COMPARATIVE ANALYSIS OF THE USE OF ORGANIC AND INORGANIC FERTILIZERS BY YAM FARMERS IN SHIRORO LOCAL GOVERNMENT AREA OF NIGER STATE, NIGERIA

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ABSTRACT

The main objective of the study was to comparatively analyze the use of organic and inorganic fertilizers among yam farmers. The specific objectives were to determine farmers preference for the use of organic and inorganic fertilizers, their average yam yields per hectare and the annual income realized from the sales of yam. It also included the examination of various factors militating against the use of both organic and inorganic fertilizers. The study was conducted in Shiroro Local Government Area of Niger State, Nigeria .The methodology involved a stepwise random sampling of 10 wards, 19 villages and purposive sampling of 131 yam farmers. Primary data were collected with the aid of an interview schedule that was validated by experts and tested for reliability using test- retest method (r = 0.83). Descriptive and inferential statistics were used to analyze data collected for the study. Hypotheses were tested at 5% significance level. Results showed that 40.5% and 59.5% of the farmers preferred the use of organic and inorganic fertilizers, respectively. There was no significant difference between annual yam yields per hectare, using organic and inorganic fertilizers. However, the study confirmed a significant difference between the income realized from sales of yam by the farmers. This might be connected to different marketing strategies being adopted by the farmers. It is recommended that Extension Agents (EAs) should encourage farmers to adopt the use of organic fertilizers with a view to complementing the use of inorganic fertilizers which were considered very expensive and not readily available .

KEY WORDS: Organic fertilizer, inorganic fertilizer, yield, income, soil nutrients and yam

INTRODUCTION

Yam is a tuber crop which is widely cultivated in the humid and sub-humid lowland regions of West Africa and the Caribbean, with more than 90 percent of the worldwide production being produced in West Africa (Onwueme and Havekard,1991). In coastal West Africa, more than 60 million people obtain over 200 dietary calories per day from yam (Chukwu

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and Ikwelle, 2000). Yam is grown in traditional cropping system as the first crop after virgin forest or after a long period of fallow yielding about 10 tons of fresh tubers per hectare per year (Carsky, *et al*., 2001.). The potential yield of one of the most important species, *Dioscorea alata*, is estimated between 60 and 75 tons per hectare per year (Zinsou, 1998).

The major root and tuber crops such as cassava, yam, potato and sweet potato play a significant role in the global food system. They adapt to a wide range of uses, food security, regular food crop and raw materials for industrial uses. Indeed, cassava, yam, potato and sweet potato ranked among the top ten food crops produced in developing countries (Gregory *et al*., 2001). Food requirement for ever increasing world population which now stands at 5.5 billion people and will increase to 9 billion people by the year 2030, especially in developing countries, can be satisfied only through application of science and technologies, including rational use of fertilizers (Christian, 1996).To meet the challenges of food scarcity for both present and future generations, to conserve natural resources and to protect the environment, it is important that agricultural production be conducted within the overall framework of sustainable development. An important aspect of this, is the maintenance, improvement and enhancement of soil fertility through an appropriate application of nutrients in order to replenish the nutrients removed by the harvest of produce and to build up the nutrient status of soil that are inherently infertile or have been depleted (Christian,1996). Fertilizers add nutrients to the soil to maintain or increase plant's yield and its use reflects how indispensable they are in maintaining the world food supply (Ofori and Halin,1991). It has been estimated that 50 percent of the increase in agricultural production witnessed in the last decade in developing countries is attributed to fertilizer usage. Though the use of organic fertilizers dated back to 1927, Williams (1991) reported that there has been much controversy over organic versus inorganic fertilizers (artificial or commercial fertilizers). However, It is important to note that tiny root hairs of plants can absorb only nutrients that have been broken down into inorganic, water soluble forms and makes no difference to yam plant if the atom of nitrogen it is absorbing has come from a compost pile or a fertilizer factory.

There are advantages and disadvantages to each form of fertilizer, organic or inorganic. Organic fertilizers are made from materials derived from living things, such as animal manure (cow dung, poultry droppings etc), compost, bone meal and blood meal. Organic fertilizers are not immediately available to plants because it has to be broken down by soil micro organisms. Though they work slowly, organic fertilizer hold moisture, reduces soil erosion, improves soil structure and offers long term benefits. The inorganic fertilizers (artificial or commercial fertilizer), are made of synthetic derived from petroleum and are largely soluble. They are of different colours, depending on the nutrients it contained and the particles are of different shapes and sizes, large or small, granules, pellets, crystal, coarse fine or powder form, liquid or solid. Although, inorganic fertilizers are immediately available to plants but they are subjected to leaching when washed by rain or irrigation water down below the level of plant roots, especially nitrogen. Also, a heavy application of inorganic fertilizer can burn seedlings and young plants, in the process of drying or desiccation due to the presence of chemical salts within the commercial fertilizers. Another problem is that heavy application can build up toxic concentration of salts in the soil and

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create chemical imbalance. In case of organic fertilizer, a buildup of toxicity in the soil is unlikely to occur as long as the amount of incorporated organic materials in the soil is decomposed. In addition, some farmers complained that the use of inorganic fertilizers in yam production could reduce the storage life of such yam thereby resulting in loss of income.

