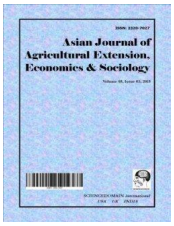

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Comparative Economic Analysis of Soil Fertility Management on Cassava Based Intercropping Systems in Oredo Local Government Area of Edo State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study was carried out in Oredo Local Government Area of Edo State, Nigeria. The broad objective was to determine the comparative economic analysis of soil fertility management options on cassava based cropping/intercropping systems. Data were obtained from both primary and secondary sources, primarily data was obtained through questionnaire distributed to eighty (80) randomly sampled farmers from the study area. Economic analysis was carried out using statistical tools such as descriptive statistics which included frequency tables, percentages, means, pie charts, bar column chart etc. which was used to determine the cost and returns of both soil fertility management options. It was also necessary to test the hypothesis of the study which was tested using the Z-Test analysis due to the sample size. The result showed that higher profit was obtained

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from inorganic fertilizer by those farmers that made use of them in which they had a gross margin (profit) of N118, 400 when compared to those farmers that made use of organic fertilizer, having a gross margin of N60, 900. However, the result from the gross margin analysis as well as the hypothesis of the study shows that the farmers stand to gain more if they use either of the soil fertility management options on their farms. Also, considering the problem of scarcity and effect often associated with inorganic fertilizer, the choice of organic fertilizer is more likely to be accepted by the farmers. Possible recommendations were also made in the course of the study which includes, transformation of farming practices through technology that would stabilize yield and reduce unpredictable variations, farmers should be encouraged to use either of the soil fertility management options to increase their yield. Organic fertilizer should be made affordable to farmer and inorganic fertilizer should be made accessible.

Keywords: Cassava; intercropping; soil fertility; management.

1. INTRODUCTION

Soil fertility in Nigeria is under depletion, and it is the main bio physical factor limiting crop production in Nigeria. Interests has been raised in using data from past fertilizer studies to identify options for increased agricultural production through increased soil fertility management. This research further shows the comparative analysis between organic and inorganic fertilizers based on their cost, environmental effect, accessibility and availability. The broad objectives of this study was to do an economic evaluation of soil fertility management options on cassava based cropping system in Oredo Local Government Area of Edo State .The specific objectives were to ; determine the socioeconomic characteristics of farmers based on intercropping system in the area, assess the different cassava based cropping systems in the area ,ascertain the soil fertility management options open to farmers ,determine the cost and returns of external inputs and natural techniques of soil fertility management in the cropping system ,identify the constraints associated with the different soil fertility management options on cassava production output. On the contrary, soil fertility is not a static feature, it changes constantly and its direction is determined by the interplay between physical, chemical, biological and anthropogenic processes. This dimension is also reflected in such terminological and anthropogenic processes. This dimension is also reflected in such terminologies like nutrient cycle, budget or balances, referring to inputs and outputs in natural ecosystem and managed agro-ecosystem to which nutrients are removed.

The average Nigerian meets about 95 percent of the minimum energy requirement mainly from cereals, roots and tubers, followed by grain legumes.

Cassava food crops are the most important staple crop of rural and urban households in southern Nigeria. Current estimates shows that dietary calorie equivalent of per capital consumption of cassava in the consumption of cassava in the country amounts to about 238 cal. [1]. The cassava tuber can supply much of the calories for human nutrition [2].

This is derived from the consumption of garri (toasted granules), chips, flour, fermented pastes and or fresh roots, the principal cassava food forms.

Cassava being one of the Base Crop in Nigeria is a very important crop to both the rural and urban dwellers in Oredo Local government Area of Edo State, its comparative production over other staple food crops encouraged its cultivation even by the resource poor farmers. It is usually grown by small holder farmers of the study area with less or low fertile soils and unpredictable rainfall. The need to create security against potential risk of monoculture has become one of the reasons for intercropping [3]. Increasing diversity on farm also reduces costs of pest control and fertilizer because these costs can be spread out over several crop or animal enterprises [4]. The small holder farmers are exposed so much to vagaries of weather with risk tendencies in their production [5]. Cassava serves as a leading staple food for over eighty million people living in the rural and urban areas. It is also the third most important food crop grown in the South South region of Nigeria which is used for human consumption, animal feed or for industrial purposes. In 2004, the estimated cassava output from Nigeria was approximately 34 million tons which have rated Nigeria as the largest producer of cassava. It is mainly intercropped with maize or melon in the Study area.In a field where cassava is grown in combination with yam and other crops, yam becomes the main crop, but

where there is no yam, cassava becomes the main crop. Cassava, maize, melon intercrop is the most popular interplanting pattern in Southern Nigeria [6]. When intercropped with cereals, it takes care of nutrient loss through leaching, run off, or erosion. Therefore cassava producing farmers need to apply the required quantity of fertilizer (organic and inorganic) depending on soil test to replace nutrient loss or depletion by harvested parts.

