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Impact of fertilizer consumption on agricultural productivity in Nigeria

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Declaration

I hereby declare that this thesis entitled Impact of fertilizer consumption on agricultural productivity in Nigeria is an original work written by me under the supervision and guardianship of Ing. Verner Vladimír Ph.D. from the Department of Economics and Development, Faculty of Tropical AgriSciences as a partial fulfillment of the requirement for the award of Master's degree in International Development and Agricultural Economics at the Czech University of Life Sciences Prague.

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Abstract

Nigeria's agriculture faces several challenges, including low productivity due to low fertilizer use and soil depletion as result of poor soil management. Majority of agricultural households in Nigeria used fertilizer either organic or inorganic. Results from the study indicated that farmers are more concerned with the non-availability of fertilizer than they are with price. With regards to factors affecting fertilizer consumption, distance to fertilizer market, state of infrastructure in the communities, weak government support, income and price of fertilizer and were identified as some of the factors affecting fertilizer use in the communities. Household characteristics such as family size, land ownership, farm size, and education also plays a significant role on fertilizer adoption decision of households. Questionnaire was administered to 105 respondents from two regions of Kajuru districts that were randomly selected. Descriptive statistics was used to analyze the data that were captured in excel. The study concluded that, the ability of farmers to be able to acquire fertilizer is perhaps the most important factor which many literatures could not capture well in this case. Because even if farmers believed that fertilizer consumption is profitable to them, the ability to acquire it may be hindered if they have limited or no cash at all and if access to credit is limited too. In an average agricultural household, the major source of income includes earnings from wages, selling of farm products and livestock.

Keywords: Fertilizer use, crop production, constraints, Kajuru, Nigeria

Abbreviation

ADPs - Agricultural Development Projects

AFDB – African Development Bank

CBN – Central Bank of Nigeria

FAO – Food and Agriculture Organization

FFD – Federal Fertilizer Department

FGN – Federal Government of Nigeria

FMARD – Federal Ministry of Agriculture and Rural Development

FOASTAT – Food and Agricultural Organization Statistic Division

FPDD - Fertilizer Procurement and Distribution Division

GDP – Gross Domestic Product

GR - Green Revolution

HA – Hectares

IFDC –International Fertilizer Development Company

IITA – International Institute of Tropical Agriculture

Kg – Kilogram

MGGs – Millennium Development Goals

NALDA - National Agricultural Land Development Authority

NEPAD – New Partnership for African Development

NBS – Nigerian Bureau of statistics

NFDP - National Fadiman Development Project

NPK – Nitrogen Phosphorous Potassium

NPC – National Population Commission

OPEC – Organization of Petroleum Exporting Countries

SSA – Sub-Saharan Africa

TN - Tonne

UNDP – United Nation Development Program

QTY – Quantity

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1. Introduction

The significance of the agricultural sector to the sustainability of development in any sub-Saharan economy cannot be overemphasized. The World Bank (2013), declares that the agricultural sector is an essential tool for sustainable development, poverty reduction, and a reliable source for food sufficiency. This declaration is of three consequential importance in the case of Nigeria. Firstly, given the country's status as the most populous nation in Africa (NPC, 2009). This huge population is depending on the agricultural sector for its food supply. Secondly, as Wedding and Tuttle (2013) observed, agriculture is the source of livelihood and household nutrition for nearly 70% of the population of sub-Saharan Africa. The agricultural sector plays a similar role in the life of Nigeria's teeming population. Finally, Nigeria's position as the biggest economy in Africa also is impacted by the level of its agricultural sector productivity (NBS, 2013 as cited in Maboja, 2015). The agricultural sector is estimated to contribute about 40% of Nigeria's $509.9 billion GDP, making the sector not just an economic lifeline for the general populace, but also the second highest foreign exchange earner for the country, second only to the oil and gas sector (Maboja, 2015). These critical roles of the agricultural sector in the Nigerian economy have attained a higher significance given the falling price of crude oil, which is the country's top foreign exchange earning source.

The understanding of any aspect of the sector is not only important to the majority of Nigerians, but of undeniable importance for the country's economic development. It is therefore of consequential essence to understand any factor(s) that impact on the productivity of the agricultural sector. Fertilizer has significant and direct empirical effects on productivity as well as reduction in poverty level (Christiansen and Demery, 2007). This means increase in agricultural productivity is not only of relevance to the economy of Nigeria, it is also of economic importance to Nigerians on individual basis. Given the dual economic significance of fertilizer, this research study into the understanding of the effect of fertilizer consumption on agricultural productivity, with special attention to timeliness, access, price and other factors that could be of hindrance to farmers to acquire fertilizer. Timeliness and access to fertilizer is relevant given the fact that any improvement in supply chain and understanding the impact of fertilizer on agricultural within the country will enable the government to introduce more effective policy on the usage of fertilizer for the economic benefit of the country and its teeming population.

2. Literature review

2.1 Nigeria's economic performance

Nigeria, despite being a developing country is a member of OPEC alongside twelve other countries. The country is identified among the growing economy with a lot of potentials in agriculture, industry and services (AFDB, 2015).

The country occupies an important role in the African economy and it is now considered as the largest economy in Africa after the 2014 economy rebased. This action also placed the country as the 26th largest economy in the world (World Bank, 2015; AFDB, 2015). The economy has enjoyed a sustainable growth over a decade now with an annual real (GDP) increasing by about 7% (CBN, 2014; AFDB, 2015). The main drivers of growth in the economy are the non-oil sectors, with services contributing about 57% while agriculture and manufacturing contributing about 21% and 9% respectively (UNDP, 2014). The country's economy is diversified and it is becoming more of service oriented economy through real estate, retail and wholesale trade, information and communication. Meanwhile, the robust growth of about 7% in the past decade is threatened by macroeconomic challenges such as exchange rate volatility and the falling global oil prices.

However, development strategies objectives alongside social solidarity are having positive impacts in the country (UNDP, 2015). Nigeria plays a vital role in both the economy of Africa and that of the Sub-Saharan Africa in particular with special attention to agriculture as a tool for sustainable development and poverty reduction. The country has made progress in meeting the MDGs by reducing the percentage of people living in absolute hunger by half for which the country received recognition from (FAO 2013, UNDP, 2015).

Despite this appreciable development, other targets were not met due to challenges in the areas of social inequality, poverty, youth unemployment, insecurity and absence of inclusive growth (UNDP, 2015). Meanwhile, the poverty and equity data of the World Bank shows that the number of people living on less than $1.90 a day has not received any tremendous change as expected (World Bank, 2013).

Nevertheless, the country is closed to meeting the MDGs due to the transformative intervention in the country's agricultural sector (UNDP, 2015).

Meanwhile, there are extreme levels of disparities among the six geo-political zones, and between states, urban and rural regions. There is a high level of prevalence of hunger in the northern region which is more endemic in the rural areas compare to urban and semi-urban centers (UNDP, 2015).

Generally, the policy environment in Nigeria looks promising to deliver better results in the future given the high assurance of priority on agriculture. The increase in agricultural productivity could have a positive implication to poverty reduction.

2.2 Global trend in fertilizer

The demand for food globally will continue to be at the increase in the future as the population keeps increasing. Meanwhile, it is expected that the population will increase by 35 percent from the current population of about 6.9 billion to 9.3 billion by the year 2050.

This frightened development is expected to push the demand for agricultural products high, which could complicate other factors such as a decrease in rural workforce and the provision of feedstock to biofuel market. Another considerable factor that may affect world crop production system is an expected shift towards meat consumption especially for countries where traditionally their diet has been grain base. This is usually driven by high consumer affluence, especially in the developing countries.

By global estimates, world food production will have to increase from the current state to be able to accommodate the rapid increase in world population. It is also expected that world food production will have to increase by 70% while production in developing countries have to double Stewarts and Roberts, (2012). These projections open the need for many developing countries such as Nigeria to increase crop production in order to meet their rising population growth.

One of the basic questions that arises when deliberating such predictions has been ''how can we produce more to meet the future demand for food and other agricultural products?'' Few among the suggested answers could be;

➢ We produce more with the available land already in production – intensify
➢ Allocate vast portion of land into production

➢ Initiate and implement a combination of intensification and new land breakout

On a large scale, land expansion could be problematic due to factors such as lack of infrastructure, technology, political will, and environmental concern.

Therefore, the most suggested way of meeting the food need in Nigeria in the future is to depend heavily on increasing yield and intensifying production on the existing farm land around the country because according to FAO (2009), there is a considerable potential in raising crop yield with existing farm land and technologies. It further estimated a 90% growth in crop production globally by 2050 (with 80% growth in developing countries) is expected to come from increase in yields and increased cropping intensity, while the remainder coming from land expansion which is expected to come from sub-Saharan Africa and Latin America.

2.3 The emerging role of fertilizer in Nigeria

Large investments in the area of policy are directed toward investing in agriculture with the aim of strengthening the economy at the national level. Partnership with the private sector is putting more effort to revive the dying domestic fertilizer industry (FMARD, 2014). Nigeria is paying more attention to increase fertilizer use among farmers for greater agricultural productivity.

The role of fertilizer in raising crop yield and sustaining the natural resources cannot be over emphasis. When the projections of global starvation in the mid-1960s was prevalent, the role of fertilizer was not questioned because fertilizer, alongside other inputs are very important contributors in raising agricultural output level by increasing yields thus ensure food security (Bumb and Baaranta, 1996; Osha, 2012). With excess productivity, farmers will be able to feed their families, increase their income level and developed other commercial activities.

On the other hand, fertilizer was an essential part of the Green Revolution that assisted many densely populated nations including countries like China and India to achieve food self-sufficiency within a period of between 20 – 25 years Bumb and Baaranta, (1996). Green Revolution was driven by a technology revolution, comprising a package of modern inputs such as improved seeds, fertilizers, irrigation package, and pesticides which combined together dramatically increased crop production in many countries in Asia Hazell, (2009). Prior to the Green Revolution, fertilizer use

across Asia was also growing. For example, in 1970, 23.9kg of fertilizer nutrients were applied per hectare of agricultural land and average use grew rapidly to reach102.0 kg/ha by 1995 Hazell, (2009).

However, fertilizer has become an integral part of criticism mainly due to heavy use in many developed countries where it was having a negative impact on the environment via nitrate leaching, eutrophication, greenhouse gas emissions and heavy metal uptakes by plants and soils Bumb and Baaranta, (1996). Nevertheless, fertilizer is still an indispensable source of nutrients for plant growth and food production. Soil nutrients are lost in both traditional and modern farming system and need to be replenished if not the natural resources in the soil will be lost through depletion and soil degradation leading to deforestation.

2.3.1   Fertilizer consumption trend in Nigeria

Fertilizer consumption trend is expressed in terms of quantity of fertilizer used in kilogram per hactare of total crop area. This covers both demand and supply decision of farmers. Therefore, it is important to understand the issues related to fertilizer in the enitire country.

Fertilizer consumption across Sub-Saharan Africa (SSA) is estimated to have remain unchanged for about a decade now prompting stagnant consumption between 6kg to 12kg/ha (Monpellier, 2013; Sommer et at., 2013) as cited in (Liverpool-Taste, Barrett and Sheehan, 2014.) and no country in Africa has been able to achieved the 50kg/ha targeted for 2015 at the 2006 Abuja fertilizer summit in Nigeria (Monphellier 2013; Sommer et al., 2013) as cited in (Liverpool-Taste, Barrett and Sheehan, 2014.)

Increased in fertilizer consumption is often considered as an important factor for growth in agricultural productivity, especially in a country like Nigeria where fertilizer use is perceived to be low and output growth of the main food crops such as maize, rice, sorghum, soybeans and millet have been slow thereby, prompting the adaptation of several policies with a single objective of developing commercial input sector, including the management of subsidies, development of input-supply networks via credit or the liberalization and deregulation of the fertilizer sector (Ariga and Jayne, 2011; Morris et at., 2007).

The general perception about low fertilizer consumption in Nigeria can be traced back to as early as the 1940s. With the rising population density, the focus has always been on improving the agricultural sector by stimulating fertilizer consumption, grow the commercial fertilizer sector and lower fertilizer prices in order to increase yield (Liverpool-Taste et al., 2014).

Meanwhile, evidence that fertilizer use has increased substantially in the country is limited even with more recent programs such as the National Special Program for Food Security, Fadiman Development Programs, and the Presidential Initiatives on Agriculture Development

(Liverpool-Taste and Takeshima, 2013; Liverpool-Taste et al., 2014). However, there are limited evidence on the nature as well as the rationale for the actual patterns of which fertilizer consumption rate is observed across Nigeria's different farming system and cropping patterns.

Fertilizer consumption and the demand for it vary across Nigeria according to cropping systems, agro-ecological conditions, policies, fertilizer market conditions, and fertilizer responsiveness, since farmers are confronted with different constraints in agricultural production which is sometimes based on region or location of the farmer. Fertilizer use is typically higher in the Northern states than in the southern states. The reason for the high consumption in the north is due to lower soil fertility (FFD, 2011; Smith et al. 1997), larger cultivated area and the growth of high value crops like cereals and vegetables Ebon et al., (2006). In addition, Northern states have provided higher fertilizer subsidies than other states in the country Mustapha (2003).

Figure 1: Fertilizer consumption (kg/ha of arable land)

Fertilizer consumption (kg/ha of arable land)
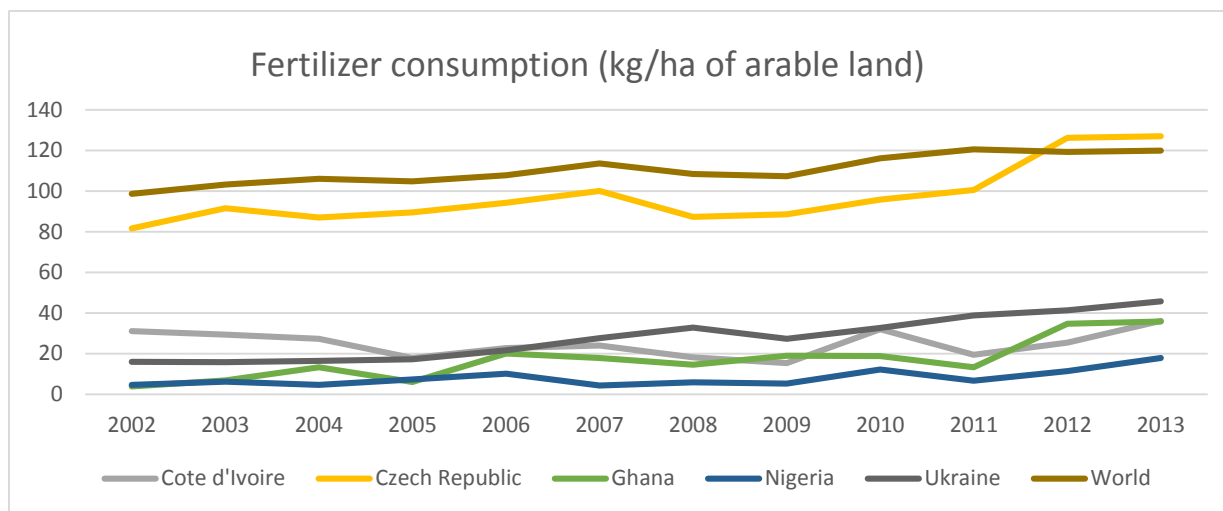
Source: Data from FAOSTAT and modified by the Author

Figure 1 above clearly indicated that Nigeria is still lacking behind in fertilizer consumption compare to her counterpart in Africa and other part of the world. Although there has been quite a tremendous change however, this change is not significant enough compare to countries like Czech Republic and Ukraine. The highest growth in consumption in kilogram per hectare was in 2013 which stood at 17.8 while her counterpart in Ghana under the same period recorded 35.82.

2.3.2   Fertilizer use and food security in Nigeria

Fertilizer use, food security and agricultural production are mutually interrelated because fertilizer along with improved seed use is the major driver of agricultural production which in turn leads to the attainment of food security (Barron et al., 2013; Osha, 2012; Oyo and Adebayo, 2012). They are critical in improving agricultural production and food security through nutrient loss replenishment on farmers' fields (Ammani et al., 2010; Osha, 2012).

Meanwhile, food security , is a situation when all people at all times gain access to sufficient, safe and nutritious food to maintain healthy active life World Food Summit, (1996). The United Nations and FAO refer to food security as the availability of food and its accessibility. A household

can be considered food secured when every member of that household do not live in hunger or fear of being starved .