Generally, the demand for fertilizer in Niger State has continued to increase, especially among the yam farmers, but the scarcity and high costs of inorganic fertilizers affect its usage. Moreover, since agricultural production is time bound, farmers are unable to access these products at the right time in the required quantity. Indeed, these constraints had made some farmers to adopt the use of organic fertilizers despite its inability to make nutrients available to plants immediately and high labour cost because of its bulky nature. In view of all these, this study aims at examining the use of organic and inorganic fertilizers among yam farmers.

Objectives of the study

The main objective of the study was to do a comparative analysis of the use of organic and inorganic fertilizers among yam farmers in Shiroro Local Government Area (LGA), Niger State. The specific objectives were to:

i. identify the socio – economic characteristics of the yam farmers in the study area ,
ii. determine the farmers preference for the use organic and inorganic fertilizers, separately;
iii. determine average annual yam yield per hectare among farmers using organic and inorganic fertilizers, separately;
iv. determine the average income realized per annum from sales of yam in the last two farming seasons among farmers using organic and inorganic fertilizers; and
v. describe factors militating against the use of fertilizers (organic or inorganic) among yam farmers.

Null hypotheses

1. There is no significant relationship between yam farmers socio – economic characteristics (level of educational attainment and age) and preference for the use of organic and inorganic fertilizers.
2. There is no significant difference between yam yield/Hectare (Ha) of farmers using organic and inorganic fertilizers.
3. There is no significant difference between the average annual income realized by yam farmers using organic and inorganic fertilizers.

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METHODOLOGY

Shiroro Local Government Area (LGA), is one of the twenty five LGAs that made up Niger State with its Headquarters located at Kuta. The local government consists of 6 districts and 15 geo-political wards. The major occupation of the people is farming especially, yam, maize, groundnuts, rice, guinea corn, benniseed and cotton production. Other occupations include fishing and hunting among others.

Stepwise random sampling technique was used to select 10 wards, 19 villages from the selected wards and a purposive sample of 131 yam farmers from the selected villages (Table 1). Primary data were collected with the aid of an interview schedule that was validated by experts and tested for reliability using Test- retest method ($r = 0.83$). Descriptive (frequency, percentages and mean) and Inferential statistics (Chi-Square and Analysis of Variance, ANOVA, were used to analyze data collected for the study. The hypotheses were tested at 5% significance level.

Measurement of variables

Farmer's preference for the use of organic and inorganic fertilizers was measured on 2-point Likert scale (Yes = 1, No = 0) with a score range of 0 – 2 points for each respondent. The mean weighted scores were subsequently calculated. Yam yield was measured by number of tons harvested per hectare of land cultivated and the average annual income was obtained by dividing total annual sales of yam for two cropping seasons by 2.

Table 1 Summary of selected wards, villages and sample size

Selected ward	Selected villages	No. of Sampled yam farmers
1.Zumba/Gussoro	Zumba	9
	Shakwodnu	8
2.Gwada/Egwa	Gwada	9
	Chiri	5
3.She	Gunu	5
	She	6
4.Galadima Kogo	Galadima Kogo	7
	Gope	9
5.Ubandoma	Kobwa	5
	Apavi	9
6.Erena	Erena	5
	Ajatai	8
7.Pina	Pina	5
8.Bangajiya	Tawalin Kuta	9
	Godna	5
9.Gurmana	Gurmana	8
	Kpaki	5
10.Kurebe/Kushaka	Kurebe	6
	Kushaka	5
	Total	131

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RESULTS AND DISCUSSION

Socio-economic characteristics of the yam farmers

The factors considered in this section include age, marital status, sex, family size and highest educational attainment. Table 2 showed that majority of the yam farmers were males and within the age group of 26 and 55 years, while few were less than 25years (6.1%) and above 55 years of age (4.6%). This suggests that young people were more involved in yam production .Moreover, majority of them were married (84%) with many of them having a family size of 1-8 (84.7%).Studies had shown that one of the most important factors affecting yam production is labour requirement. Therefore, any farmer with a large family size may likely want to increase his or her farm size because of the advantage of free family labour. This may lead to an increase in yam production and probably a corresponding demand for fertilizers to boost production. However, the standard of education of the yam farmers was poor with over one-half of them having no formal education (53.4%) and this may affect their knowledge and skills in the use of fertilizers efficiently and effectively. This is because education acquired can help farmers to understand and follow instructions carefully as directed by both the Extension Agents and the manufacturers.

