifting, there is no record of such uses in any part of Nigeria (Musa, 2004).

It is generally acknowledged that credit to farmers is most important instrument in improving farm productivity. This applies especially to peasant small-holders whose lack of capital seems to be a crucial factor limiting farm development. According to Simon *et al.* (2010), in Nigeria, animal traction is widely used among smallholder farmers who accounted for over 90% of the country's agricultural outputs (Baba and Alhassan, (2000). However, the innovation of animal traction lacks policy and investment support from the stakeholders to make it more efficient (Paul, 2008; Bentley, Wasser and Creed-Kanashiro, 2011). The focus of this study therefore, is to assess the respondents' socio-economic characteristics and determine the impact of animal traction usage on crop farmers' income in Northwestern Nigeria.

**Hypotheses of the Study**

$H_o$**:** There was no significant impact of animal traction on crop farmers' income.

$H_a$**:** There was significant impact of animal traction on crop farmers' income.

## MATERIALS AND METHODS

### Study Area

This study was carried out in Northwestern zone of Nigeria. The zone comprises of Jigawa, Kebbi, Kaduna, Kano, Katsina, Sokoto and Zamfara States. The zone is located in northern part of Nigeria. North Western zone lies between latitudes $9^0 10^{'}$ and $11^0 30^{'}$ north and longitude $69^0 52^{'}$ and $9^0 10^{'}$ East of Greenwich meridian which falls mostly within the Northern Guinea Savannah zone of the sub humid climate of Nigeria. The zone has a total population of 35, 915,467 million people representing 25.58% of the total population of the country (NBS, 2007). The projected population of the zone is put at 46,208,205 people in 2015 at a growth rate of 3.2 % per annum.

Northern Nigeria is characterized by tropical climate with temperatures varying at different times. High temperatures are normally recorded between the months of April and September with the daily minimum and maximum temperatures $14^o$ and $35^o$ Celsius respectively. The zone borders Benin Republic to the west, North East (Bauchi, Gombe and Yobe) to the east, Niger Republic to the north and North Central Niger, Plataeu, Nassarawa and Federal Capital Territory (FCT) to the south. The study area falls within Sahel/Sudan/Gunea Savannah zones and has an area of about 102,531 $km^2$ thus making up about 11% of the country's landmass The zone is also characterized by two distinct seasons; the rainy ver,and dry seasons. The raining season lasts from May to September with average rain fall of between 400mm and 1300mm and dry season lasts from for about seven months from October to April.

Majority of the users of animal traction surveyed was small-scale farmers. However, Most of them owned between one and three teams of work bulls. Even though animal training centers were spotted in Kaduna and Kano States, most farmers surveyed did not have access to the implements such as ox- drawn weeders, ox-drawn seed planters, ox-drawn sprayer and ox-drawn fertilizer applicator. Three categories of farm households were identified, namely; those who owned work bulls and implements, households who used animal traction but did not own the package (users of animal traction) and households who depended wholly on hoe cultivation (non- users of animal traction). Among the users of the technology, land tillage (ploughing, ridging and transportation) were the most common use to which animal traction was engaged (Omotayo, 1996).

### Sampling Procedure

A multistage sampling procedure was used to select respondents for this study. The first stage involved random selection of Kano, Kaduna and Zamfara States out of the Six (6) States that made up Northwestern Nigeria due to prominent participation in animal traction practices. The second stage involved random selection of 10% of 71 Local Government Areas from the 3 States, giving Seven (7) LGAs identified for the study. The third stage involved random selection of 10% of (11) villages in the selected LGAs on the basis of high number of farmers using animal traction technology in the selected villages. Finally, a random selection of 10% of 3,100 animal traction users and non-users from the selected villages using balloting technique was employed to select 140 users and 170 non-users. Thus, a total of 310 farmers as respondents were used for the study.

**Data Collection**

Users and non-users of ATT were the primary source of data collected by questionnaires administration. In addition, questionnaires and interview schedule were employed to obtain the relevant information from the respondents. Data collected comprised socioeconomic characteristics of respondents such as age, educational level, household size, income, access to credit, farming experience, access to market, marital status, extension contact and membership of cooperative. Data on the inputs and outputs of respondents such as farm inputs (labour, fertilizer, seed, and insecticide/herbicide) crop output and farmers' level of living were collected in order to estimate the impact of animal traction on the users income. In addition, a pilot test for reliability of the instrument was conducted using a test-retest procedure (Musa, 1990; Omotayo, 1996) in Maigana, Gwarzo and Bungudu in December 2015 and January, 2016. The variability and reliability tested were conducted given the reliability score of r = 75. The questionnaire was tested and modified by experts from Federal University of Technology (FUT) Minna. The actual survey was carried out between April and June, 2016 through questionnaires.

