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# Economic Analysis of Land Management Practices in the Guinea Savannah Agro-ecological Zone of Nigeria: the case of Arable Crop Farmers in Benue State

**Agboola W. L.**
*Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria*
agboolawl@gmail.com

## Abstract
The study assessed the economic analysis of land management practices in Guinea Savannah Agro-ecological Zone of Nigeria: the case of arable crop farmers in Benue State. Data was collected from 175 arable crop farmers using multistage sampling technique and analyzed with descriptive statistics, budgetary technique and profitability index. The results showed that farmers were distributed across seven different land management practices that were prevalent in the area. These were application of organic manure, bush fallowing, crop rotation, application of inorganic fertilizer, alley cropping, cover cropping and mulching. Budgetary technique showed that Gross Margin was highest (N1,173,382.48) in the case of application of inorganic fertilizer while it was lowest (N 472,638.86) in the case of bush fallowing. Return per naira outlay was found to be highest (3.50) in the case of alley cropping while it was lowest in the case of bush fallowing (2.39). The study therefore recommends a labor saving device such as alley cropping and provision of subsidy on inorganic fertilizer.

**Keywords:** Land Management Practices (LMP); Arable Crop Farmers; Guinea Savannah Agro-ecological Zone, Gross Margin

## Introduction
The economy of every nation is connected to the land use either directly or indirectly. This statement holds true for Nigeria where at least 70 percent of the working population is dependent upon agriculture for their means of sustenance (Ayodele *et al.*, 2012). The utilization of land involves a complexity of interaction among such variables such as population, land tenure system, the state of technology, the stage of a country's development, and even the varying proportions in the taste of the country. However, its sustainable use is highly affected (among other factors) by bio-physical and institutional aspects of land (Teshome *et al*., 2016).

Today, a growing concern about the ecological damage caused by poor land management techniques is generating new interests in sustainable agriculture in which soil nutrient cycling plays a central role (Foster and Magdoff,2000; Millennium Ecosystem Assessment, 2007). Estimate of environmental disasters shows that 1.5 billion people with 2 billion hectares of land were affected worldwide (Babalola and Olayemi, 2014) while 5–8 million hectares of formerly productive land goes out of cultivation due to degradation (Lal *et al.,* 2012). In Sub-Saharan Africa, the problem is responsible for low agricultural productivity (Nakhumwa and Hassan, 2012), where 17 percent 494.2 million hectares) of land were affected with an annual monetary value of loss production as a result of the problem amounting to $65million (Ezeaku and Davidson, 2008). In Nigeria, about 400,000 hectares of forest land is lost to deforestation (Thisday newspaper, 2015). Thus, soil degradation is a serious threat to Nigerian environment and by extension the economy.

Over the years, Nigeria has devoted large hectares of land to the cultivation of arable crops. However, productivity has remained low, a phenomenon that has entangled the farmers in a vicious cycle of poverty. Among factors responsible for the low productivity of these farmers are, the use of obsolete cultural practices, scanty plant stands, poor weed control, non-usage of inorganic fertilizer, organic manures and other improved agricultural inputs including the management of the crop under degraded soil condition, (FAO 2003). The earth has about 7.86 billion acres of land potentially suitable for agriculture, half of which has been put into use (Schiller 1980). To boost agricultural production, there are two possibilities of either bringing the rest of the land into cultivation or by increasing the output per acre. If the first option is to be heeded, there is imminent trouble staring at the human populace because a time shall come when there could be no more land to farm. Therefore, the importance of land management in agriculture cannot be over emphasized. Widely claimed, it is one of the most critical challenges facing agricultural development and food security in the sub Saharan African (SSA). Also, agricultural growth in the midst of population and socio-economic pressures has led to land degradation and soil nutrient depletion, which have become a major constraint to agricultural productivity in northern Nigeria (Akinola *et al*., 2011).

Tunde *et al*., (2015) examined economic analysis of fish farming in Saki-East Local Government Area (LGA) of Oyo State, Nigeria. Structured questionnaire was administered to randomly selected respondents in the study area. Data collected were analyzed using descriptive statistics, costs and budgetary analysis and multiple regression analysis. The result of a Cost and Return Analysis showed a total revenue of N244364.30 per cycle, while total cost was N129379.52 per cycle. This implies that fish farming was profitable and is expected to continue to operate. In addition, Benefit Cost Ratio (BCR) was 1.9, fish farming was therefore considered to be profitable. The rate of Return on Investment was 0.8887, meaning, for every N1 invested; there will be a return of 88.8.