The use of much organic or inorganic fertilizer can be expressed properly in terms known as external and internal input farmers. The external input farmers include those farmers that make use of inorganic fertilizer and minerals that can promote soil fertility depletion and increase soil nutrient. While the internal input farmers usually make use of organic fertilizer such as animal manure, crop residue etc. which in most cases does not supply sufficient and adequate nutrient to the soil but improves the soil structure and texture for effective plant growth. The fact that farmers do not supply or apply sufficient fertilizer and do not use soil conservation practices when the cassava crop is grown is more of socio economic problem than a technical problem.

It is necessary to develop simple practice that are suitable to the local situation or environment that can provide short term benefit to the cassava farmers as well as long term benefit in resource conservation practice.

The above trend of low fertilizer use and poor soil conservation continue unabated because successive individuals and Nigerian Government have not done enough to enable increase in cassava production with sustainable cropping practices.

2. METHODS

The study was conducted in Oredo Local Government Area of Edo State. It is one of the eighteen Local Government Areas that made up Edo State. The climate of the study area is humid tropical and it is characterized by two distinct seasons known as the wet and dry season. Its soil type is ferrosol or loose sandy sediment. Some part have a deep well drained soil with moist warm climate. Oredo L.G.A is predominantly a cassava growing area. The agricultural fertile land, relatively flat terrain, has good climatic and edaphic factors which favour the production of cassava and a wide range of other crops. About 150 registered farmers were used as the sample frame. Random techniques were employed to select the respondents of the study Area. The first stage was the random selection of eight wards out of fifteen in the study area. The second stage was the random selection of ten cassava based intercropping farmers from eight wards out of fifteen in the study area. The second stage was the random selection of ten cassava based intercropping farmers from eight wards earlier stated which gave a total of eighty farmers (respondents). These farmers made use of different fertilizer treatment (organic and inorganic fertilizer) on their farms. The essence was to give the farmers equal chances of being selected. Primary and secondary data were used. The primary data were collected through structured interview and questionnaire. The data were in socio economic characteristics, production inputs, cost, returns and constraints while secondary data were from literature of previous work. Analysis of the data was done using descriptive statistics, gross margin analysis and production function analysis. Objective I, II, III were achieved using descriptive statistics, such as percentages, frequency distribution, column and pie charts. The gross margin analysis was employed to determine the profitability of the use of different fertilizer treatment on cassava based intercropping system. This was used to analyze objective IV. It was calculated as the deference between the farm total returns or revenue and the total variable cost [7]. Mathematically it is expressed as

$$GM = TR - TVC \quad (1)$$

GM = Gross Margin ₦/ha
TR= Total revenue ₦/ha
Percentage (%) n/N X 100%

The Z – test at 5% level of significance was used to test the hypothesis HO: There is a significant difference between organic and inorganic fertilizer management techniques in cassava based intercropping system in Oredo Local Government Area.

Since it' s a two tail test, it can be mathematically expressed as

$$H_O: \bar{X}_1 = \bar{X}_2 \quad \text{or} \quad \bar{X}_1 - \bar{X}_2 = 0 \quad (2)$$

$$H_A: \bar{X}_1 \neq \bar{X}_2 \quad \text{or} \quad \bar{X}_1 - \bar{X}_2 = 0 \quad (3)$$

Where $\bar{X}_1$= Cost input for inorganic fertilizer $\bar{X}_2$ = cost input for organic fertilizer

Since Z-test due to its sample size which is greater than 30 (N >30),

$$Z\ Cal = \frac{\bar{X} - \bar{X}}{\frac{\sqrt{0^2 + 02}}{n1 \quad n2}} \quad (4)$$

Where
X_1 = Mean of inorganic/internal input
X_2 = mean of organic/internal input
0^2_1 = variance of external input
0^2_2 = variance of internal input (40)
ni = sample size of external input (40)

$$X_1 = \frac{\sum X\,1}{N1} \qquad X_2 = \frac{\sum X\,2}{n2} \quad (5)$$

3. RESULTS AND DISCUSSION

Gross margin of cassava or from cassava production: from the objective earlier stated which determined the cost and return of external input (inorganic fertilizer) soil fertility management and natural techniques (organic fertilizer) of soil fertility management in and external inorganic) with reference or in terms of profitability from both input techniques of soil fertility management.