The questionnaires were administered by trained enumerators chosen from the staff of Agricultural Development Projects (ADPs) of the selected States on the basis of their ability to communicate in the local language. This study was conducted between February and June 2016.

**Data Analytical Techniques**

There are several methods of data analysis commonly used in impact assessment on farmers' income. The statistical methods identified to achieve the objectives and test the hypotheses of the study include Descriptive statistics, Double Different Estimator, Logit regression analysis and propensity score matching (PSM) model. The above mentioned statistics were also used to evaluate whether adopting animal traction technology causes the farmers to improve their income and increase their level of living. The propensity score matching method was used to determine the difference between the income of the users and non-users. The propensity scores was based on which matching was performed and estimated using the following logit regression formula:

$$L_i=\frac{P(Y=1|X)}{1-P(Y=1|X)}= \beta_0 + \beta_1X_1+ \beta_2X_2+ \beta_3X_3+ \beta_4X_4+ \beta_5X_5+ \beta_6X_6+ \beta_7X_7+ \beta_8X_8+ U_i$$

Where:

Y = Extent of ox-drawn implements usage (ox-plough, ox-cultivator, ox-ridger, ox-carts, and ox-harrow. Others include ox-sprayer, ox-weeder, ox-pod-lifter, ox- drawn fertilizer applicator and ox-operated cane crusher)

ATT (1= Users, 0= Non-users)

$X_1$ = Age of the respondents (Years)

$X_2$ = Years of education (Years)

$X_3$ = Household size (Numbers)

$X_4$ = Amount of credits received (₦)

$X_5$ = Number of extension visits (Numbers)

$X_6$ = Years of experience in farming (Years)

$X_7$ = Membership of cooperative(s) (Years spent in the cooperative)

$X_8$ = Access to market (Distance in km)

$\beta_0$ = Intercept term

$\beta_1$ ... $\beta_9$= Slope coefficients

Propensity score matching-based nearest neighbor matching was specified as follows:

$$A\hat{T}E_1 = \frac{1}{n_T}\left[\sum_{i\epsilon T} y_{1ij} - \sum_{i\epsilon u} \omega(i,j) y_{0ij}\right]$$

Where:

$A\hat{T}E_1$ = Impact of ATT programme on income of the treated farmers

$n_T$ = Number of treated farmers

$y_{1ji}$ = ATT programme on income of the farmers within the treatment group

$y_{0ji}$ = ATT programme on incomeof the farmers within the statistical control group

$\omega(i,j)$ = Weight

$j$ = Farm household identifier = $1, 2, \ldots, 310$

$i$ =ATT programme (1= Users, 0= Non-user)

**Double difference method**

Double difference method is a standard program evaluation tool used to measure potential program impacts (Verner and Verner, 2005). To use this model, information on both Animal traction users and non-users is often required for before and after program intervention. This was used to attain objectives (ii) of the study. The Verners model adapted for this study is specified as follows:

$$DD^s = \left[\frac{1}{p}\sum_{i=1}^{p}(Y_{1ia} - Y_{1ib})\right] - \left[\frac{1}{C}\sum_{j=1}^{p}(Y_{0ja} - Y_{0jb})\right]$$

Where

$Y_{i1}$ = total revenue or income at time a and b

Time a, and b = after and before project respectively.

P - Number of participants

C = number of individuals in the control group (non-participant)

$DD^s$ = the difference between the average changes in the income for the participant and non-participant.

**Chow-test statistics**

The chow test statistics was used to tests the hypothesis which stated that there was no significant impact of animal traction on the income of animal traction technology users.

The Chow-test statistics is expressed mathematically as:

$$F = \frac{(RSSR - SSR1 - SSR2)/ k}{(SSR1 + SSR2)/ n - 2k}$$

Where:

RSSR = the sum of squared residuals from a linear regression in which $b_1$ and $b_2$ are assumed to be the same, b has dimension k, and there are n observations in total

$SSR_1$= the sum of squared residuals from a linear regression of sample 1

$SSR_2$= the sum of squared residuals from a linear regression of sample 2

The total number of observation is $n = n_1 + n_2$ and the number of parameters is k.