Tesfaye *et al*., (2016) in assessing the costs and benefits of improved land management practices in three watershed areas of Ethiopia, used survey data collected from 750 farm households. A production function was estimated to quantify the costs and benefits of more sustainable land use management practices. Result shows that the soil conservation measures significantly increase productivity and hence food security. Comparing the costs and benefits, the results indicates that implementing soil conservation measures would benefit farm communities in the case study areas through increased grain productivity and food security.

Against this background, it then became necessary to address the following specific objectives of the study; to identify the land management practices that were predominant among arable crop farmers in the study area and assessing the cost and returns to the farmers associated with each of the land management practices.

## Materials and Methods

*The Study Area*

The study was carried out in Benue State Nigeria. The state lies in the middle of the country with 23 local government areas and

shares boundaries with Nasarawa to the north, Taraba to the east, Cross River to the south, Enugu, Ebonyi to the southeast, Kogi to the west and republic of Cameroon to the southeast. The state occupies a landmass of 33,955sq.km with a population of (4,253,641) according to 2006 census. The state enjoys a tropical climate, which manifests into two distinct seasons; the wet season, which begins in April and ends in October and dry season from November to March. Annual rainfall varies from 1750mm in the southern part to 1250mm in the northern part, while annual temperature ranges between $32^0$c to $38^0$c. Farming is the major occupation of the people of the state. Main crops produced include yam, rice, cassava, soya beans, groundnut, sweet potatoes, millet and guinea corn with tree crops like mangoes, citrus/orange, pawpaw and pineapple. Major ethnic groups and tribes are Tiv and idoma: others include Igede, Etulo, Jukun, Hausa, Akweya and Nyifon.

**Method of Sampling**

The study population comprised arable crop farmers in Benue State. A multistage sampling technique was used in the study. The first stage was the random selection of four local government areas (Buruku, Oju, Otukpo, Ushongo) from the state, the second stage was the random selection of twelve communities/villages from the state, with the number of communities/ villages selected from each local government proportionate to the number of communities/villages in each local government area. The third and the last stage was the proportionate selection of the farmers from the selected villages/ communities. A total of 200 copies of the questionnaire were administered with only 175 returned with useful information that was to be used for the analysis as shown in Table 1. Using a well-structured questionnaire, data were collected on the socio-economic characteristics of the farmers, plot levels including land tenure, farm size, cropping patterns, crop production, land management practices, crop output quantity and their prices, input used and their prices access to nutrient enhancing inputs, access to extension services, non-farm income and the value of livestock owned.

**Method of Data Analyses**

*Gross Margin Analysis (Budgetary Technique)*

Budgetary technique was used to estimate cost and returns with regards to arable crop production in the study area. The specific types of budgetary technique used were the gross margin analysis and the net farm income. According to Alimi and Manyong (2000), a budget is a quantitative expression of total farm plan summarizing the income, costs and profit (a residue of total cost from total revenue). Revenue was computed as the monetary value of the total farm output sold or consumed by the farmer's household, given out as gifts or used for other purposes. Costs and returns were computed on per hectare basis. Variable costs which changed with the level of production include; labour cost, cost of planting materials, cost of inorganic fertilizer, cost of agrochemicals and others. Fixed costs which do not vary with the level of production, include cost of depreciation of assets (which was determined using the straight line method, with no salvage value at the end of useful life for items like sprayers, hoes, cutlasses, files, watering cans etc.) and rentage on land. This variable

represented the amount farmers would have paid for land (if they did not own it) and interest on loan (which represents the interest paid by farmers on formal loans). The budgetary technique was used to evaluate levels of profitability of the enterprise by estimating the revenue, gross margin and net farm income at the end of the production process. The difference between the two parameters is a measure of net profit or return in arable crop production. The following were computed for each category of arable crop farmers:

i) Gross Revenue (GR): GR = P × Y
where: P = Output Price and Y = Output Quantity,
ii) Gross Margin (GM): GM = GR - TVC
where: GM = Gross Margin, TVC = Total Variable Costs and GR = Gross Revenue,
iii) Net Farm Income (NFI) = GM - Total Fixed Cost (TFC) or GR – TC
iv) Operating Expense Ratio = TVC/GR
v) Net Farm Income Ratio = NFI/GM
vi) Return/Naira Outlay = NFI/TC
where: TC = TVC + TFC and TC = Total Cost.
vii) Fixed Costs were arrived at by depreciating the fixed assets using the straight line method.