Table 2 Socio-economic characteristics of yam farmers (N = 131)

Variable	Frequency	percentage
Sex		
Male	103	78.6
Female	28	21.4
Total	131	100.0
Marital status		
Married	110	84.0
Single	21	16.0
Total	131	100.0
Educational level		
Formal education	61	46.6
No formal education	70	53.4
Total	131	100.0

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Table 2. continued

Variable	Frequency	percentage
Age		
Less than 25	8	6.1
26-35	84	64.1
36-45	21	16.0
46-55	12	9.2
Above 55	6	4.6
Total	131	100.0
Family size		
Below 5	51	38.9
5-8	60	45.8
Above 8	20	15.3
Total	131	100.0

Farmer's preference for the use of organic and inorganic fertilizers

This section delved into the types of fertilizers preferred by the yam farmers as well as the different kinds of organic and inorganic fertilizers they used on their farms. Results in Table 3, therefore showed that 40.5% and 59.5% of the yam farmers preferred organic and inorganic fertilizers, respectively. This result agreed with the finding of Ofori and Halin (1991) which stated that despite the high cost of inorganic fertilizers, farmers still preferred it because productivity and income are higher when used in yam production. Also the use of organic fertilizers cannot replace the use of inorganic fertilizers even though the effects of organic fertilizers go beyond nutritional aspect by contributing and improving soil properties (Christian, 1996). Findings also showed that N.P.K and cow dung were the most frequently used inorganic and organic fertilizers respectively. The choice of cow dung may be attributed to its availability because of the activities of the Fulani herdsmen who graze their cattle around farm lands. The study further revealed that based on past experiences, most farmers recorded lower yields of yam tonnage per hectare without fertilizer application when compared with yam yields with fertilizer application. Carsky *et al.* (2001) stated that yam grown in traditional cropping after a long period of fallow without fertilizer yielded about 10 tons / hectare/year.

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Table 3:Use of fertilizers among yam farmers

Variable	Frequency	Percentage
Preference		
Organic fertilizer	53	40.5
Inorganic fertilizer	78	59.5
Total	131	100.0
Type of inorganic fertilizer commonly used	**Frequency**	**Percentage**
N.P.K.	54	69.2
S.S.P	9	11.5
Urea	15	19.3
Total	78	100.0
Type of organic fertilizer commonly used	**Frequency**	**Percentage**
Compost	7	13.2
Poultry dropping	9	17.0
Cow dung	37	69.8
Total	53	100.0

Comparative analysis of yields and sales of yam with the use of organic and inorganic fertilizers

The findings in Table 4 showed that 66% and 30.8%% of the farmers who used organic and inorganic fertilizers had a yield of less than 10 tons / ha , respectively while 18.9% and 39.7% of them had above 20 tons/ha respectively. The rest of the farmers recorded between 10 and 20 tons of yam yield/ha/ year. The finding implies that almost one-fifth (18.9%) and two-fifth (39.7%) of the farmers using organic and inorganic fertilizers recorded very high yields /hectare respectively. The cost of purchase, methods of application, timely availability and application of these fertilizers, especially in the use of inorganic fertilizers, may have serious effects on yam yield per hectare. These factors might be responsible for the low average yield of less than 10 tons/ha by almost one-third of the yam farmers using inorganic fertilizers compared with those using organic fertilizers

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reported that the application of NPK 10:10:20 mixed fertilizer at the rate of 260kg – 500kg/ha, 10cm away from the stand and 10cm deep around each stand for 2-3 months of planting increased yam yield.

Generally, yam farmers may realized reasonable income from their sales based on the period and places of sales as well as the quality and quantity of yams harvested . However, prices offered by prospective buyers may also be influenced by the law of demand and supply factors. Therefore, the practice of selling larger percentage of yam harvested at the peak of harvest by most farmers, probably due to financial pressures, inadequate storage and processing technologies may result in low prices because of high supply and low demand at these periods. Findings in Table 4 showed that the percentages of farmers who realized above eighty thousand naira (N80,000) on the average over the last two farming seasons from the sales of yam were more with those who used inorganic fertilizers than organic fertilizers.

Oluwatoyinbo *et al.* (2005) showed that acid soils cover about 17 million hectares of land (representing about 18% of total land area) in Nigeria. The Ultisols and Oxisols, particularly have problems associated with Al toxicity, low nutrient status, nutrient imbalance and multiple nutrient deficiencies (Sanchez *et al.*, 1987). Acid infertility factors limit crop growth and yield as well as soil productivity in highly weathered soils of humid and sub-humid regions of the world due to deficiency of essential nutrient elements (Akinrinde *et al.*, 2005). The challenge has been to develop sustainable agricultural systems that will reverse the soil acid infertility and consequently boost crop production in such areas.