## RESULTS AND DISCUSSION

### Distribution of Respondents by Socio-economic Characteristics

Table 1 shows that 40% of ATT users were within the age 40-49 years with an average age of 47 years, and 39% of the non-users of animal traction technology were also within the age brackets 40-49 years, with an average age of 46 years. This result shows that there was no significant difference between the age of the users and non-users of animal traction. The implication of these findings is that large proportions of the respondents were in their active age and can be regarded as agile and physically disposed to farming activities (Gedikoglu and McCann, 2007; Babatunde, Omotesho and Sholotan, 2007).

The result also revealed that 29% of users of animal traction technology had 11-15 persons per household with mean household size of 8 persons per households. Also, 49% of non-users of animal traction technology had 6-10 persons per household with mean household size of 9 persons per households. The average household size among respondents in the study areas was 6 members. This is above the national average of approximately 5 (Imonikhe, 2004). The result of the study also shows that a little above half (57%) of the draught animal technology users had accessed to bank loan. Only about 5% of ATT users had access to agricultural credit by money lender as compare to (16%) of ATT non-users. This implies that accessibility of draught animal technology users in the study area was higher than that of the ATT non-user (Musa, 2004).

**Table 1: Socioeconomic characteristics of the respondents**

| Characteristics | Users | | Non –Users | | Pooled | | t-statistic |
|---|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | Frequency | % | |
| **Age** | | | | | | | **0.359** |
| Less than 20 | 1 | 0.7 | 2 | 1.1 | 3 | 1.0 | |
| 20-29 | 8 | 5.7 | 10 | 5.9 | 18 | 5.8 | |
| 30-39 | 20 | 14.3 | 22 | 12.9 | 37 | 11.9 | |
| 40-49 | 56 | 40.0 | 62 | 36.5 | 122 | 39.4 | |
| 50-59 | 35 | 25.0 | 49 | 28.8 | 85 | 27.4 | |
| 60-69 | 13 | 9.3 | 18 | 10.6 | 31 | 10.0 | |
| 70-79 | 5 | 3.6 | 7 | 4.1 | 12 | 3.9 | |
| 80-89 | 2 | 1.4 | Nil | Nil | 2 | 0.6 | |
| **Total** | **140** | **100** | **170** | **100** | **310** | **100** | |
| Mean | 47 | | 46 | | 46 | | |
| Standard deviation | 11.45 | | 11.60 | | 11.59 | | |
| Minimum | 17 | | 18 | | 18 | | |
| Maximum | 80 | | 70 | | 70 | | |
| **Household size** | | | | | | | **3.96*** ** |
| 1-5 | 27 | 19.3 | 45 | 26.5 | 75 | 24.2 | |
| 6-10 | 39 | 27.9 | 84 | 49.4 | 125 | 40.3 | |
| 11-15 | 41 | 29.3 | 24 | 14.1 | 70 | 22.6 | |
| 16-20 | 16 | 11.4 | 14 | 8.2 | 24 | 7.7 | |
| 21-25 | 14 | 10.0 | 2 | 1.2 | 13 | 4.2 | |
| 26-30 | 3 | 2.1 | Nil | Nil | Nil | Nil | |
| Greater than 30 | Nil | Nil | 1 | 0.6 | 1 | 0.3 | |
| **Total** | **140** | **100** | **170** | **100** | **310** | **100** | |
| Mean | 11 | | 9 | | 10 | | |
| Standard deviation | 6.65 | | 5.31 | | 5.88 | | |
| Minimum | 1 | | 1 | | 1 | | |
| Maximum | 29 | | 38 | | 38 | | |
| | | | | | | | **-0.492** |
| **Access of Credit** | | | | | | | |
| Bank loan | 80 | 57.14 | 27 | 15.88 | 98 | 31.61 | |
| Cooperative | 10 | 7.14 | 13 | 7.26 | 51 | 16.45 | |
| society | 32 | 22.86 | 31 | 18.24 | 47 | 15.16 | |
| Relatives / | 11 | 7.86 | 77 | 45.29 | 64 | 20.65 | |
| friends | **7** | 5.00 | 22 | 12.94 | 50 | 16.13 | |
| Money lenders | **140** | **100** | **170** | **100** | **310** | **100** | |
| **Total** | | | | | | | |

**Source:** Field survey, 2016

This result conformed to the findings of Hoppe and Banker (2006), who found significant correlation between amount of credit and adoption of farm innovation and farm output among farmers of north-west, Nigeria. This could have reduced adoption of draught animal technology by the respondents (Ambali, Ologbon and Akerele, 2012).