With a projected population of 177 million and a rising population density of 3.2% NPC, (2015), Nigeria is the most populated country in Africa and the 7th most populated country in the world (World Bank, 2014; NPC, 2014), and has the largest number of people to feed Osho, (2012). In the area of employment, agriculture is by far the most significant sector of the economy, engaging about 70% of the labor force. Meanwhile, growth in the agricultural sector has remained steady at 6% over a period of time and its contribution is relatively low to the total export in the country. It has contributed between 0.5% - 2.0% over the past 6 years and 20% - 50% yield per hectare compare to other developing countries FMARD, (2014). The country is a net importer of food such as rice, wheat, sugar and fish. The reason for such a decline is attributed to low agricultural inputs use such as fertilizer, improved seed, irrigation facilities, and modern technology. Fertilizer consumption is between 6kg/ha – 12kg/ha as the case in many SSA countries Monpellier, (2013; Sommer et at., 2013; FAO, 2011). The current Agricultural Transformation Agenda is working towards changing that.

The rise in population comes with an increase in food demand and the need to balance between the population growth and food production. Meanwhile, population growth is placing an intensified pressure on natural resources such as land, water and air to produce excess food, fiber and raw materials to meet the increasing demand for it. Food production in Nigeria has been experiencing pendulum growth due to economic, environmental, political, social and technical problem. Solution to increase and maintain food production is identified in the area of fertilizer use, farm mechanization, the use of improved seeds, irrigation farming and infrastructure development. Both economic and social strategies require short and long term approaches to social re-adjustment and institutional change. For example, large scale farmers should be contracted by certain firms as growers.

Agricultural yield has been fluctuating in the past few decades where increase in agricultural productivity is derived more from expanded cultivation areas for staple crops than from increase in yield Philips et al., (2011). Domestic fertilizer production and supply is still a major constraint to fertilizer use despite large quantity of phosphate deposits. One key way to the food security

pathway is to provide farmers with access to quality and timely inputs, particularly fertilizer and the knowledge to apply them efficiently and effectively Osha, (2012) as shown in figure 2

Figure 2: Pathway to food security attainment

Source: Osha, (2012)

To meet the rising demand for food by 2020, food production will have to be increased by 70% globally FAO, (2010) and Nigeria has to play an important role in ensuring that the rising food demand in the country is met as well.

2.3.3   Structural changes in the Nigerian agricultural sector

Until the discovery of oil in large commercial quantities, Nigeria's economy was dominantly agriculture with a huge foreign market. Despite the role of agriculture today, sadly, Nigeria is a net importer of food and agricultural products (Verter and Becvarova, 2016). Even with strong demand, changes in the country's agricultural sector has not occurred to usher a new era of transformation needed for the sector. The implementation of economic reforms that is designed to reduce or completely eliminate government control of the sector has not been implemented. Such reforms are meant to stabilize the economy and create more friendly policies to favor investment in agricultural production and export. The sector has not moved completely from traditional farming system to the science based on a large number of farmers in Nigeria are predominantly subsistent.

There is a high need to ensure food security by tackling challenges such as the increase in population, soil degradation, urbanization, low fertilizer application, and low seed use. To shore

up and attain food security level in Nigeria, there must be an improvement in the agricultural production system (Osha, 2012). It requires the promotion of sustainable agricultural production via higher productivity in one hand and cropping intensity on the other hand.

The adaptation of new agricultural technologies and innovations such as agrochemicals, improved seed, and fertilizer is necessary. This could help change the entire farming environment in the country into a more productive agribusiness economy.

2.3.4 Agricultural production and farming system

Agricultural holdings in Nigeria are generally small and scattered across different regions. The farming system is subsistence, and it is characterized by the use of simple tools and shifting cultivation. The weather condition in Nigeria is diverse and varies according to regions. It ranges from tropical in the coast to arid in the north. The diverse nature of the climate makes it possible to grow different agricultural commodities for both tropical and sub-tropical. The world has experienced a huge change in agricultural production in terms of farming methods, quality of farming, and annual output. Undoubtedly, most of these dramatic changes are more experienced in advanced countries than in developing economies, especially sub-Saharan countries like Nigeria.
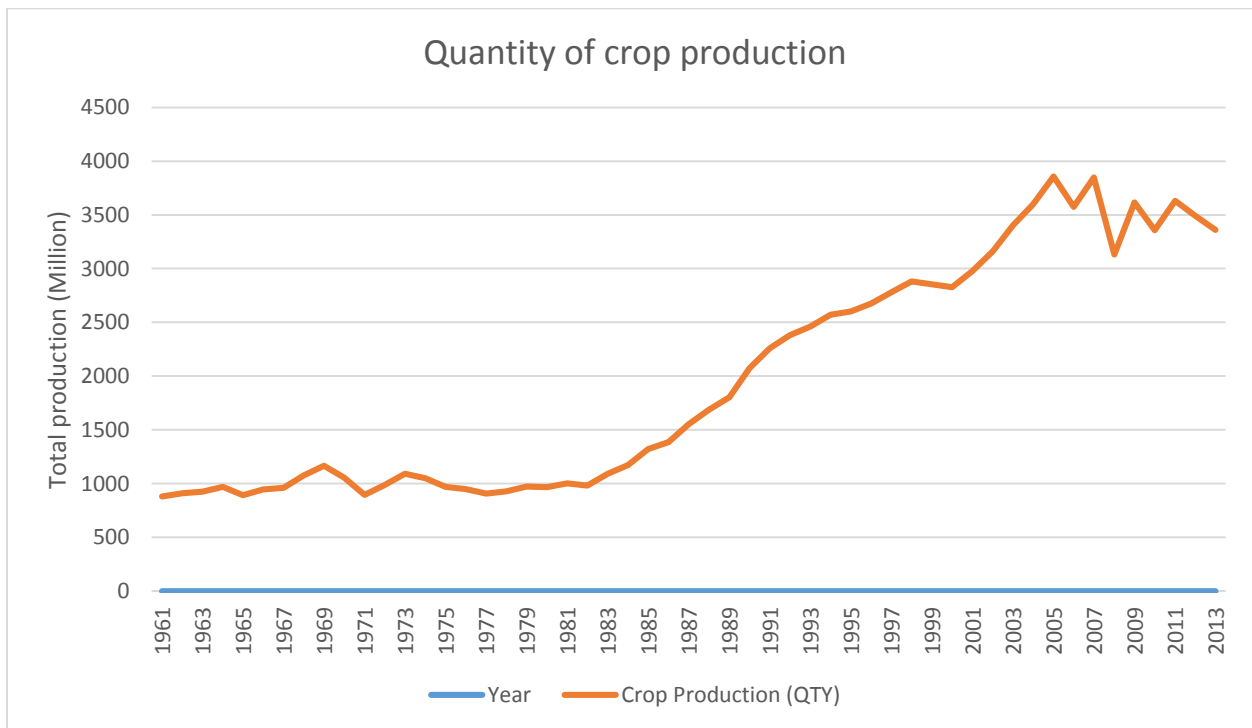
Figure 3: Quantity of crop production

Economic growth has largely been accounted for by growth in agriculture associated with performance in four sub-sectors namely; crops, livestock, fisheries and forestry (Ebon et al., 2012). While the agricultural sector may have in recent years contributed significantly to improved growth performance, it real contribution appeared to be short of the total potential (Oyakhilomen and Zibah, 2014). The share size of agriculture in many African countries suggests that early strategies designed to promote economic growth from the beginning cannot ignore agriculture. The promotion of rural economy in a sustainable way has the ability of increasing employment opportunities in the countryside, reducing regional income disparities, stemming pre-mature rural-urban migration, and ultimately reducing poverty level at its very source (Anriquez and Stamoulis, 2007). Nigeria is an agririan nation "endowed with substantial natural resources" which include: 68 million hectares of arable land; twelve million hectres of fresh water resources,, coastline and ecological diversity covering 960 km which enable her to produce a wide range variety of crops and livestock, forestry and fisheries products (Arokoyo, 2012). Poverty is concentrated in the rural regions, which are home to more than 70% of the nation's poor. Thus the lacking behind in the development indicators such as low income, higher infant mortality rates, shorter life expectancy, illiteracy, and malnutrition is widely spread and large number of the people have limited or no access to clean drinking water, health facilities and improved sanitation services (Tigas and Ehui, 2006).

Table 1: Net Production Value (constant 2004-2006 1000 $)

Year/indicator	Value of agric. production: Ivory Coast		Value of agric. production: Ghana		Value of agric. production: Nigeria			Agric. production in Nigeria (% of world production)		Value of Agric.prod in Nigeria (% of Africa production)	
	Agriculture	Crops	Agriculture	Crops	Agriculture	Crops	Livestock	Agriculture	Crops	agriculture	crops
1961	1,014.5	895.0	1,452.0	1,362.0	7,211.5	6,966.9	683.6	1.09	1.57	14.88	19.18
1965	1,252.0	1,107.3	1,541.1	1,426.0	8,440.7	8,307.3	733.5	1.14	1.67	15.29	19.74
1970	1,619.5	1,456.1	1,840.7	1,711.1	10,517.3	10,533.1	933.6	1.25	1.84	16.31	21.08
1980	2,580.2	2,344.4	1,621.0	1,413.1	9,380.0	8,225.3	1,671.0	0.89	1.17	12.65	15.00
1990	3,719.5	3,390.4	1,956.3	1,701.8	15,460.2	14,940.1	1,847.3	1.14	1.65	15.67	20.13
2000	5,355.7	5,006.2	4,155.4	3,867.3	25,707.4	25,164.9	2,644.6	1.54	2.23	19.18	24.43
2010	5,759.9	5,284.7	6,595.9	6,234.7	33,243.8	32,579.8	3,561.4	1.54	2.23	17.51	22.31
2012	6,485.0	5,973.1	7,359.2	6,980.2	34,889.5	33,268.9	3,711.9	1.54	2.16	17.37	21.51
2013	6,660.3	6,130.9	7,621.3	7,213.9	36,377.0	34,441.9	3,792.9	1.57	2.14	17.50	21.46

Source: Data from FAOSTAT analyzed by Author

Table 1 described the historical data on the value of agricultural net production in Ivory Coast, Ghana and Nigeria from 1961 to 2013. In this period under review, all countries indicted improvement in agricultural production. In the same way, the share of Nigeria's agricultural production globally and in Africa increased slowly from 1.1% and 14.9% in 1961 to 1.6% and 17.5% in 2013. Similarly, the share in crop production also increased from 1.6% and 19.2% in 1961 to 2.14% and 21.5% in 2013 respectively.

This tremendous growth indicated that Nigeria is still a major contributor in agricultural production in Africa, West Africa and the world in general. The trend as shown in figure 4 indicated an increase in annual quantity of crop output in the country between 1962 and 2014 with a bid of fluctuation especially in 2009.
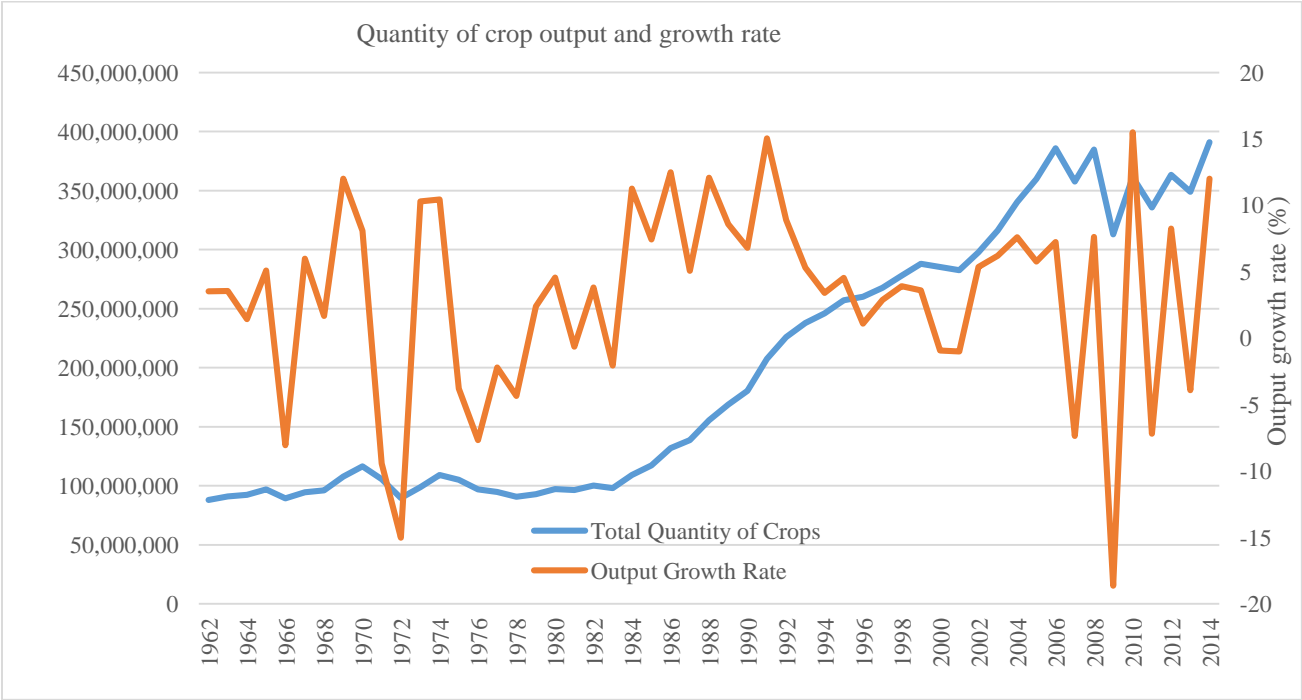

Figure 4: Total quantity of crop production (t '000) and growth rate (%), 1962-2014
Source: Data from FAOSTAT, 2016

2.3.5 Cropping systems in Nigeria

Cropping system in Nigeria is characterized by diversity with small cultivated area of about $2 - 5$ ha. Huge number of farmers are classified as subsistent farmers engaging in farming to meet family needs. However, surplus sometimes are sold out in the market to maintain family liquidity. Labor are usually done manually and the cultivation of two or more crops on one piece of land is a common and accepted tradition. The idea is to maximize return from limited resources which many farmers do not have. Such practices accommodate common crops from the sampled regions which include millet, maize, groundnuts, cowpea, sorghum, yam, cassava, rice and cocoyam.

Combining crops with different growing periods enable farmers to develop a highly diversified cropping pattern which sometimes could involve as many as $2 - 3$ different crops. The complex mixture and high yielding farmland are usually small and much closer to the house where soil fertility is high due to high level of concentrated animal manure, ashes and household sweepings.

On the contrary, yield from mixed cropping generally declines in farmland that is a distance from the household. In such land, output is proportionate to the addition of organic manure or chemical fertilizer as well as crop rotation and fallow system.

2.3.6 Constraints to fertilizer use in Nigeria

Owing to the poor nature of the natural endowment in the country's soil aggregate by poor management and damaging soil practices, there is a wide agreement that sustainable increase in fertilizer use is necessary to restore and maintain soil fertility and enhance productivity (Idku et al., 2015). Thus, the need for fertilizer use is essential to increase agricultural productivity. The importance of fertilizer in agricultural production and food self-sufficiency in the country has already been stressed (Morris et al., 2007; Ariga and Jayne, 2011). The factors promoting growth in fertilizer consumption holds the key to accelerating agricultural production and productivity in the short-run and improve soil fertility in the long-run (Phillip et al. **2009**).

Constraints usually associated with fertilizer use covers a wider range of issues from distribution system, late arrival, transportation bottleneck, political influences, product diversion, fertilizer subsidy, government policies, dual fertilizer market, price, access to fertilizer and fertilizer market, (Oyo, 2009; Olaide, 2009). Widespread of fertilizer in the country came with the proliferation of Agricultural Development Projects (ADPs). However, there was limited impact as many of the ADPs could last.

2.3.7 Common challenges and opportunities with fertilizer in Nigeria

The declining nature of soil fertility is recognized as a major bio-physical factor affecting agricultural production in Nigeria, especially the northern part. However, the struggle for food and the idea to increase food production is the main concern of the larger portion of the country's population. The need to increase global food supply to attain self-sufficiency is on the increase but for many developing countries, food security is at the forefront of their concern. Tackling the negative relationship between food demand and food supply is one of the biggest challenges the country is faced with. Agricultural sustainability and livelihood improvement is more of a theoretical action than practical. Nutrients depletion is still threatening food production in many parts of Nigeria creating food shortage leading to food insecurity for many families in the country (NEPAD, 2007). Limited access to inputs, irrigation facilities, poor land management and access to modern technology has led to low agricultural productivity. Poor land management is also responsible for the continuous nutrient lost in many farms (Mekuria, 2013).