Fixed costs were depreciated using straight line method represented as $\frac{V-S}{N}$
where
V= Original value of fixed input
S= Salvage value
N= No of economically useful life

**Results and Discussion**

*Description of Farmers' Specific Land Management Practices in the Study Area:*

Land Management Practices in the study area are seven and they include organic manure application, bush fallowing, crop rotation, inorganic fertilizer application, alley cropping, cover cropping, and mulching. Farming households in the study area which were interviewed on their choice of the specific LMP for crop production cut across the seven (Table 2).

Although multiple responses were given, farmers were classified based on the type of land management practices most frequently used as indicated in the questionnaire(Table 2). Classification under a particular land management practice does not imply that farmers were exclusively looking for a single practice to use but rather a combination of practices with various degree of preference for one over the other. As shown in the table; inorganic fertilizer application ranked highest as 18.9% of the sampled households used it. This could be attributed to the e-wallet programme which gives farmers access to the input at a highly subsidised rate and its ability to sustain crop yield and retain soil fertility. Next to this is crop rotation (15.4%), which became popular because it has no residual effect on crop; it is also a biological method of pest and disease control. After this is mulching which accounted for 14.9%, it helps to suppress weed and retain soil-water. Some 13.7% of the sampled households used organic manure, which farmers obtained from cow dung and that of other animal manure; this helps in soil fertility retention and sustains crop yield. Next to this is alley cropping (13.0%) which has no residual effect on crop. Bush fallowing accounted for 12.6%; this is a practice which is becoming less popular due to population pressure. Cover cropping which accounted for 11.01% was the least practiced among the sampled households.

**Table 1: Sampling Procedure for the Selection of Farmers**

| States | LGAs | Communities | Number of questionnaire administered | Number of questionnaire retrieved |
|---|---|---|---|---|
| Benue | Buruku | Abwa, Biliji, Mbats aase and Mbaya | 66 | 57 |
| | Oju | ObotuOroru-Ainu, Okpoma Ainu, Oyinyi Iye che and Uchuo | 66 | 59 |
| | Otukpo | Otukpoicho and Okete | 34 | 29 |
| | Ushongo | Sati Ikov and Bilaja Ikom | 34 | 30 |

Source: Field Survey

**Table 2: Farmers' Specific Land Management Techniques**

| Land management Practices | Frequency | % |
|---|---|---|
| Organic Manure | 24 | 13.7 |
| Bush Fallowing | 22 | 12.6 |
| Crop Rotation | 27 | 15.4 |
| Inorganic Fertilizer | 33 | 18.9 |
| Alley Cropping | 23 | 13.0 |
| Cover Cropping | 20 | 11.5 |
| Mulching | 26 | 14.9 |
| Total | 175 | 100 |

Source: Field Survey

*Gross Margin Realized from Arable Crop Farmers in the Study Area:*

This section presents the costs and returns of arable crop farmers based on the land management practices they used. In any production process, costs are incurred and income or returns are generated from the sale of outputs. In the African context, the income or returns could be in cash or non-cash. Table 3 presents the summary statistics of the costs and returns profile of arable crop farmers in Benue State based on the LMP used.

For any entrepreneur in the agricultural sector to make any meaningful progress in what he/she embarks upon, certain indicators have to be observed to show the performance either in terms of success or otherwise of the venture. Therefore, Gross Margin/Net Farm Income was used to analyze the data collected on costs and returns among arable crop farmers in the study area following Ohen and Ajah (2015);Tunde *et al*., (2015); Zekeri and Mukhtar(2015). The table shows an average total cost of N 230, 332.41. This was found to be highest among the users of inorganic fertilizer (N 337, 218.41) and lowest among the users of cover cropping (N153,960.73). The highest total cost in respect of users of inorganic fertilizer could be attributed to the fact that farmers under this category cultivated large farms. Also, the cost of procuring the inputs as well as its