**Propensity Score Estimate of Animal Traction on Income of Users and Non-Users**

Result in Table 2 present the estimates of the impact of animal traction technology usage on the income of the farmers. The study reveals that there was a difference in the incomes of both treated (396,778) and control (233,473.5) otherwise refers to as the users and non-users. The average treatment effect on the treated (ATT) was positive (₦163,304.5) and statistically significant at 1% level of probability. This implies that animal traction had impact on the users' income. In other words, the users experienced an average significant increase of about ₦163,304.5 as a result of animal traction technology usage. The average treatment effect (ATE) of the respondents in the study area was positive (₦223,541.1). This implies that if all the farmers in the study area had participated in animal traction technology usage would have experience an increase of about ₦223,541 in their income as a result of their usage. The result is in line with studies by Alderman and Linnemayr (2009) who reveal that animal traction contributed significantly to improved living conditions and income of smallholder farmers respectively. Similar studies by Adesiina and Baidu-Forson (1995), had earlier on reported that high level of technology adoption by farmers are capable of increasing farmers' income, meeting their required daily food needs and also promote their general economic growth (Mathenge *et al.,* 2010).

**Table 2:** Impact estimates of ATT usage on farmers' income

| Sample | Treated (140) | Control (170) | Difference | S.E | T-stat |
|---|---|---|---|---|---|
| ATT | 396,778 | 233,473.5 | 163,304.5 | 745.98 | 6.98*** |
| ATE | | | 223,541.1 | | |

*** P<0.01

**Source:** Field survey, 2016

### 3.3 Test of Hypothesis

The result (Table 3) shows that Chow F calculated was 13.73, while F Table value at 9 degree of freedom with sample size of 310 was 1.91 at 5% level of probability which implies that there was a significant impact of animal traction on the income of users. Hence, the study rejects the null hypothesis ($H_o$) which stated that there was no significant impact on the income of animal traction users and accept the alternative hypothesis which stated that there was significant impact on the income of animal traction users in the study area,

**Table 3:** chow-test result showing significant impact on income of users and non-users

| Income | $R^2$ | RSS | N | K | F-cal | F-tab |
|---|---|---|---|---|---|---|
| Pooled Samples | 0.49 | 4856141E+06 | 310 | 9 | 13.72 | 1.91 |
| Users | 0.36 | 2050848 E+06 | 140 | | | |
| Non-users | 0.34 | 1247981 E+06 | 170 | | | |

$R^2$ = regression coefficient, RSS = residual sum of square, N = numbers of observation and K = numbers of parameters

**Source:** Field survey, 2016

## CONCLUSION AND RECOMMENDATIONS

Based on the empirical evidence emanating from the findings of this study, it was concluded that farmers' usage of animal traction technology had significant impact on the income of the users. Therefore, the study hereby recommended that further research and extension in ATT be replicated in other zones of Nigeria particularly, those zones which have potentials for animal traction technology practices. This if implemented will improve the animal traction technology usage and also serve as an opportunity for increasing the income of farmers especially among smallholders who are involved in the bulk of food production activities across the country.

## REFERENCES

Adesiina, A.A. and Baidu-Forson, J. (1995). Farmers' Perceptions and Adoption of New Agricultural Technology: Evidence from Analysis in Burkina Faso and Guinea, West Africa. *Journal of Agricultural Economics,* 1 (3): 1-9.

Alderman, H. and Linnemayr, S. (2009). Anemia in low-income countries is unlikely to be addressed by Economic Development without Additional Programmes. *Food Nutrition Bulletine,* (30): 265-69.

Ambali O. I., Ologbon, O.A.C. and Akerele, E.O. (2012). Effect of Agricultural Technology on Income of Cassava and Maize Farmers in Egba Division of Ogun State, *Nigeria Journal of Agriculture and Veterinary Sciences,* 4 (2): 1-11.

Baba, K.M. and Alhassan, A.H. (2000). Impact of Animal Traction on Agricultural Production and Farm Income: A Case Study of the Work-Oxen Model of the Second Pilot Livestock Development Project, Sokoto. *Nigeria Journal of Agriculture Extension,* 12 (2): 9-19.

Babatunde, R.O, Omotesho, O.A. and Sholotan, O.S. (2007). Socio-economic Characteristics and Food Security Status of Farming Householdsin Kwara State, North-Central Nigeria. *akistan Journal of Nutrition,* 6 (1): 49-58.

Bentley M, Wasser H, Creed-Kanashiro H. (2011). Responsive Feeding and Child Under-Nutrition in Low and Middle-Income Countries. *Journal of Nutrition,* 14 (1): 502–507.