Major challenges with chemical fertilizer is the adverse impact it has on the environment such as nitrate leaching, destruction of greenhouse gasses, heavy metal intake by soil and plants. Fertilizer if not managed properly could contribute to environmental damage. Nevertheless, fertilizer is an important source of nutrient required by plant to grow and it will remain an essential input needed to meet the future need for food production.

2.3.8 Increasing agricultural productivity and closing the gap

The need for agricultural production in Nigeria will be needed to meet the current increasing demand for food. However, food security on the national level will continue to depend on major food crops such as maize, ice, sorghum, wheat, yam and cassava. These crops occupy about 60% of the annual crop area in the country and provide about 45% - 50% of needed food calories to the general population. Wheat, rice, sorghum, yam and cassava have been essentially an energy supplier to the larger population of Nigerians since inception. Meanwhile, maize, soya bean and groundnut have been an energy provider for many commercial animal feeds (Fischer et al., 2009).

Lobell et al., 2009 studied the literature on maize, wheat and rice cropping systems and found an average yield range of 20% - 80% yield potential of these major cropping system on a global level. They define potential yield as the yield of an adapted crop when cultivated under favorable weather condition without limitations from nutrients, pest, diseases and water. The conclusion was that several major cropping systems such as rice and wheat recorded yield potential approach of between 70% - 80%. However, none of these crops had grown beyond that point which suggests a limit to agricultural yield gap reduction. Prompting the argument on the increase in fertilizer use via agricultural intensification to increase productivity to meet the current demand for food.

Successful agricultural intensification which means closing the wide gap between actual yields and attainable yields, sorely depends on a deeper understanding of nature and the strength of regional specific constraints that surrounds farmers across different regions in Nigeria. Some of these constraints could be from biophysical limitations arising from climatic conditions (e.g. rainfall distribution and changes in temperature), topography, lack of irrigation facilities, and low soil fertility.

However, socio-economic constraints such as access to educational program, access to credit, government policies, price of inputs and access to markets is highlighted as few among the major factors playing a critical role in agricultural development in Nigeria. Thus, the improper and inadequate use of agricultural inputs and the adaptation of other cultural practices could be either as a result of ignorance or lack of access to a better option (Stewarts and Roberts, 2012). Undoubtedly, improvement in technology and crop management practices will be significantly needed to increase productivity as fertilizer and nutrient management are among many practices

that will continue to improve, as many could argue that crop nutrition is the foundation upon which other technologies stand (Stewarts and Roberts, 2012).

2.3.9   The role of fertilizer in increasing crop yield

A fundamental question that both agricultural experts and experts in the fertilizer industry in Nigeria have been struggling to address for a long time now is "how much of crop production is actually attributed to fertilizer consumption?" the answer to this fundamental question is quite critical to any large scale risk-benefit discussion of fertilizer as an input and the fertilizer industry in general. It is important to note that global crop production and fertilizer consumption are in one way correlated as illustrated in figure 4 below. The figure described the relationship between crop production and fertilizer consumption. It is quite visible and truthful to admit that there is a relationship between fertilizer consumption and agricultural productivity. But it is imperative to also note that this relation could be correlated sometimes and vice versa in another case. Figure 4 below indicated that in the mid-1980s Nigeria recoded growth in crop production as fertilizer consumption also grew. However, between 1993 and 2005 there was an inverse relationship whereby there was growth in crop production where fertilizer consumption was decreasing.
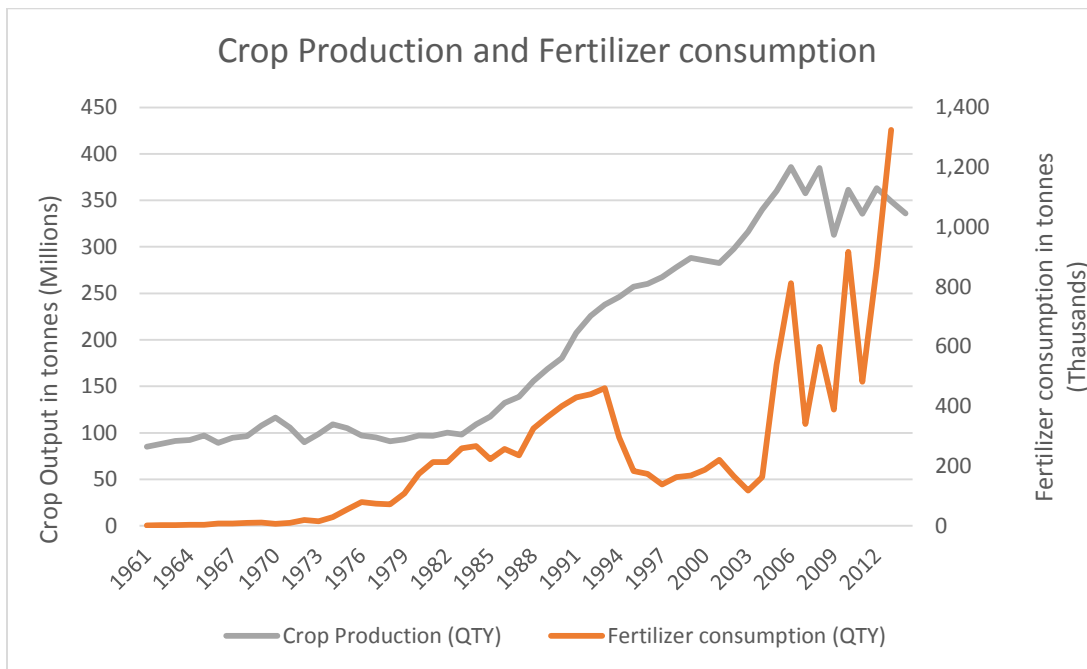

Figure 4: Change in Crop production and fertilizer consumption

There has been quite a tremendous attempt to estimate or predict how much of agricultural productivity can be attributed to nutrients inputs. Historically, the usual estimates have always been between 30% and 50% especially for major crops (Bruinsma, 2003). One-third of the growth in crop production globally and half of the growth in India's grain production during the Green Revolution (GR) has been attributed to increasing in fertilizer consumption (Bruinsma, 2003). About 50% - 75% of increase in crop yield in many countries in Asia was attributed to increase fertilizer use (Heisey and Mwangi, 1996).

3. Aims and Objectives

The main aim of the thesis is to determine the availability and accessibility of fertilizer and to analyze and understand the factors influencing farmer's decision with emphasis on supply and price of fertilizer. Thus the specific objectives are to,

- ➢ Determine the availability and accessibility of fertilizer by rural farmers
- ➢ Analyzed and understand factors influencing farmer's decision on fertilizer use
- ➢ Identify and assess fertilizer marketing constraints confronting farmers in Nigeria

In order to explain the objectives of this research and to align the research with the main aim, the following research questions were drafted.

1. What are the available fertilizer market and how are they accessible by local farmers?
2. What are the major factors influencing fertilizer use decision among rural farmers?
3. What are the key challenges faced by subsistence farmers in Nigeria and how critical are these to crop production?

4. Methodology

4.1 Introduction

This chapter briefly described the methodology used to achieve the objectives of this research, at the same time to answer the research questions as stated previously. The chapter covers the study area, research design, sampling design and data collection methods.

4.2 Study Area

This study was conducted in Kajuru district. Kajuru is located in Kaduna state on latitude longitude 9° 59'N and 10° 55'N and latitude 7° 34'E and 8° 13'E covering a total land area of 2464 km2.

At creation in 1999, Kajuru was only two districts but today there are fourteen districts which borders with Chikun on the west, Kaura on the east, Zangon Kataf on the south-west and Kachia on the south respectively.

According to the 2006 national population census, Kajuru has an estimated population of about 110,868 inhabitants with Adara as the major ethnic group. Other ethnic groups include Gbagyi, Ham, Hausa, Yoruba, Fulani and Igbo.

The climate is classified as tropics which is marked by raining and dry season with high temperatures up to 37 °C between March and May. Low temperature could be as low as 20 °C around December and January which is usually intensified by low humidity due to the dry and dusty harmattan wind that cuts across the entire state. Rainfall distribution is around 1300mm a year with a maximum rainfall in the month of August. Relative humidity during the raining season ranges between 65% and 70% and between 18% and 38% during the dry season. The FAO classified the soil in Kajuru as sandy-loam which makes it rich in mineral contents that support high agricultural production.

Kajuru is an agrarian based economic with agriculture serving as the major economic activity of the people which includes food production, crop production, livestock production, poultry production and crafting. The farmers practiced subsistence farming system cultivating crops such as maize, rice, millet, sorghum, soya bean, groundnut, ginger, cassava and sweet potato. However, irrigation farming is a common practice among small number of farmers living along the river bank growing products such as tomatoes, okra, sugar-cane, pepper, onions and vegetables. These

few additional products attract not only additional income for the farmers but traders from the surrounding districts.

The study area was selected based on primary information gathered from research participants. The most prevalent and relevant selection criteria for the study areas were factors affecting fertilizer demand, distribution, and the role of government in the fertilizer supply chain in Kajuru district. The focused region could generally be considered as a representative of poor agricultural region in Nigeria where weak government policies and other factors discussed in the literature review were addressed.
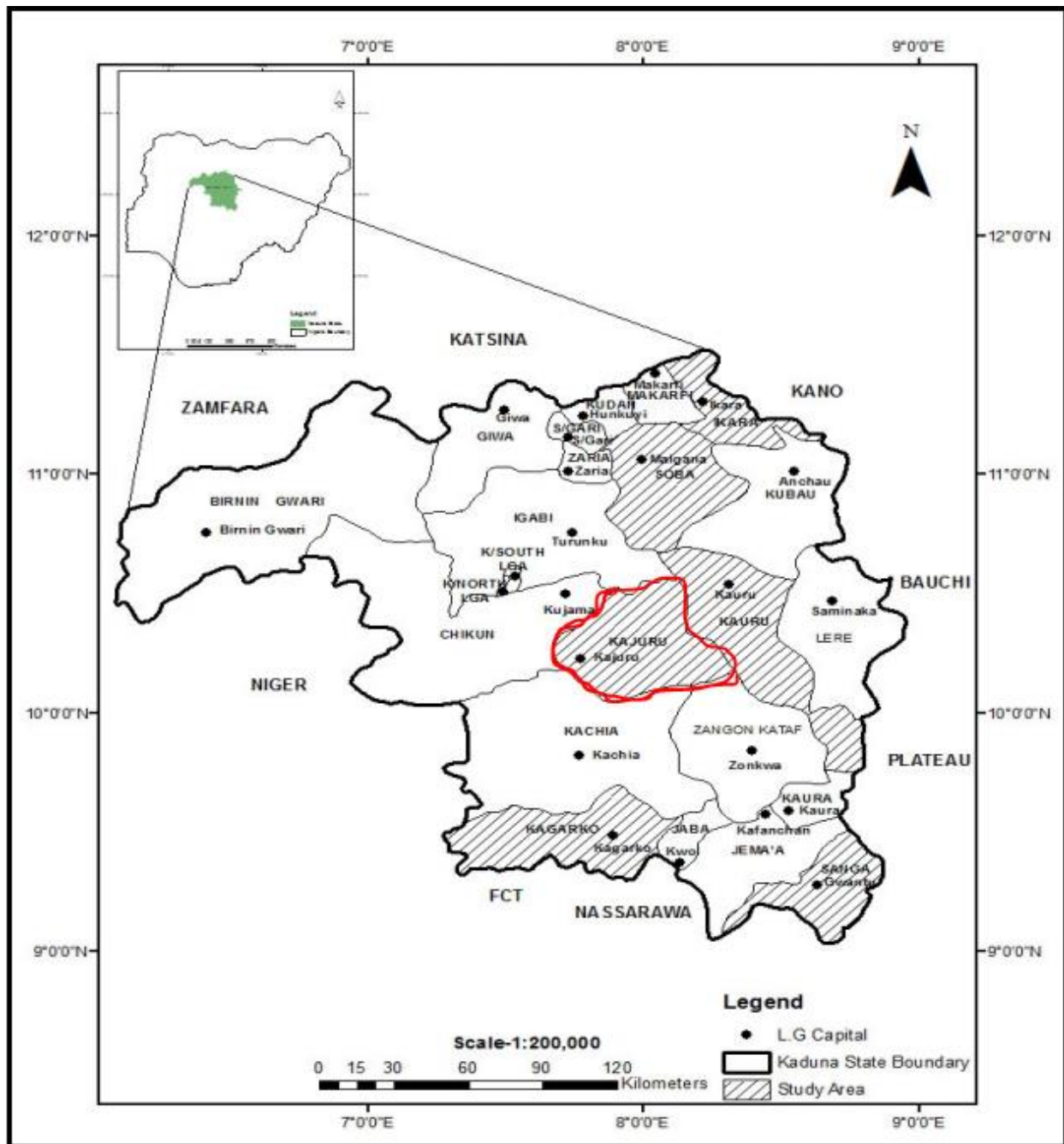
Figure 6: Map of study area

Source: Abaje et al., 2015

4.3 Research Design

The researcher uses cross-sectional method of research because the method is considered the best technique of collecting original data to describe a situation that is too large to observe directly (Best and Kahn, 2013). The population in Kajuru district is very large (N110,868). Therefore, the choice of this research design method would assist the student to complete the research within a short period by selecting a manageable sample to represent the rest of the population. To survey simply means to observe the occurrence of events in the natural to derive meaning out of it (Best and Kahn, 2013).

According to Leedy (2014), a phenomenon where little is known is best explained using survey design. Because survey is the most fit since it involved the gathering of new information from a sample that represents a household population. Bogdan and Biklen (2006) concludes that survey design is the best in original data collection because it does not influence research correspondents and they are not controlled rather, it observes, describes and explain the opinion and general perception of the sample group. The results obtained from the sample group would then be applied to the entire population. The research design is however cheap and all needed information can be gathered from a large population within a short period.

4.4 Sample design

The target population in this study were rural farmers from two provinces of Kajuru district namely Idon and Kufana. However, probability sampling was applied to make up the sample. Meanwhile according to Cohen and Manion (2011), probability sampling method is a method in which every member of the sample population has equal or non-zero probability of being selected. With a similar procedure to the works of Kuboja and Temu (2013) multi-stage sampling was also applied. Kajuru district was selected for this study due to the number of subsistence communal farmers in this region and also the nearness of the area to the researcher. A simple random sampling technique was then used to select eleven villages and respondents from the farmer's fertilizer distribution list obtained from the office of the district head. The fertilizer distribution list therefore formed the basis of the sample size. The population comprised some rural farming household in the district. According to the Kaduna State Statistical year book (2014), the entire district of Kajuru has an estimated number of 99,781 communal farmers. Best and Kahn (2013), described population in research as any group of people with one or more characteristics in common that the researcher is

interested in. The farmers were ideal and shared the same social, economic and environmental challenges. The sample population (N = 99,781) was considered large and too expensive to cover sufficiently. This confirms the argument of Best and Kahn (2013), who reiterated that it is impractical if not impossible to study an entire population to arrive at a generalization. However, it was too costly and impractical to collect data from all the farmers within a given period. Bell (2014), consider that time consuming and waste of effort to investigate every member of a population when statistical data can be drawn from a portion to represent the same population.

For the purpose of this research, the researcher chooses a representative sample (n) from the population (N) of farmers in Idon and Kufana region of Kajuru district. A minimum sample (n) of 105 respondents was quite sufficient and was calculated using Raosoft Sample Calculator at 9.56% error margin and 90% confident level. To have equal distribution of the respondents from the selected villages, 10 farmers were selected each at random however, only a total of 105 farmers were interviewed.

 A sample can be described as a small part of a population that is selected for observation from which a reliable inference can be made (Borg and Gaul, 1996). However, the features of the sample should be able to match that of the population to guarantee any statistical deductions and more so, a sample should be large enough to represent a population adequately.

4.5 Data collection

This study uses a combination of both quantitative and qualitative method of data collection. A detailed questionnaire was administered to obtain primary data from farmers. Questionnaire are effective in every research because they enable the capturing of vital information from respondents within a short period of time (Cohen and Manion, 2011). Because questionnaires provide a permanent and verifiable record of record of data collection (Leedy, 2014). The information was gathered by the researcher between October 2015 and December 2015. Both close-ended and open-ended questions formed the basis of the questionnaires. In their argument, Best and Khan (2013) highlighted that, closed questions are useful where high level data specificity is required. Participants were instructed to choose one option from a given set of options, therefore providing no room for respondents to change or give unintended answers. This is to enable data collected to

compare and analyze easily. However, closed-ended questions reduce the ability of the respondents to include minor details, which may make data analysis and data comparison difficult (Tuckman, 1994). Meanwhile, the researcher also added few free response questions, however, their inclusion was justifiable because according to Cohen et al. (2011), fixed response questions have the ability to chock or confiding the respondent into one direction. Key informants were interviewed and focus group discussion was conducted as a method of triangulation so that same information can be collected. Secondary data on fertilizer consumption trend and trend in agricultural productivity were collected from government databases such as the federal ministry of agriculture, the central bank of Nigeria, national bureau of statistics, FEPSAN, national population commission and other international bodies such as FOASTAT, World Bank, UNDP and the United Nations.