**Table 3: Descriptive Statistical Analysis of Gross Margin Realized from Food Crop Farmers in Benue State**

| Cost items | Organic Manure n=24 | Bush Fallowing n=22 | Crop Rotation n=27 | Inorganic Fertilizer n=33 | Alley Cropping n=23 | Cover Cropping n=20 | Mulching n=28 | Pooled n=175 |
|---|---|---|---|---|---|---|---|---|
| **Variable costs** | | | | | | | | |
| **Labour cost** | 127,817.08 (54.9) | 117,846.64 (61.5) | 128,425.58 (57.8) | 210,095.42 (68.9) | 123,420.07 (64.4) | 92,923.95 (60.4) | 147,029.80 (61.9) | 138,454.98 (60.1) |
| **Cost of planting materials** | 35,740.90 (15.4) | 25,637.50 (13.4) | 30,697.91 (13.8) | 42,324.19 (12.6) | 16,757.14 (8.7) | 18,816.66 (12.2) | 43,262.00 (18.2) | 31,801.24 (13.8) |
| **Cost of inorganic fertilizer** | 31,340.91 (13.5) | 25,250.00 (13.2) | 22,762 (10.2) | 32,416.13 (9.6) | 25,861.90 (13.5) | 16,972.22 (11.0) | 17,462.50 (7.4) | 25,069.25 (10.9) |
| **Cost of agrochemicals** | 12,313.65 (5.30 | 7,795.00 (4.1) | 13,110.00 5.9) | 17,456.45 5.2) | 8,881.25 (4.6) | 8,294.44 (5.4) | 11,210.41 (4.7) | 11,749.53 (5.1) |
| **Other variable costs** | 4,000.00 (1.7) | 2,175.00 (1.1) | 1,500.00 (0.7) | 2,658.33 (0.7) | 2,500.00 (1.3) | 1957.14 (1.3) | 1,500.00 (0.6) | 2,312.12 (1.0) |
| **Total Variable Costs(TVC)** | 211,212.52 (90.8) | 178,704.14 (93.3) | 196,495.49 (88.4) | 304,950.52 (90.4) | 177,420.36 (92.5) | 138,964.41 (90.3) | 220,464.71 (92.9) | 209,387.12 (90.9) |
| **Fixed costs** | | | | | | | | |
| **Cost of depreciation** | 6,810.76 (2.9) | 6,139.98 (3.2) | 10,909.10 (4.9) | 8,361.98 (2.5) | 6,729.21 (3.5) | 5,162.99 (3.4) | 6,283.66 (2.6) | 7,389.07 (3.2) |
| **Rent** | 2,395.00 (1.0) | 2,375.00 (1.2) | 2,528.00 (1.1) | 4,822.58 (1.4) | 3,238.09 (1.7) | 3,833.33 (2.5) | 2,480.00 (1.0) | 3,142.89 (1.4) |
| **Interest on loan** | 12,228.57 (5.3) | 4,357.14 (2.3) | 12,290.83 (5.5) | 19,083.33 (5.7) | 4,400.00 (2.3) | 6,000.00 (3.9) | 7,944.44 (3.3) | 10,413.33 (4.5) |
| **Total Fixed Costs(TFC)** | 21,434.33 (9.2) | 12,872.12 (6.7) | 25,727.93 (11.6) | 32,267.89 (9.6) | 14,367.30 (7.5) | 14,996.32 (9.7) | 16,708.1 (7.0) | 20,945.29 (9.1) |
| **Total Cost(TC)** | 232,646.85 | 191,576.26 | 222,223.42 | 337,218.41 | 191,787.66 | 153,960.73 | 237,172.81 | 230,332.41 |
| **Revenue** | | | | | | | | |
| **Cassava** | 115,877 | 122,966 | 129,038 | 140,308 | 127,433 | 73,833 | 116,000 | 117,922.14 |
| **Yam** | 403,544 | 284,977 | 430,743 | 544,936 | 302,679 | 224,000 | 570,325 | 472,305.71 |
| **Maize** | 50,400 | 70,000 | 50,500 | 80,000 | 70,000 | 49,333 | 43,600 | 59,119 |
| **Groundnut** | 156,000 | 53,400 | 85,000 | 180,000 | | 130,500 | 84,320 | 114,870 |
| **Rice** | 100,285 | 120,000 | 147,714 | 239,089 | 283,375 | | 70,000 | 160,077.16 |
| **Soybean** | 80,000 | | | 114,000 | 80,000 | 161,500 | | 108.875 |
| **Sorghum** | | | | | | | | |
| **Millet** | | | | 180,000 | | | | 180.000 |
| **Vegetables** | 2,651.13 | | | | | | | 2,651.13 |
| **Total Revenue** | 836,757.13 | 651,343 | 842,995 | 1,478,333 | 863,487 | 639,166 | 884,245 | 1,215,820.14 |
| **Gross Margin (GM=TR-TVC)** | 625,544.61 | 472,638.86 | 646,499.51 | 1,173,382.48 | 686,066.64 | 500,201.59 | 663,780.29 | 1,006,433.02 |
| **Net Farm Income (GM-TFC)** | 604,110.28 | 459,766.74 | 620,771.58 | 1,141,114.59 | 671,699.34 | 485,205.27 | 647,072.19 | 985,487.73 |

**Source: Field Survey** **Values in parenthesis represent the percentage**

associated cost of transporting a bag which was found to be between N 340 and N350 in line with (Liverpool-Tasie*et al*., 2016) could account for this while the lowest total cost in respect of cover cropping could be attributed to the fact that cover crops help to suppress weeds, enabling the farmers save money that would have been used on weeding. Also, some cover crops have the ability to trap atmospheric nitrogen, thereby cutting down the amount that would have been spent on nitrogen fertilizer (Agboola, 2016).