Chang, H. H., and Boisvert, R. N. (2005). Are Farmers' Decisions to Work off the Farm and Participate in the Conservation Reserve Program Independent, Joint or Sequential? *Selected*

*Paper for Presentation at the American Agricultural Economics Association Annual Meeting,* Providence, Rhoe Island, July 24-27.

Cornejo, F. J., Hendricks C., and Mishra, A. (2005). Technology Adoption and Off-farm Household Income: The Case of Herbicide-Tolerant Corns." *Journal of Agricultural and Applied Economics*, 37(3), 549-563.

Department of Agricultural Economics & Rural Sociology, Ahmadu Bello University Zaria, Kaduna State, Nigeria.

Gedikoglu, H. and McCann, L. (2007). Impact of Off-farm Income on Adoption of Conservation Practices." *Selected paper at the 2007 Annual Meeting of American Agricultural Economics Association, Portland, Oregon*, July 29, 2007.

Gefu, J.O. and Otchere, E.O. (eds.), Draught Animal Power Research and Development in Nigeria, NAPRI/ABU, Zaria, Nigeria: 102 - 116.

Hoppe, A. R., and Banker, E. D. 2006. "Structure and Finances of U.S. Farms: 2005 Farm Family Report." Economic Information Bulletin Number 12, U.S. Department of Agriculture, Economic Research Service.

Imonikhe, G. A. (2004). Impact of Katsina State Agricultural and Community Development Project on Income and Productivity of Farmers. Unpublished Ph.D Thesis of the

Mathenge, M. Place, F. Olawande, J., and Mithoefer, D. (2010). Participation in Agricultural Markets among the Poor and Marginalized: Analysis of Factors Influencing Participation and Impacts on Income and Poverty in Kenya, a study report. Tegemeo Institute of Agricultural Policy and Development, Nairobi. Pingali P.1997. From subsistence to commercial production System: The transformation of Asian Agriculture. *American Journal of Agricultural Economic*, 79 (2):628–634.

Musa, H.L. (1988). Animal Power Utilization for Increased Agricultural Production in Nigeria. In: Proceedings of a National Conference on Pastoralism in Nigeria: Past. Present and Future, pub. by NAPRI/ABU, Zaria, Nigeria, Gefu, J.O. et al (eds.): 102-1 16.

Musa, H.L. (1990). Development and Use of Animal Drawn Implements in Nigeria. In:

Musa, H. L. (2004). Donkey Mechanization: A Supplementary Power Source for Agricultural Production. *Proceedings of Nigerian Society of Agricultural Engineers,* 2:55-59.

National Academy of Engineering (NAE). (2000). Greatest Engineering Achievements of the 20th Century. Available online at *http://www.greatachievements.org/*. National Bureau of Statistics (NBS), (2012). Consumption Pattern in Nigeria 2009/10 Preliminary Report.

Omotayo, M. A. (1996). Analysis of Animal Traction Utilization on Crop Yields of Farmers in Katsina State. Ph.D Thesis of the Department of Agricultural Economic and Rural Sociology, Faculty of Agriculture, Ahmadu Bello University, Zaria.

Paul, M., (2008). Constraints in Access and Demand for Rural Credit: Evidence from Uganda. A Paper Presented during the African Economic Conference held at Tunis, Tunisia between 12th and 14th November, 2008. 1-29.

Simonyan, J. and Omolehin, R.A. (2012). Analysis of Impact of Fadama II Project on Beneficiary Farmers Income in Kaduna State: A Double Difference Method Approach. *International Journal of Economics, and Management Sciences,* 1(11):1-8.

Suri, T., Dave, T., Irungu, C., Gitau, R., and Kariuki, D (2009). Rural Incomes, Inequality and Poverty Dynamics in Kenya, Tegemeo Institute of Agricultural Policy and Development, Working Paper No. 30/2008, Nairobi.

Thomas, T., Oram, C. and Tembo, G.(1990) Research on Diversified Uses of Work Animals: Needs, Experiences and Methods. In Lawrence, P.R., Lawrence, K., Dijkman, J.T. and Starkey, P.H.(Editors) Research for the Development of Animal Traction in Africa Proceedings of the 4th workshop of the west African Animal Traction Network Held in Kano, Nigeria.

Tsegai, D., and Kormawa, P.C. (2002). Determinants of Urban Household Demand for Cassava Production in Kaduna, Northern Nigeria. A Paper presented at Conference of International Research for Development held at Witzen House between 9th and 10th October, 2002.

United States of America Department of Agriculture (2013). Farm Household Income Online http://www.ers.usda.gov/topics/farm-economy/farm-household-well-being/farm-household-income.aspx#household