4.6 Data analysis

All data collected were analyzed using SPSS version 20 and Microsoft excel. Friedman Ranking Test was applied as a specific tool. However, descriptive statistics, was adopted, and data were subjected to descriptive statistical analysis to establish fertilizer consumption and agricultural productivity trends and the relationship between different variables used in order to explain some of the key features in the market.

4.7 Limitations of the study

The main limitation of this study was that it covers a limited portion of what affects farmer's productivity which is fertilizer however, the objectives that was set for the study were fulfilled. Major players in the fertilizer industry such as retailers, wholesalers and government officials were ignored thereby making it hard to understand the problems in the fertilizer value chain from top to the bottom. Questionnaires were administered to farmers only and the view of fertilizer marketers was not addressed. Although literature sources were diverse covering other issues, the concentration on organic fertilizer only puts organic fertilizer users at disadvantage in which there concern on the same constraints were not taken into consideration. Most of the farmers were unable

to keep track of fertilizer purchase and crop output from previous years which reduces the accuracy of the data.

5. Results

5.1 Socio-economic features of the sampled households

The socio-economic features of the sampled household presented in this section includes; age, gender, marital status, and educational level family heads. Other considerable characteristics includes; family size, income level and source of income, and farm size.

5.1.1 Respondents gender status

Majority of the respondents from the two provinces were male; 74% in Idon and 75% in Kufana province, compare to their female counterparts who accounted for only 26% and 25% respectively as shown in the figure.
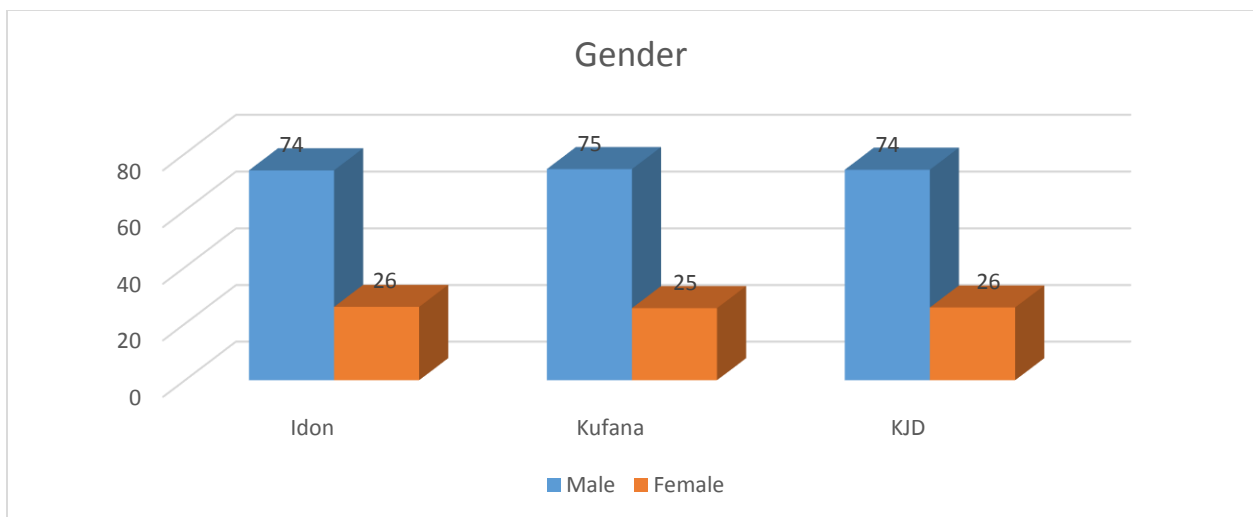

Figure 7: Gender status respondents

In addition, majority of the household sampled were headed by male. A total of 78% respondents in the entire district were headed by male while a total of 22% were headed by female who accounted for a small portion of the sampled population as shown in figure 7 below
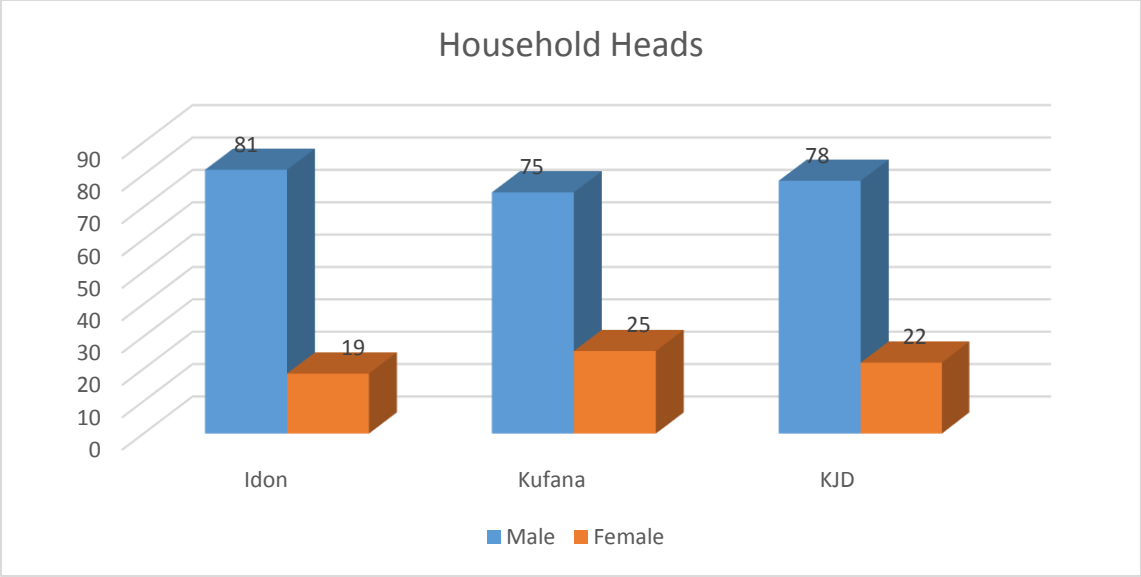
Figure 8: Gender of household heads

5.1.2 Age group of respondents

Figure 9 below shows age distribution of sampled respondents. The figure indicated that the youngest respondent was 25 years' old and the oldest was 78. From the information presented, it can be seen that 41% of the respondents were between the age of 46 and 55 while 29% were aged between 36 and 45, 12% aged between 26 and 35, 3% between age 18 and 25 as represented below.
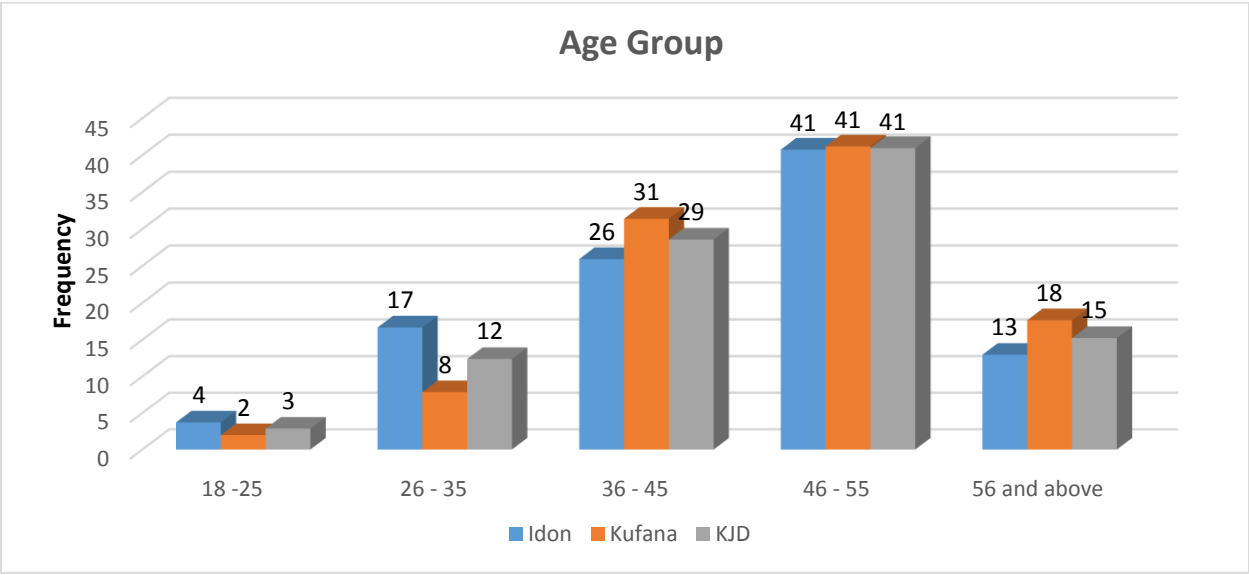

Figure 9: Age distribution of respondents

5.1.3　Marital status of household heads

From the data presented in figure 10 below, indicated that 73% of the household heads were married, 11% were widows, 7 % divorced while 9% were single as presented below.
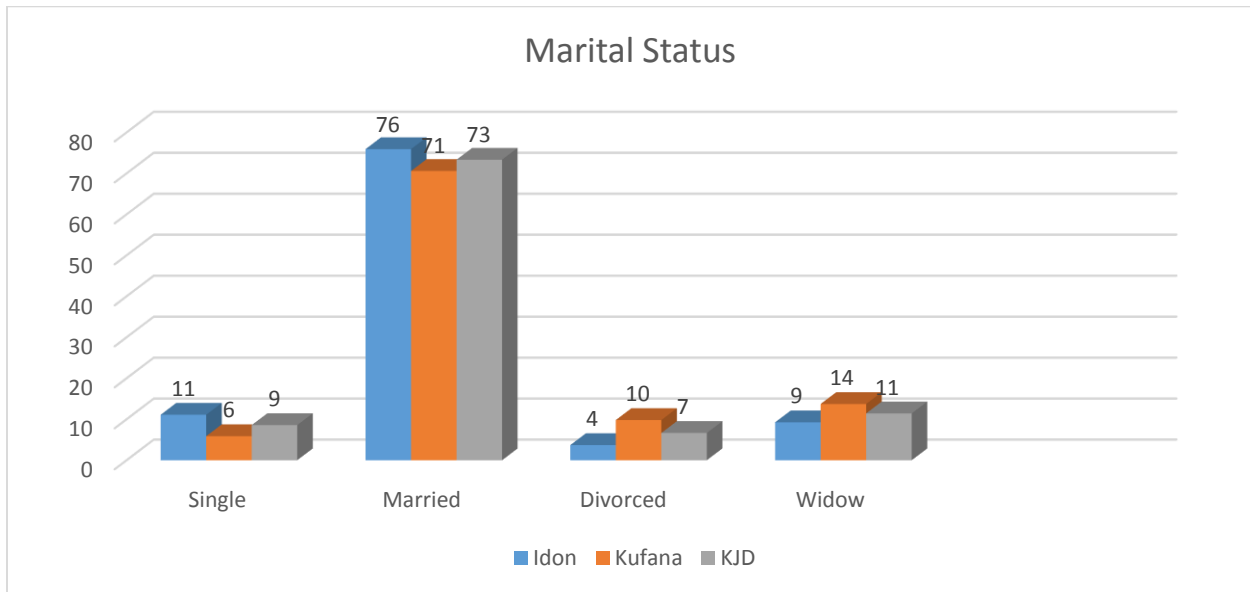

Figure 10: Marital status of household heads

5.1.4　Education level of household heads

From the data presented in figure 10 below indicated that 55% of the household heads attended elementary school. This followed by those without any formal education which stood at 26% and only 15% acquired high school education. And only 4% of the entire sampled household have tertiary education as presented in the figure below.
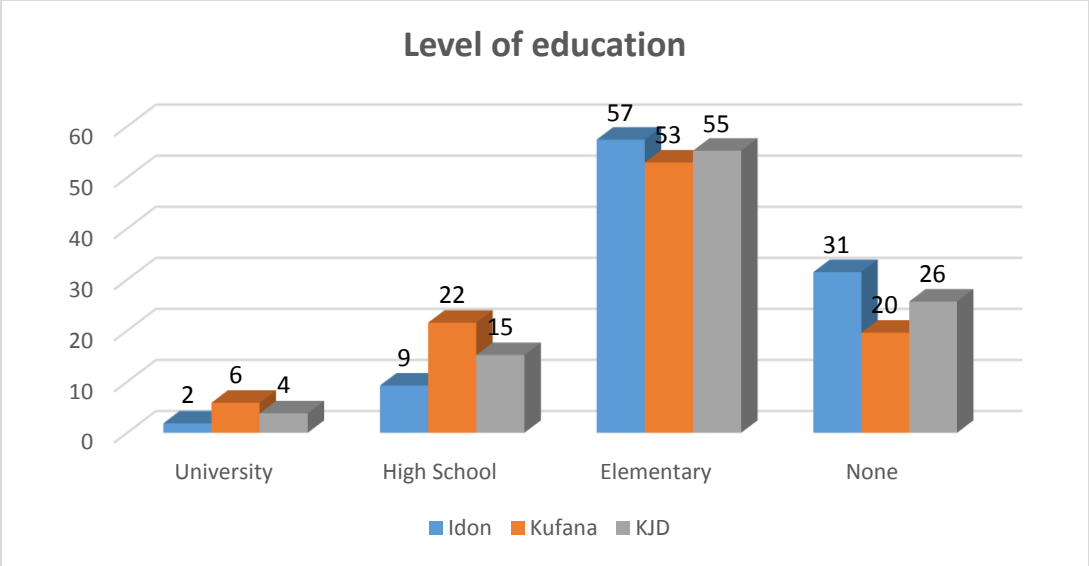
Figure 11: Education level of households

Despite the fact that majority of the household heads have acquired different level of education as presented in figure 12 above, 14% were unable to read and write. However, 86% admitted they are able to read and write.
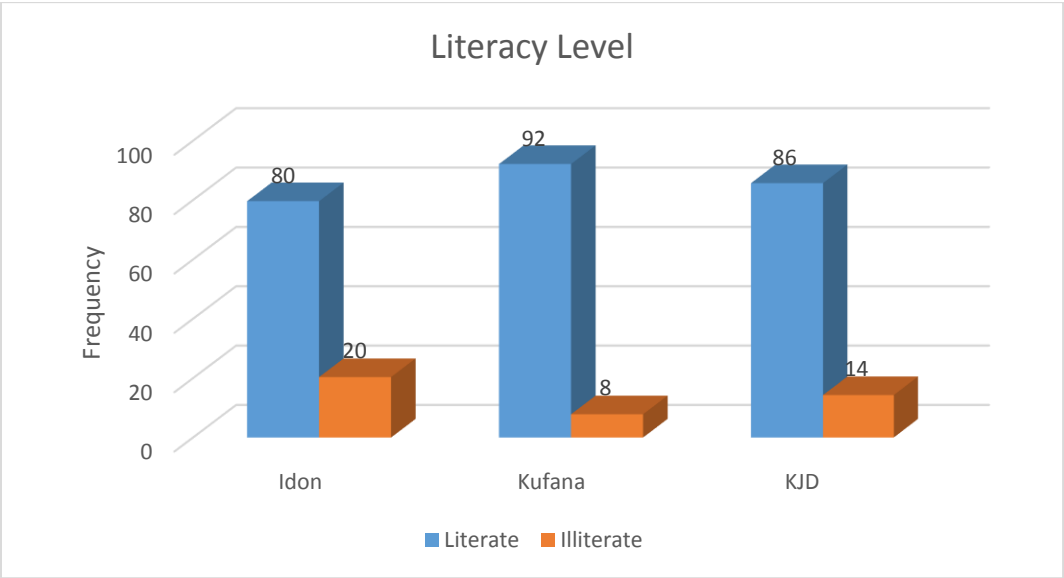

Figure 12: Literacy level of household heads

5.1.5 Household Size and number

From the sample size, the household sizes ranges from 1 to 12 members. Each household had on average 5 family members. 50% of the households had between 1 to 5 members followed by those with 6 to 10 members which accounted for 31% and 19% of the sampled household had 10 members and above as shown below.
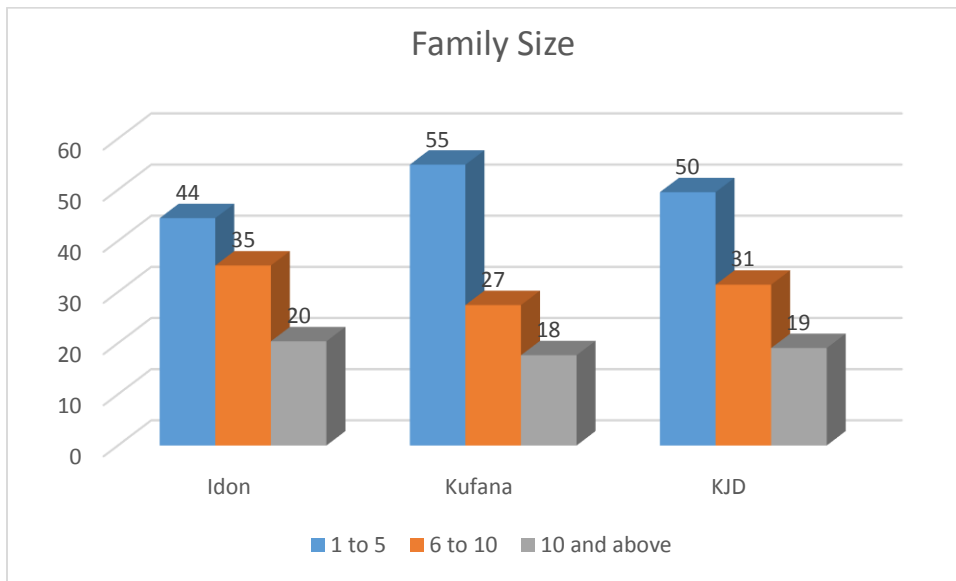

Figure 13: Size of household

In addition, records showed that 90% of the household members were able to engage on daily activities including farming. 10% of the total households indicated that few members are not able to participate on daily household activities due to illness, disability and old age. On average $3 - 4$ members of the total household were involved in farming.