Among the variable cost components, labour cost ranked the highest as it constituted 60.1% of the total cost components in the pooled result while it constituted 54.9% and 68.9% for organic manure and inorganic fertilizer, respectively. The highest value in the case of labour cost is in agreement with the findings of Adisa and Sofoluwe (2013). Next was the cost of planting materials which constituted between 8.7% and 18.2% under the different land management

practices, but it was 13.8% in the pooled result. The cost of inorganic fertilizer was between 7.4% to 13.5% under the different land management practices but it was 10.9% in the pooled result. Following this was the cost of agrochemicals which was found to be 5.1% in the pooled result but varied between 4.1% and 5.9% under the different land management practices. Other variable costs were found to be 1.0%. Total variable costs were found to be 90.9% of the total cost components, which implies that it accounted for a larger chunk of the total costs. This implies that whoever wants to be cost efficient have to reduce total variable cost, especially the cost of labour (Zekeri and Mukhtar 2015).

Fixed cost components were cost of depreciation of assets (3.2%), rentage on land (1.4%) and interest on loan (4.5%) which constituted 9.1% of the total cost components. Profitability index (Table 4)shows an average gross margin per hectare of (N 1,006,433.02), the highest in the case of inorganic fertilizer (N1,173,382.48) and lowest in the case of bush fallowing (N472,638.86); the average net farm income was N985,487.73).This implies that small-scale arable crop farming in the study area is profitable although the full potential of the enterprise is yet to be maximized.

Profitability analysis ratio shows that operating expenses ratio of 0.17 in the pooled result indicates that 17% of the gross revenue was used as operating expenses. A ratio less than 1 is always desirable for any farm business. The lower the ratio, the higher the returns on naira invested (Olukosi and Erhabo, 2004). A net income ratio of 0.98 implies that 98% of the gross revenue goes to the farmers equity while the benefit cost ratio of 4.28 indicates that for every N1.00 spent, the farmers realizes N4.28 in returns. Arable crop farming in Benue State seems highly feasible since benefit cost ratio recorded a value of 4.28, this is in line with Tunde *et al*., (2015).Profitability indicators show that arable crop farming is profitable in the state.

## Conclusion and Recommendations

Classification under a particular land management practice does not imply that farmers were exclusively looking for a single practice; they were rather looking for integrated land management techniques with a different intensity of preferences. Therefore, categorisation was based on which of the techniques farmers had the highest preference for. Arable crop production is a very lucrative and profitable enterprise in the study area. Hence, apart from being able to make the farming households food secured, it offers great opportunity for people to be gainfully employed in the face of rising unemployment challenges. This is as

**Table 4 : Profitability Measures of Arable Crop Farming Household Heads in Benue State**

| Profitability Ratios | Organic Manure | Bush Fallowing | Crop Rotation | Inorganic Fertilizer | Alley Cropping | Cover Cropping | Mulching | Pooled |
|---|---|---|---|---|---|---|---|---|
| Operating Expenses Ratio | 0.25 | 0.27 | 0.88 | 0.21 | 0.21 | 0.22 | 0.25 | 0.17 |
| Net Farm Income Ratio | 0.96 | 0.97 | 0.96 | 0.97 | 0.98 | 0.97 | 0.97 | 0.98 |
| Return/ Naira Outlay | 2.59 | 2.39 | 2.79 | 3.38 | 3.50 | 3.15 | 2.73 | 4.28 |

**Source: Field Survey**

shown in the budgetary analysis which varies across the different land management practices, it was found to be highest in the case of inorganic fertilizer application and lowest in the case of bush fallowing. Profitability index shows the returns per naira outlay was found to be highest in the case of alley cropping.

From the study, the following recommendations were made:

The highest value of gross margin and net farm income was recorded due to application of inorganic fertilizer, government should therefore make the input available at the right time and at a highly subsidized rate.

Alley cropping should be encouraged as it recorded the highest return per naira outlay in response to the world's advocate on organic farming.

Empowerment programme or poverty alleviation programme in the area should incorporate agriculture and most especially arable crop production for its profitability.

Labour cost saving device should be looked into as this constituted the highest in the variable cost component.

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