Table4:Comparative analysis of yield and sales of yam with the use of organic and inorganic fertilizers among farmers

Variables	Yam production with organic fertilizer application	Yam production w ith inorganic fertilizer application
Annual average Yield of yam (tons/ha)	**Frequency/Percentage**	**Frequency/Percentage**
Less than 10 tons	36 (66.0%)	24 (30.8%)
10 – 20 tons	8 (15.1%)	23 (29.5%)
Above 20 tons	10 (18.9%)	31 (39.7%)
Total	53 (100.0%)	78 (100.0%)
Average annual sales of yam (N)		
Less than N40,000	11(20.8%)	5 (6.4%)
40,000 – 60,000	8(15.1%)	9 (11.5%)
61,000 – 80,000	7(13.2%)	17 (21.8%)
Above 80,000	27(50.9%)	47(60.3%)
Total	53(100.0)	78 (100.0)

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Factors limiting the use of organic and inorganic fertilizers

Several reasons were adduced by the farmers as factors militating against the use of organic and inorganic fertilizers in yam production. In the case of inorganic fertilizers, high cost and inadequate supply of the commodity were their major problems. These problems were aggravated by the activities of some unscrupulous people in the society who hoard these essential farming inputs for their selfish interest. On the other hand, high cost of labour due to the bulkiness of organic fertilizers was considered a hindrance in its usage by majority of the yam farmers (Table 5). According to Akinrinde and Okeleye (2005), crops have become so expensive to produce, that nutrient deficiencies should not be allowed to limit their yields. However, this goal is far from reality. The use of fertilizers (e.g. phosphates) is beyond the reach of small scale farmers owing to procurement difficulties, especially in both under-developed and developing countries of the world.

Table 5:Factors limiting the use of organic and inorganic fertilizers in yam production(.n=131)

Factors	Organic fertilizer N(%)	Inorganic fertilizer N(%)	No response N(%)
High cost of purchase	-	102(77.9%)	29(22.1%)
High cost of labour	85(64.9%)	34(26%)	12(9.2%)
Scarcity/Unavailability	52(39.7%)	77(58.8%)	2(1.5%)
Untimely supply	-	121(92.4%)	10(7.6%)
Inadequacy /Limited quantity	7(5.3%)	124(94.7%)	-
Adulteration of product	-	66(50.4%)	65(53.7%)
Transportation	45(34.4%)	79(60.3%)	7(5.3%)

Multiple responses.

Testing the hypotheses

According to the results shown in Table 6, Chi-Square tests indicated no significant relationship between the age and educational attainments of the yam farmers and their preference for the use of organic and inorganic fertilizers.

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Table 6: Relationship between age and educational attainment, and use of organic and inorganic fertilizers

Variable	Chi-square value (X^2)	Degree of freedom (df)	P-value	Decision
Age and use of organic fertilizer	4.41	4	P > 0.05	*Not Significant
Age and use of inorganic fertilizer	6.94	4	P > 0.05	*Not Significant
Education and use of organic fertilizer	0.67	1	P > 0.05	*Not Significant
Education and use of inorganic fertilizer	0.22	1	P > 0.05	*Not significant

*5% significant level

Moreover, Analysis of variance (ANOVA) results indicated a significant difference between the income realized from the sales of yam by farmers using organic and inorganic fertilizers (F= 4.31, P < 0.05) ,while their average annual yields showed no significant difference (F = 1.04 , P > 0.05) as shown in Table 7.Since fertilizer application adds nutrients to the soil and increases soil fertility with a view to increasing crop production, the use of organic or inorganic fertilizers might have produced the same effect , hence no significant difference in yam yields. However, significant difference in sales may be due to different marketing strategies being employed by the yam farmers.

Table 7: Analysis of Variance results for yam yield and sales

Variables		Sum of squares	df	Mean square	F-value	P-value	Decision
Average annual yield/Ha	Between group	8974.87	34	263.97	1.043	P>0.05	*Not significant
	Within group	24285.44	96	252.97			
	Total	33260.31	130				

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Table 7. continued

Variables		Sum of squares	df	Mean square	F-value	P-value	Decision
Income from sales of yam	Between group	1.87E+11	61	3070090647	4.31	P< 0.05	*Significant
	Within group	4.92E+10	69	712564340.4			
	Total	2.36E+11	130				

*5% significant level

CONCLUSION

It can be concluded that use of organic and inorganic fertilizers can both improve yam production since there was no significant difference between the annual average yield using either organic or inorganic fertilizers in production. It is recommended that Extension agents should encourage the use of organic fertilizers to complement inorganic fertilizers with a view to reducing cost of production and increasing yam yield..

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