5.1.6 Household source of income

From the data presented in figure 14 indicated that majority of the household (70%) obtain their income via farming. Despite the fact that these households are subsistent farmers, however surplus of their harvested produce are sold in the market. Other sources of income were casual job with 10%, vegetable sales 7%, pension 6%, business 5% and remittance 4% as shown in figure 14 below.
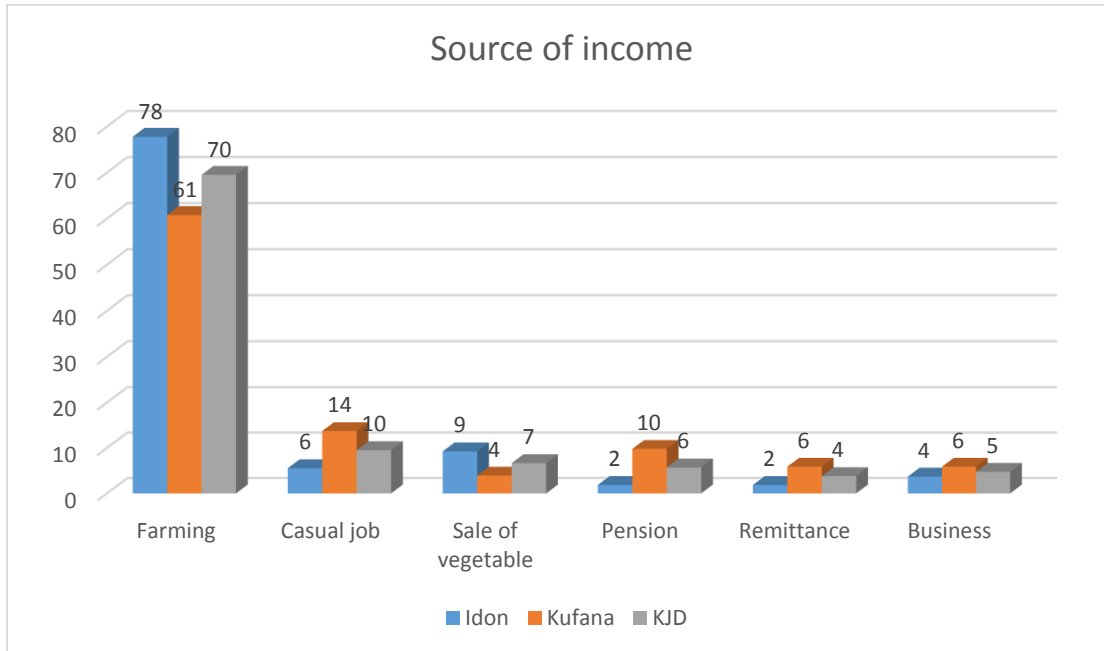
Figure 14: Household source of income

5.1.7 Household income group.

Majority of the households (50%) earn between N5,000.00 - N10,000.00. 39% earn between N11,000.00 - N15,000.00 and 11% earn above N16,000.00. Income plays a vital role in the household. Agriculture was reported as the major source of family income where is spent on taking care of the household needs. The level of income determines how much is used on family expenditure and agriculture.
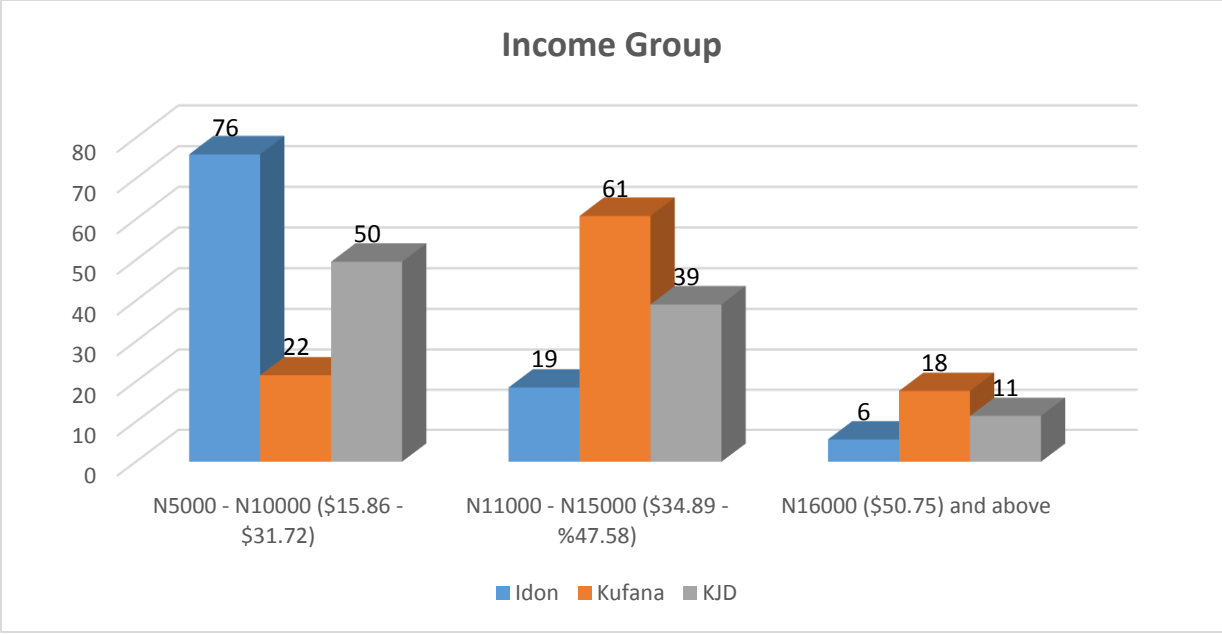
Figure 15: Family Income

5.2 Land size

Majority of the sampled households (46%) owned at least a hectare of land while 38% owned between 3 to 4 hectares. The number of household that own less than one hectare (10%) of land seems to be higher than those who own 5 hectares and above (7%). It should also be noted that about 80% of these land is used for farming purposes.
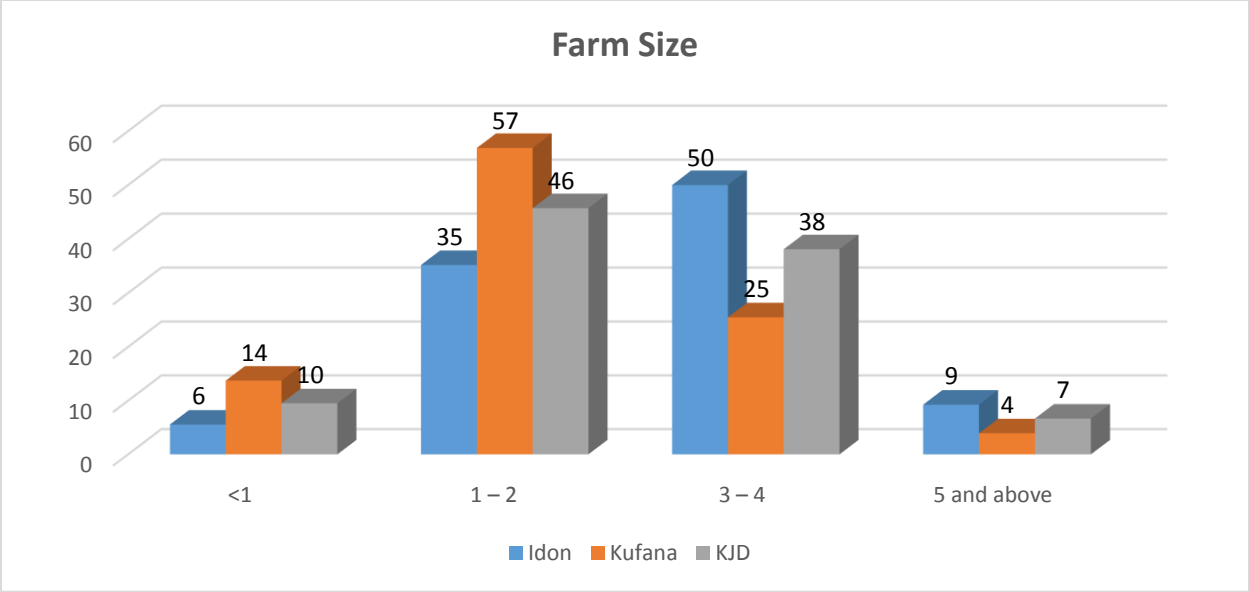
Figure 16: Household farm size

5.2.1 Land ownership

Figure 17 below shows that majority of the sampled household have which they inherited from their ancestors. They represent 87% of the total population while 9% of the household purchased their land but only 5% are renting. It should be noted that both those who purchased and those who are renting indicated that the reason for that is to increase productivity due to limited land ownership in their regions.

Figure 17: Land ownership of households

5.2.2   Farming experience

The respondents were asked to know how long they have been farming. The result indicated that 59% have been farming between 30 – 40 years and 30% reported to have been farming between 10 – 20 years while only 11% admitted to have farming for over 50 years as described in figure 18 below
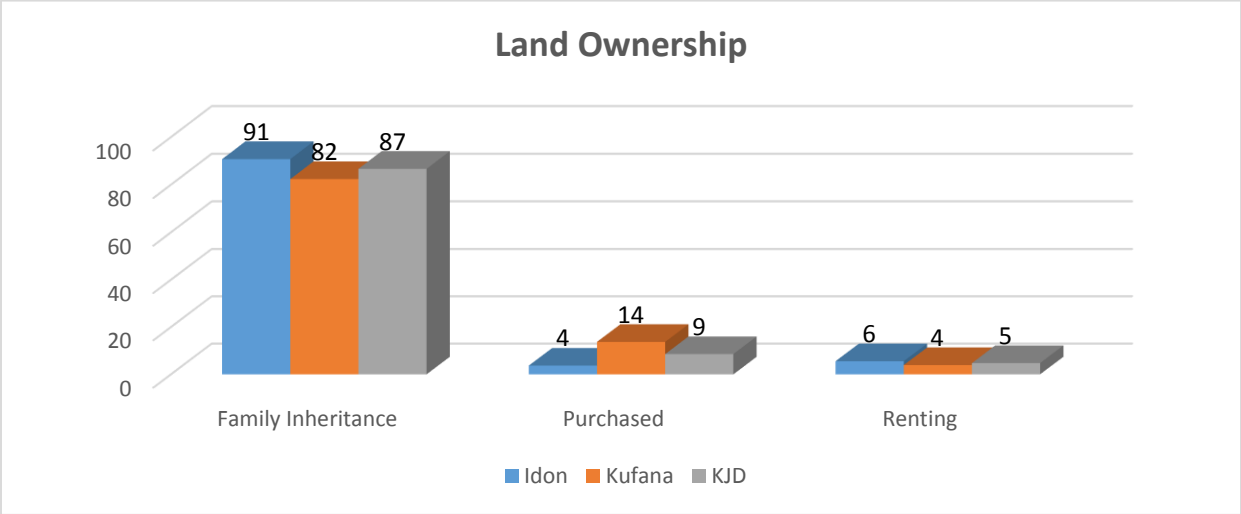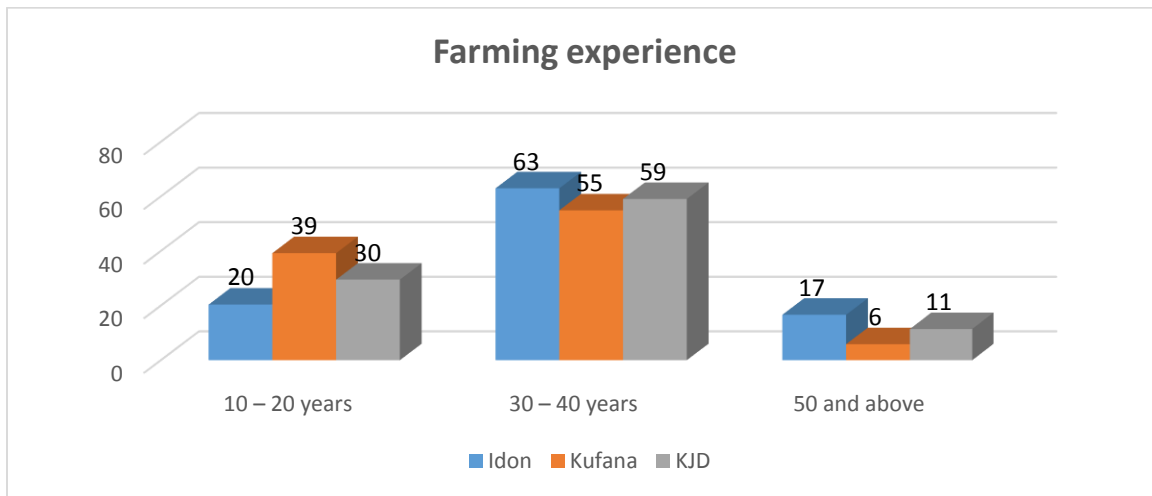

Figure 18: household farming experience

The logic behind this question is to understand if farming experience plays a role on farmer's decision to use fertilizer or not.