To get the profitability (gross margin) of both inputs of soil fertility management to attain maximum or optimum output to cassava, there is need to get total variable cost of production of cassava and the total revenue generated from cassava output and this can be illustrated as the total variable cost of cassava production. This can be mathematically expressed as

$$Gm = TR\text{-}TVC \quad (6)$$

Where

Gm = Gross margin
Tr = Total revenue
Tvc = Total Variable Cost
Net profit = Total Revenue – Total cost
We determine these variables with the use of the Table 1.

Table 1. Distribution table assessing the cost of fixed assets used by the farmers or respondent in the study area

Implement	Useful life (yrs)	Unit	Cost (₦)	Total value (₦)
Hoe	3	15	400	6,000
Matchet	3	20	500	10,000
Spade	2	5	1300	6,500
Wheel barrow	5	2	6,000	12,000
Total				34,500

Source: Field Survey, 2014

Table 2. High internal input option (organic/natural technique)

Input(s)	Unit/quantity	Price/Unit (₦)	Total value (₦)
Land (rent)	1ha	30,000	30,000
Labor (hired)	4	1,000	4,000
Labor (family)	3	300	900
Land preparation		55,000	5000
Planting		4,000	4,000
Organic fertilizer application	3 bags	5,000	15,000
Weeding (by hired labor)	4	300	1,200
Harvesting (by hired labor)	4	2,000	8,000
Total variable cost			68100

Table 3. For revenue

Output(s)	Unit/quantity	Price/Unit (₦)	Total value (₦)
Cassava tubers	50 bags of10kg	1,500	75,000
Cassava sticks	6 5sacks of3kg	400	26,000
Others		28,000	28,000
Total Revenue		55,000	129,000

Source: Field Survey 2014

Table 4. High external input option (inorganic/artificial tech.) for variable cost

Input(s)	Unit/quantity	Price/Unit (₦)	Total value (₦)
Land (rent)	1ha	30,000	30,000
Labor (hired)	7	3000	4,000
Land preparation		5,000	5000
Tractorization		25,000	4,000
planting		4,000	15,000
Chemical fertiizer application	3 bags	3000	9,000
Weeding (by hired labor)	7	300	8,000
harvesting (by hired labor)	7	2,000	
Others			
Total variable cost			91,200

Table 5. For revenue

Output(s)	Unit/quantity	Price/Unit (₦)	Total value (₦)
Cassava tubers	85 bagsof10kg	1,500	127,500
Cassava sticks	107 sacksof 3kg	300	32,100
Others		50,000	50,000
Total Revenue			209,600

Source: Field Survey 2014

From the table given above, gross margin for both input (external/inorganic and internal/ organic) in soil fertility management options on cassava based intercropping system in the study area, can be calculated as:

FOR INTERNAL/ORGANIC INPUT

$$GM = TR - TVC \quad (7)$$

GM = ?
TR = ₦129,000, TVC = ₦ 68,100
TFC = ₦ 34,500 (constant for both input)

Therefore,
GM = ₦ (129,900 – 68,100)
= ₦ 60,900

Net profit for internal input or inorganic input

NP = TR – TC =>129,000 – 34,500 + 68, 100
NP = ₦ 26,400

FOR EXTERNAL (INORGANIC INPUT)

$$GM = TR - TVC \quad (8)$$

GM=?
TR = ₦ 114,500, TVC = ₦ 91,200
Therefore,
GM = ₦(209,600 – 91,200)
₦118,400

Net profit for external input or inorganic input

NP = TR – TC => 209,600 – 34,500 + 91,200
NP = ₦ 83,900.

4. CONCLUSION

By way of conclusion, cassava based intercropping system in the study area is very

bright but needs the assistance of the government in mechanization to reduce drudgery. Tractor hiring should be made affordable and accessible. Improved crop varieties especially cassava should be provided. Modern farming practices should be extended to farmers through Extension agents. Farmers should be encouraged on the optional use of input to increase yield while sustaining the natural resource base of the soil. The farmers in the study area should be provided with the fertilizer especially organic at a lower cost. Comparison on organic and inorganic nutrient source shows that organic fertilizer effect on crops and soil is more beneficial both in quality, quantity and sustainability when compared to inorganic inputs. Government and other policy makers on agriculture should be sensitized on the need to assist the farmers in achieving sustainable techniques in land management. Inorganic input which is also preferred by some farmers irrespective of its effects on the soil should also be made easily accessible.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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