5.2.3   Fertilizer use and productivity

Results from the sampled household indicated that 90% of the households use fertilizer often while 10% admitted they do not use fertilizer that often. The reasons given for not using fertilizer always was due to the location of most of their farmland. According to them, farmland which are located closed to the forest along the river bang are somehow rich in nutrients deposits and does not required much fertilizer for crop cultivation on those land. None of the respondents reported not using fertilizer. The result is presented in figure 19 below
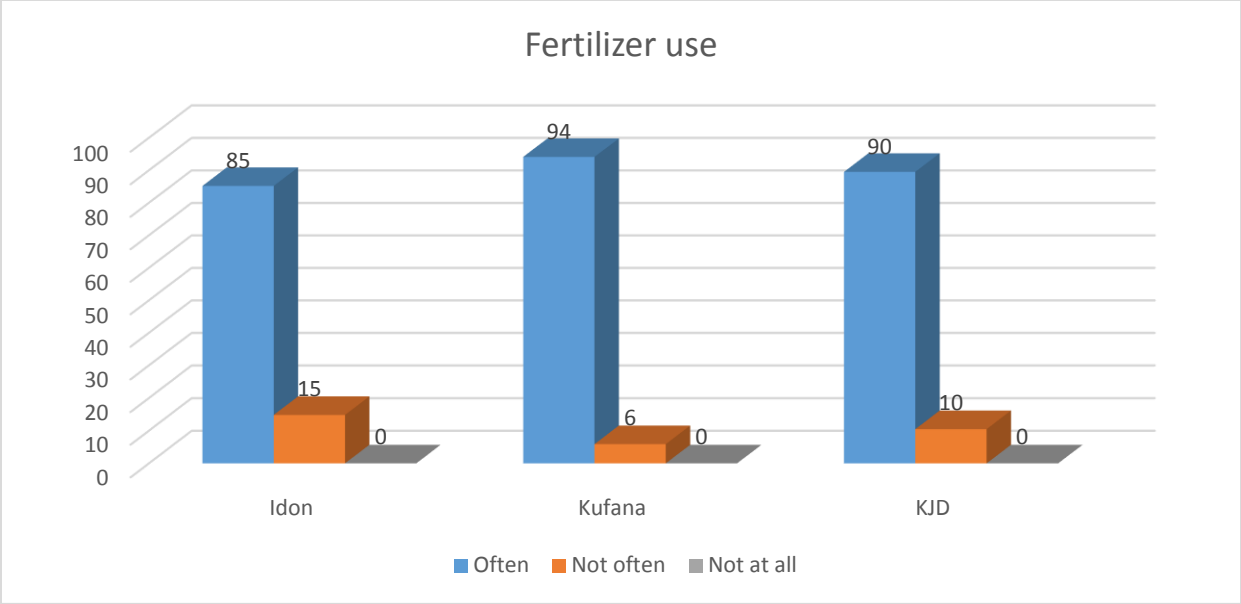
Figure 19: Household fertilizer use

5.2.4 Reason for fertilizer use

Figure 20 below shows the results on the main reason for fertilizer use among households. Each of the sampled household had the opportunity to choose from the provided options. Choosing from what they consider most important. The ranking options were; yield increase, climate argumentation, and support seed. All the households interviewed indicated that, the reason for fertilizer is to increase yield. In addition, the households also admitted soil support and their second reason, 57% of the total population admitted to that while 32% and 11% indicated reasons such as climate argumentation and support for seed.
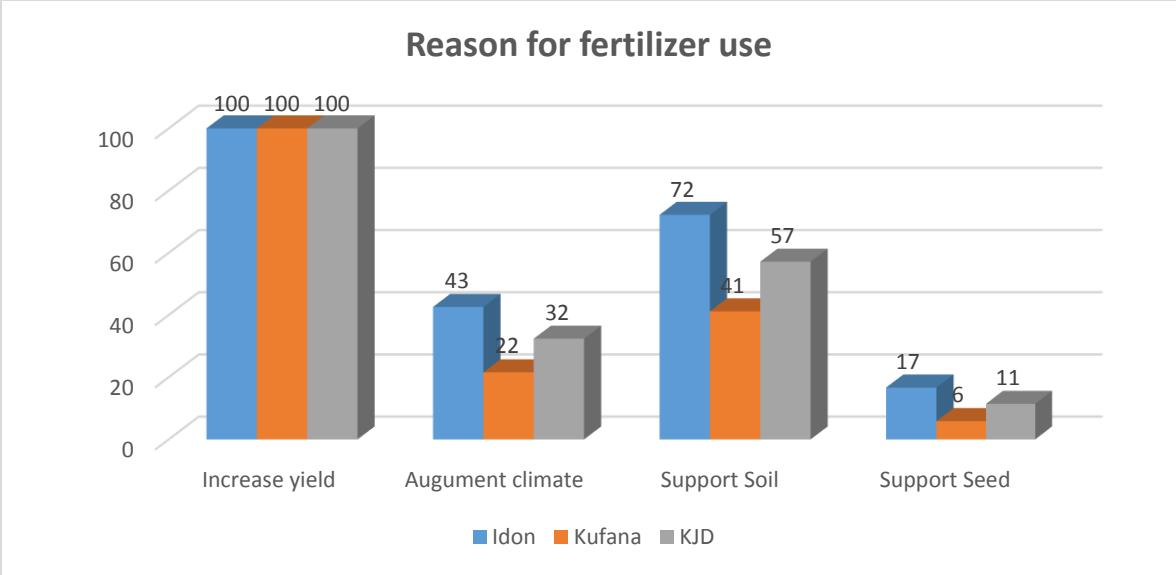
Figure 20: Household reasons for fertilizer use

5.2.5 Type of fertilizer use

In order to increase yield, farmers need to apply fertilizer as several literature sources have indicated weak soil nutrients across several regions in Nigeria including part of Kajuru. Fertilizer is one of the input that presents a larger component of crop production cost. The result presented shows that 73% of the overall studied household used inorganic fertilizer, 16% indicated they used organic fertilizer while 10% admitted they do not use neither organic nor inorganic as presented in figure 21 below
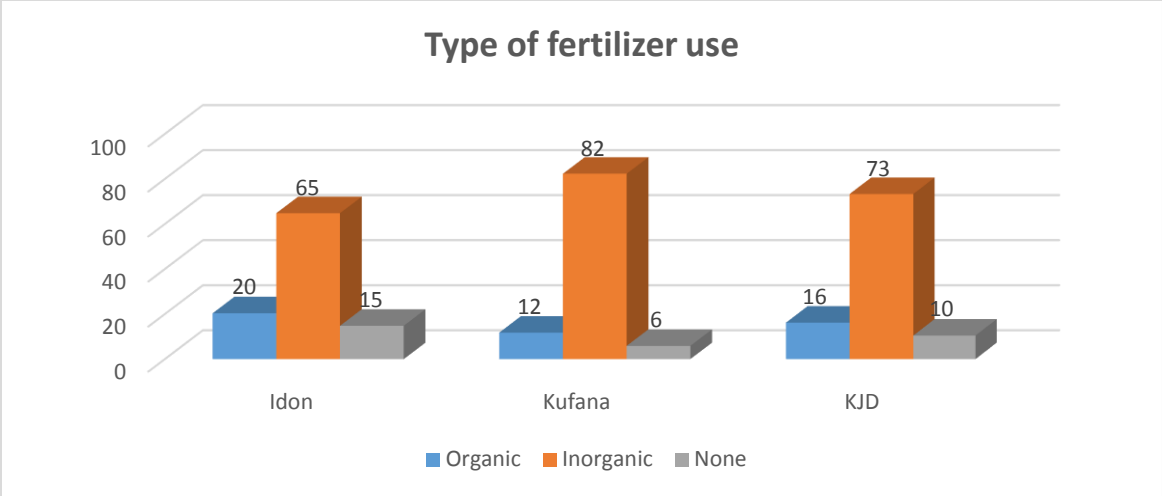
Figure 21: Households choice of fertilizer type

5.2.6 Fertilizer availability

Figure 22 below shows that 81% of the total household interviewed indicated that fertilizer availability is one of the major determinant of output quantity and quality beside weather and soil condition. However, these same respondents admitted that fertilizer is not always available at the time the product is needed. They reiterated, the earlier fertilizer is made available to them, the better chance they have in having a bumper harvest. 10% admitted that not be sure if fertilizer is available or not while 9% admitted that fertilizer has always been available to them at the time they needed it as presented in figure 22 below. This question was raised to determine if fertilizer availability has any impact on the quality and quantity of household's output.
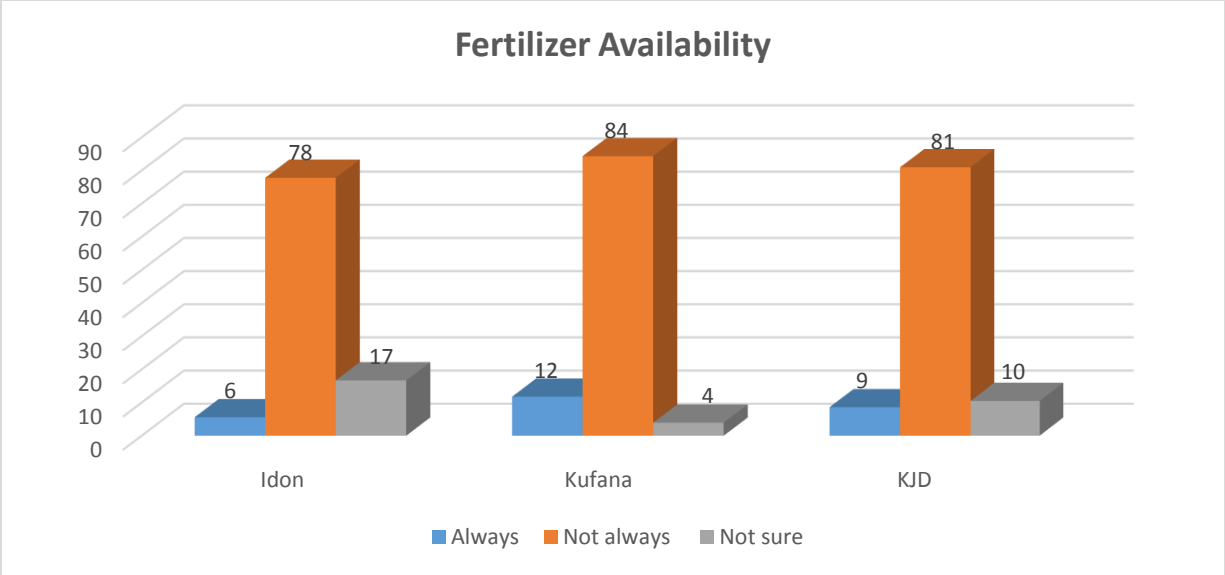
Figure 22: Fertilizer availability

It should be noted that respondents who admitted to the availability of fertilizer happen to be those with easy access to Kajuru town which is a hub for many businesses including fertilizer market.

5.2.7 Quantity of fertilizer purchased

Figure 23 indicated that majority of the sampled households purchase between ½ - 5 bags of 50kg of fertilizer per farming season and 81% of the households admitted to have purchased between that range. Meanwhile, 16% admitted to have purchased between 5 -10 bags of 50kg while 3% reported to have purchased above 10 bags. An average quantity of fertilizer purchased per household in the district is 2. It was noticed that those who admitted to have purchase more fertilizer were those who are active in politics and those who apart from farming, are also engaged in small trading business.
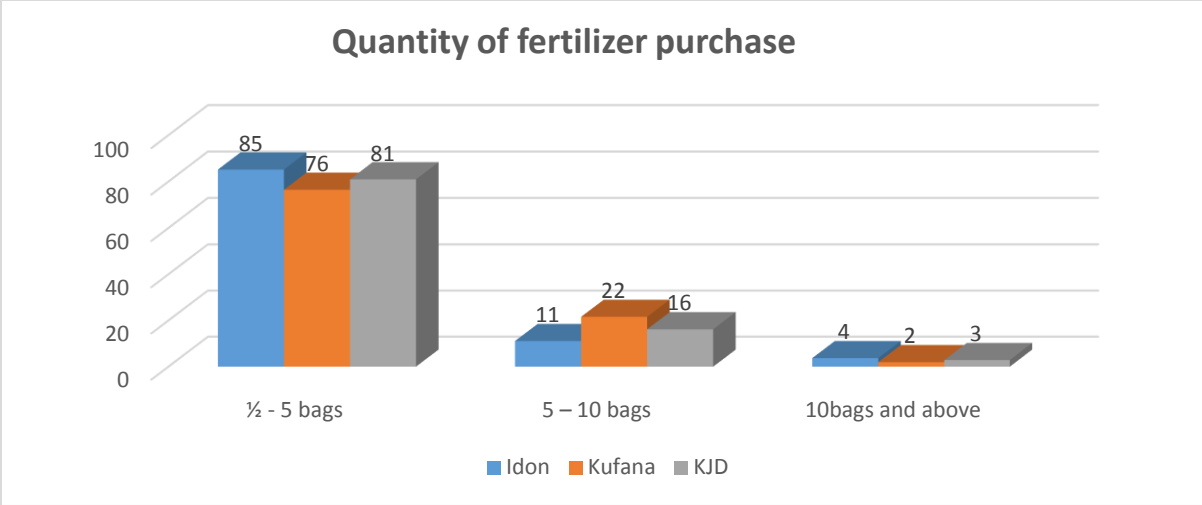
Figure 23: Quantity of fertilizer purchase

5.2.8   Share of fertilizer on major crop

The sampled household indicated that 50% of fertilizer is used in maize cultivation followed by sorghum which consumes 34% in total and 10% goes to millet while 6% goes to rice as presented in figure 24 below. The households further indicated that the millet and rice can be cultivated even with fertilizer but that is not the case with maize and sorghum.
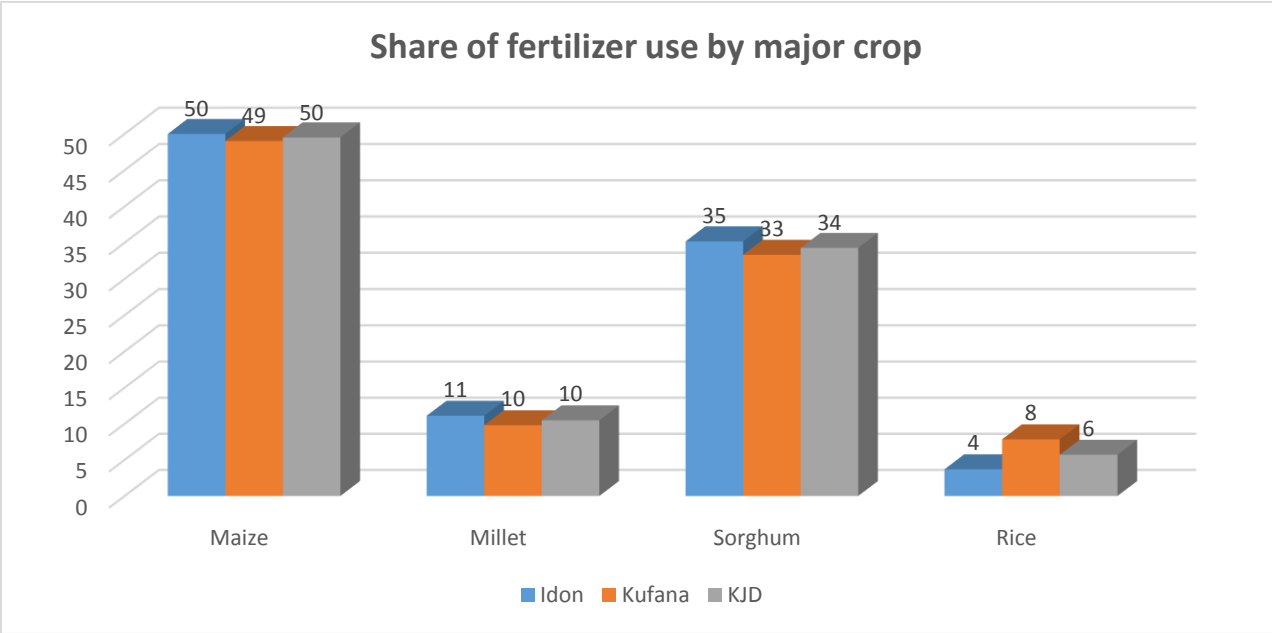
Figure 24: Share of fertilizer on major crops

5.2.9 Crop yield per hectare

In most of the available land, crops were cultivated together which opens door for competition especially for farmers with less plots of land. Most of the crops were grown for food purposes. 45% of the household gained a yield of $1.5 - 2$ tn/ha, 32% gained a yield of 1tn/ha, while 14% $2.5–3$ tn/ha and 9% got above 3.5 tn/ha as presented in figure 25 below
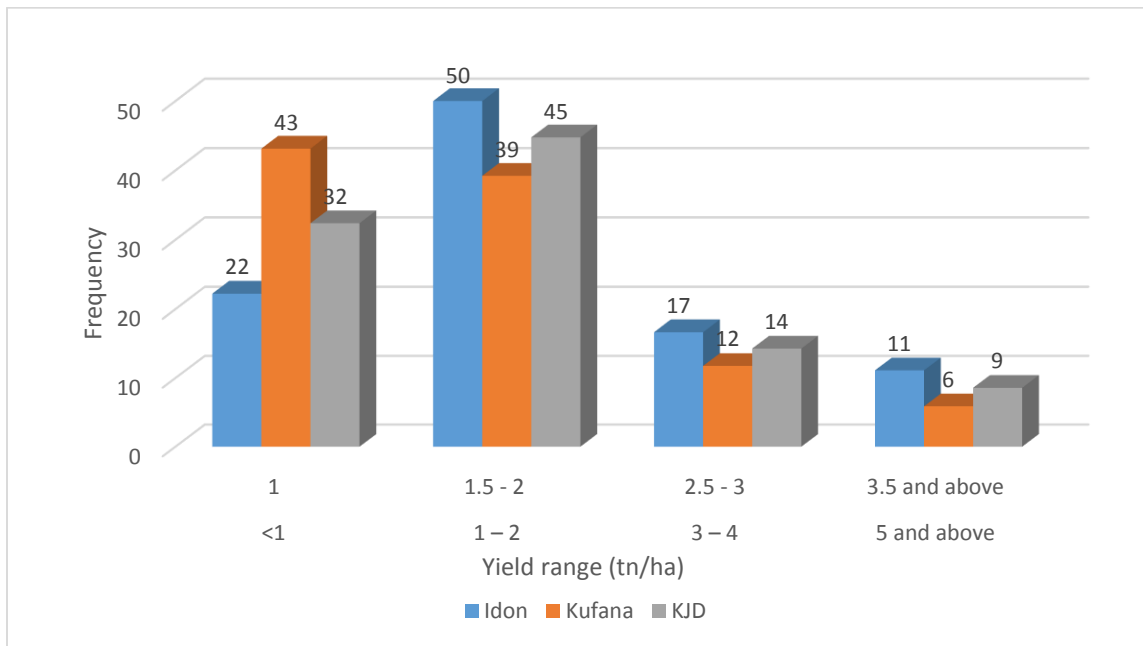
Figure 25: Crop yield per hectare

5.3 Access to fertilizer

5.3.1 Benefit from FGN program

To burst productivity and alleviate poverty, farmers need to source for inputs and one of them is fertilizer. Figure 26 shows that 74% of the household admitted that they have not benefited from the federal government fertilizer program while 26% said they have benefited and 7% were not sure. Although both those who benefited and those who did not benefit from FGN fertilizer admitted to be aware of the federal government' fertilizer program.
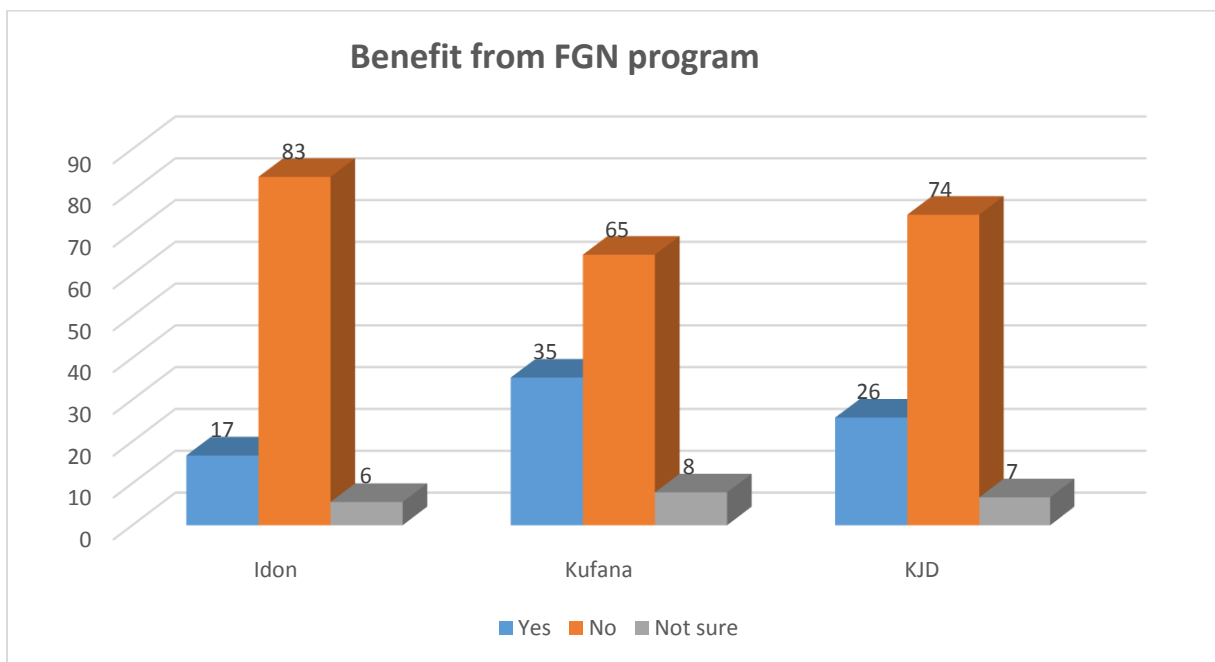
Figure 26: Beneficiary of FGN fertilizer program

5.3.2 Type of FGN Program

From figure 27 shown below, 67% of the sampled household said they were not sure of the FGN program they benefited from. Most of the reason they gave was that they had received fertilizer through the local community head with little or no explanation. However, 27% of the sampled population admitted to have benefited from FGN subsidy program while only 7% benefited from the registration program.
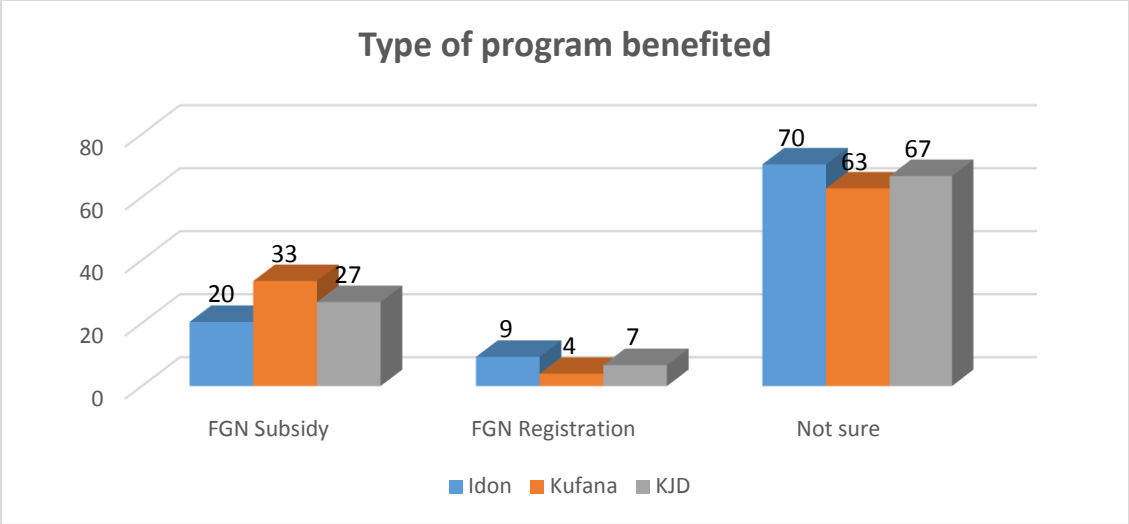
Figure 27: FGN program benefited

5.3.3 Other sources of fertilizer

In figure 28 below majority of the households (24%) indicated that have obtained fertilizer through the state government program while 63% said they got fertilizer through the private market and 13% got it via mixed market.
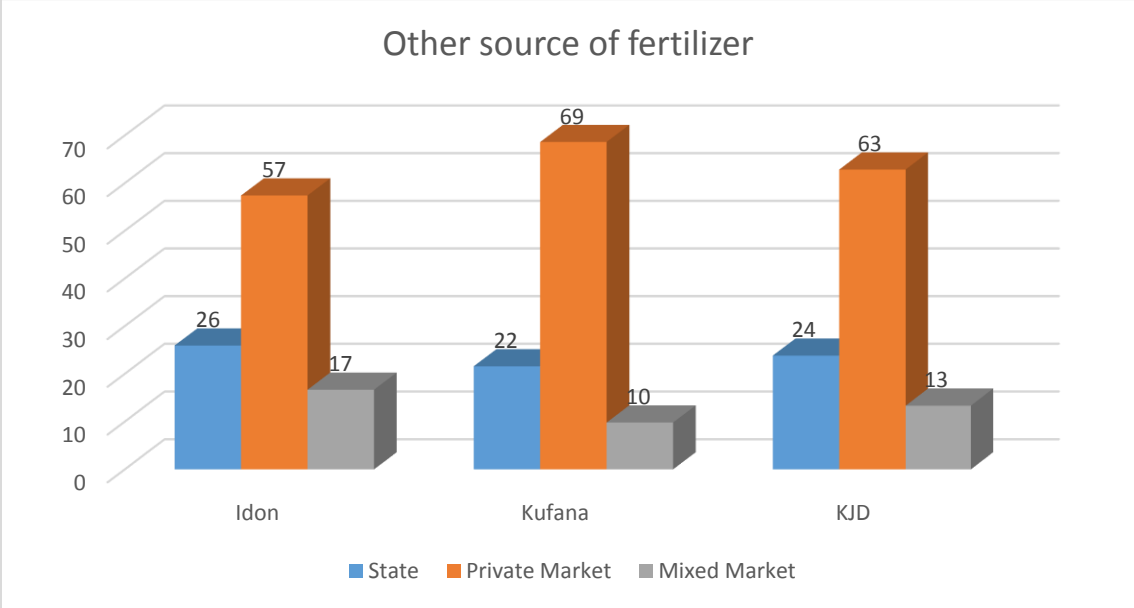
Figure 28: Other sources of fertilizer

5.3.4   State program benefited

Out of the sampled respondents that admitted to have benefited from the state government fertilizer program, 63% attributed this to the state subsidy program while 24% said they were able to obtain fertilizer via the state mobile program and 13% out of the total sampled area admitted that though they were able to purchase fertilizer at a cheaper price they were not sure of the source. This is presented in figure 29 below
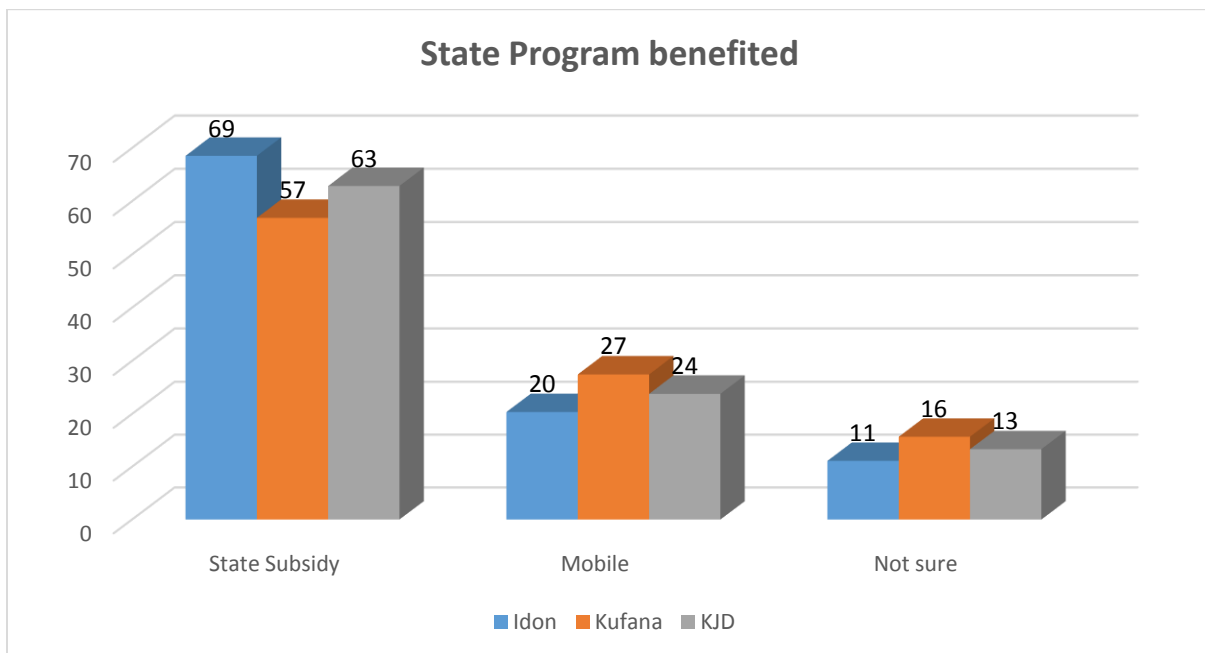
Figure 29: State benefited program

5.3.5   Effect of government' policy on fertilizer

Several literatures have reported the role of government as a hindrance to growth in Nigeria's agricultural sector. And changes in policies has been described as one of the problems. In our effort to understand that, the respondents were asked if government policy has any adverse effect on access to fertilizer in their region. 64% of the respondents said yes compare to 20% that said yes while 16% admitted not be sure if that has any impact on them. The result is presented in figure 30 below
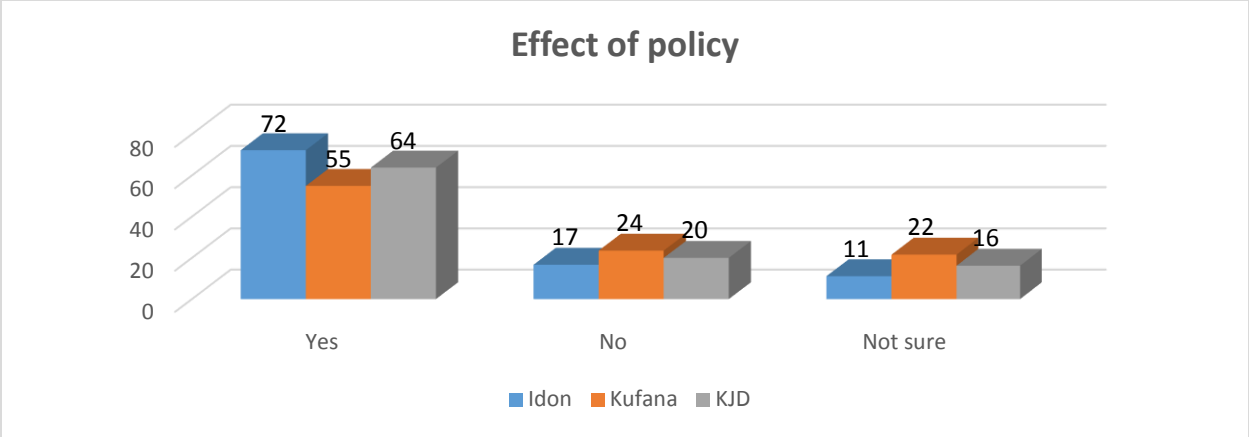
Figure 31: Effect of government policy on fertilizer

5.4 Fertilizer market and constraints

5.4.1 Distance to fertilizer market

Distance to fertilizer market was cited as one of the major constraint in obtaining fertilizer. Sampled farmers admitted that they sometimes had to travel a distance of between 10km to 40km and above in search for fertilizer. 38% of the farmers travelled between 30km to 40km while another 23% admitted to have travelled between 20km to 30km. The shortest distance travelled accounted for only 17% of the sampled population and 22% accounted for the farthest distance travelled in search of fertilizer among the sampled population as shown in figure 32 below
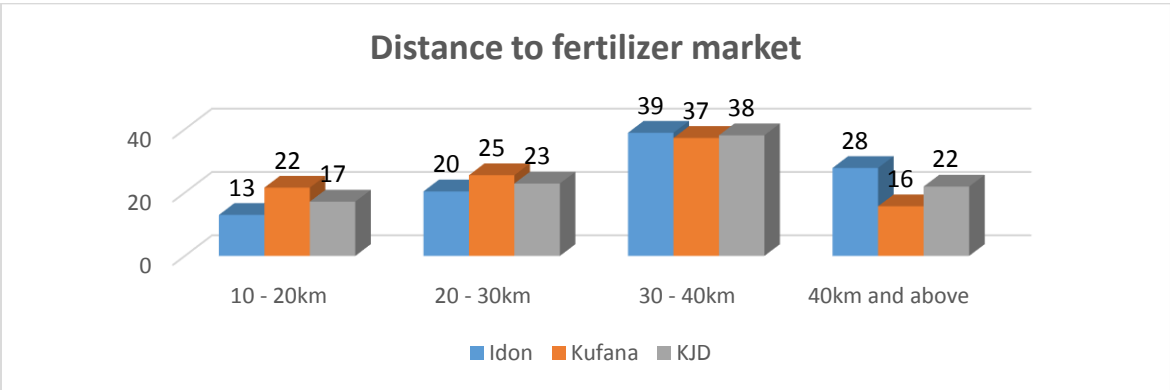
Figure 32: Distance to fertilizer market

5.4.2 Price of fertilizer

Some farmers consider high prices of fertilizer as a factor affecting their use of fertilizer. According to farmer a bag of 50kg fertilizer cost between N3000 to N7000 ($9 – $20) and above depending on the market the farmer is buying from. This price range differs according to location of the fertilizer market, 40% reported buying fertilizer between N3000 to N4000 ($9-$12) per bag while 42% bought the product between N5000 - N6000 ($15 - $18) and 18% reported to have obtained fertilizer above N7000 ($20) as shown in figure 33 below

Price of fertilizer
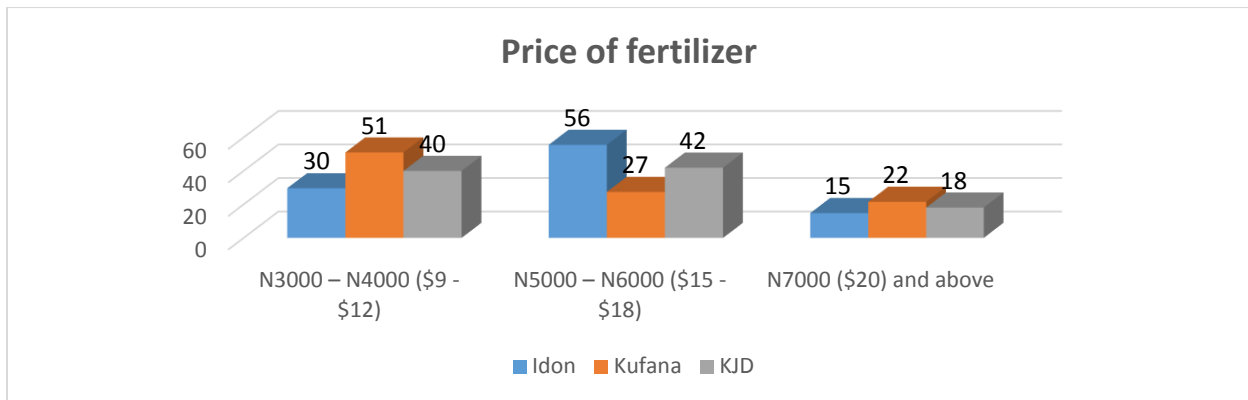
Figure 33: Price of fertilizer

5.4.3 Cost Affordable

In connection with the price of fertilizer, 70% of the sampled population indicated that they hardly afford the cost of a full 50kg bag of fertilizer. Sometimes a bag is shared between 2 – 3 people. Only a handful of 30% admitted they the cost is affordable. This indicated that farmers are sometimes concern about their ability to afford a bag of fertilizer as presented in figure 34 below
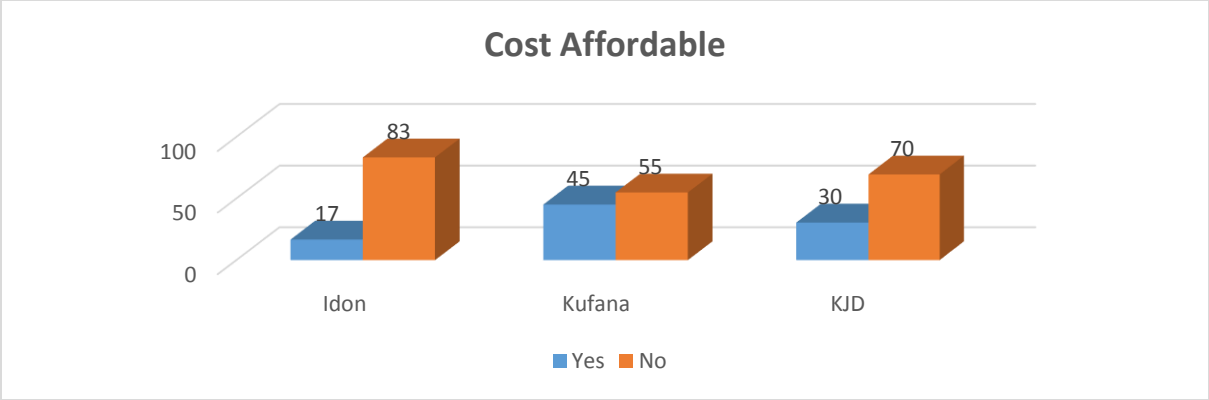
Figure 34: Cost affordability

5.4.4   Purchasing decision

In trying to determine what household considered in fertilizer before deciding on buying one. Majority of the respondents considered fertilizer availability of the product first before price and quality. 59% of the farmers attest to that while 30% said they consider price first and 11% consider quality as their top priority as presented in figure 35 below
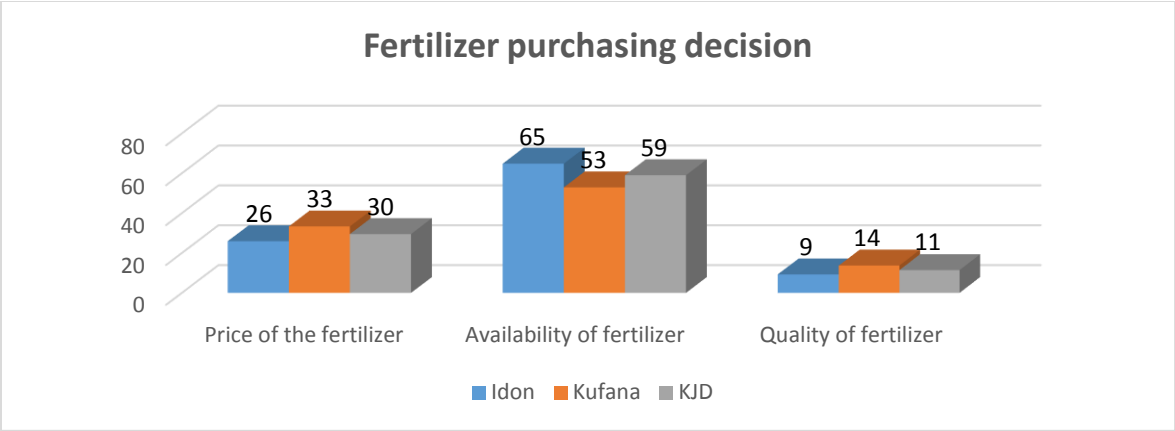
Figure 35: Fertilizer purchase decision

5.4.5 Common fertilizer brand

Figure 36 below shows the common fertilizer brand the sampled farmers preferred. Urea and NPK 15 -15 -15 happens to be among their preferred brand. A total of 48% indicated that they prefer Urea while 35% preferred NPK 15-15-15. Other brands including potassium nitrate and ammonium sulphate recorded 3%, 7% and 8% respectively.
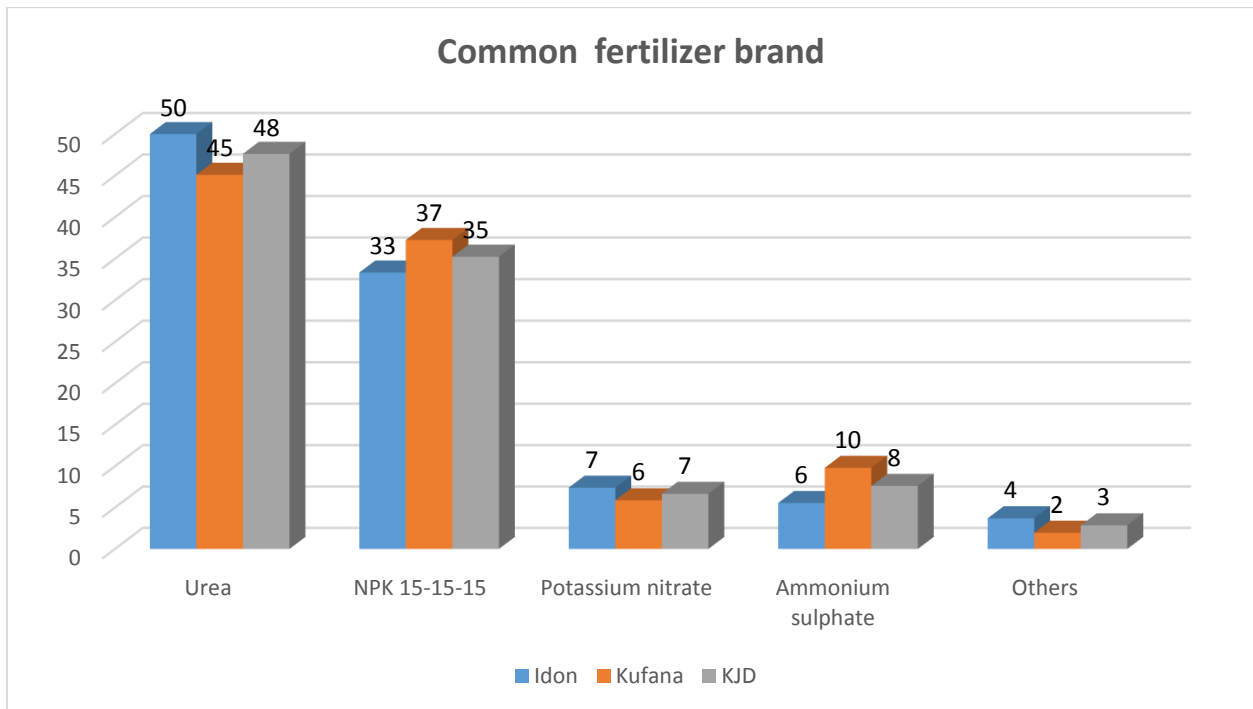
Figure 36: Fertilizer brand

5.5 Community and cooperative constraints

5.5.1 Community problems

Soil quality, bad road network and lack of government support has been identified as major constraints affecting fertilizer consumption in many farming communities in Nigeria including those in Idon and Kufana. This was confirmed as 56% of the sampled farmers in the regions indicated that lack of government support is one among the problem their communities are faced with. 18% indicated soil quality and bad road, 14% admitted low input use while lack of irrigation

and technical as well as lack of organized market accounted for just 5% as presented in figure 37 below
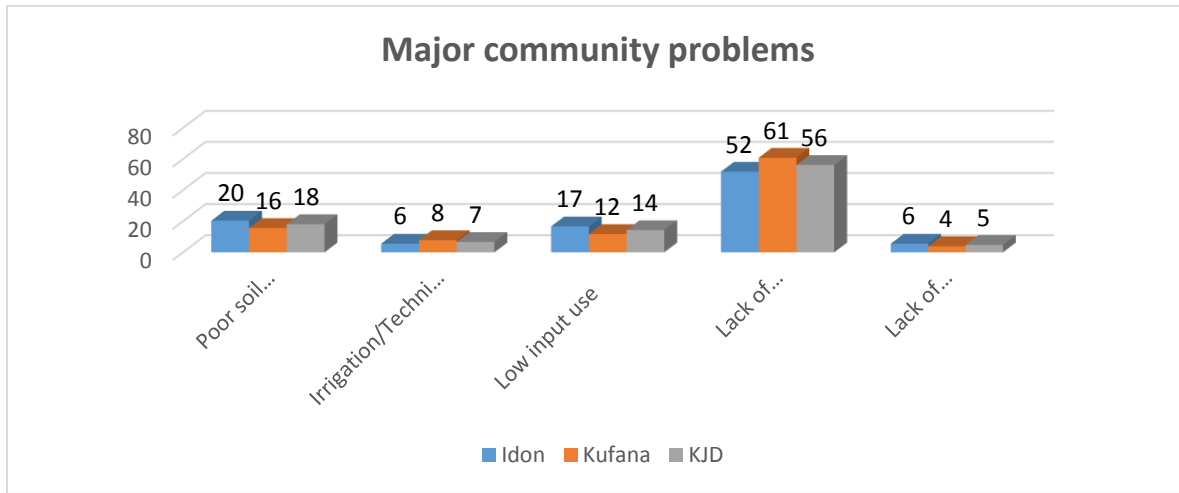
Figure 37: Community problems

5.5.2 Effect of community problems on agricultural productivity

Figure 38 below indicated that the common community problems have an adverse consequence on agricultural productivity. 88% of the sampled farmers attest to that while 12% did not consider those as hindrance to agricultural productivity.
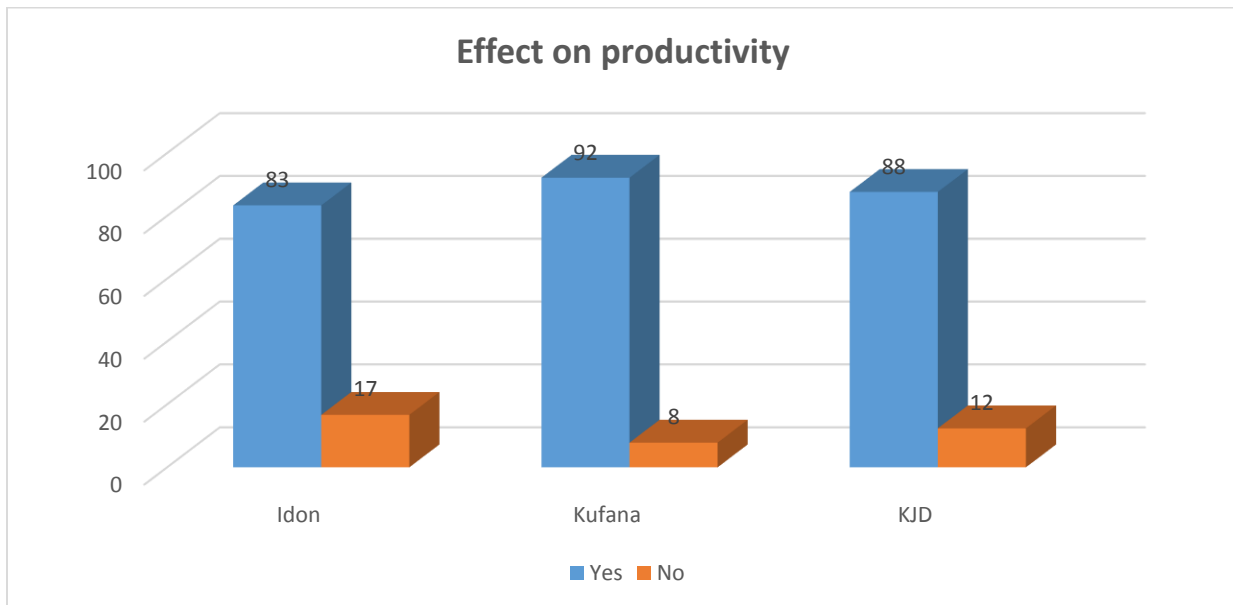
Figure 38: Effect on productivity

5.5.3   Member of cooperative

From figure 39 below, 66% of the sampled size reported that they do not belong to any farmer's cooperative while 34% admitted to belong to one farmer's cooperative. Cooperatives have been cited as one of the major player in community development but in many communities in Africa, the role of farmer's cooperatives has not been effective.
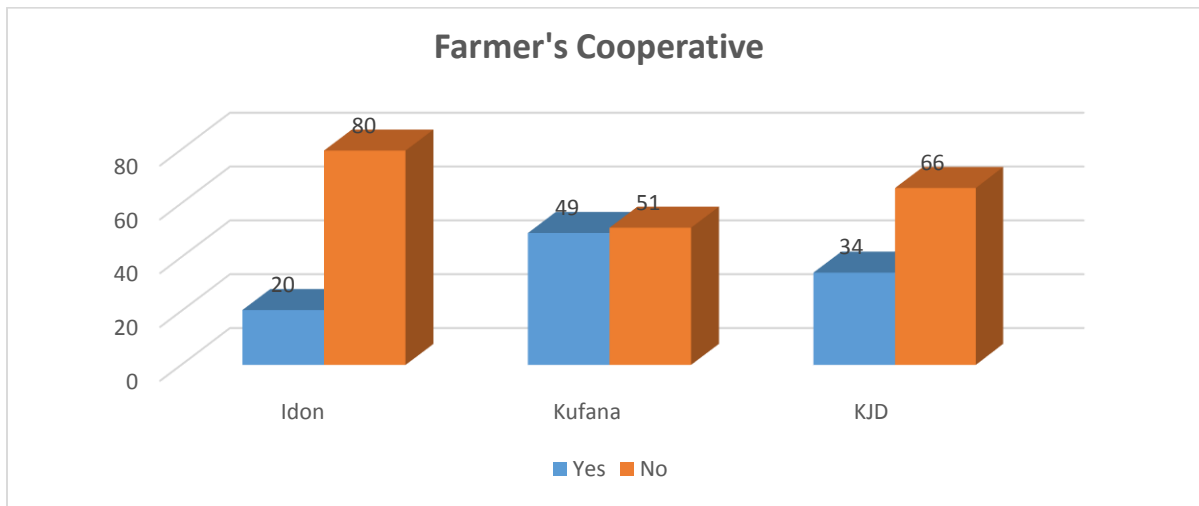
Figure 39: Farmer's cooperative membership

5.5.4   Assistance from cooperative

The idea of joining a cooperative by many farmers is to be able to obtain loan or any assistance they will require either to buy inputs or to any items they will need to enhance productivity. From the sampled farmers that admitted to be a member of cooperatives, 69% of them admitted to have received assistance in the form of loan from the cooperative they belong while 31% reported not to have received any assistance. In addition, those who admitted not have received any assistance said not that they were denied such assistance but they did not apply for any that was the reason the chose no as an option. The result is presented in figure 40 below
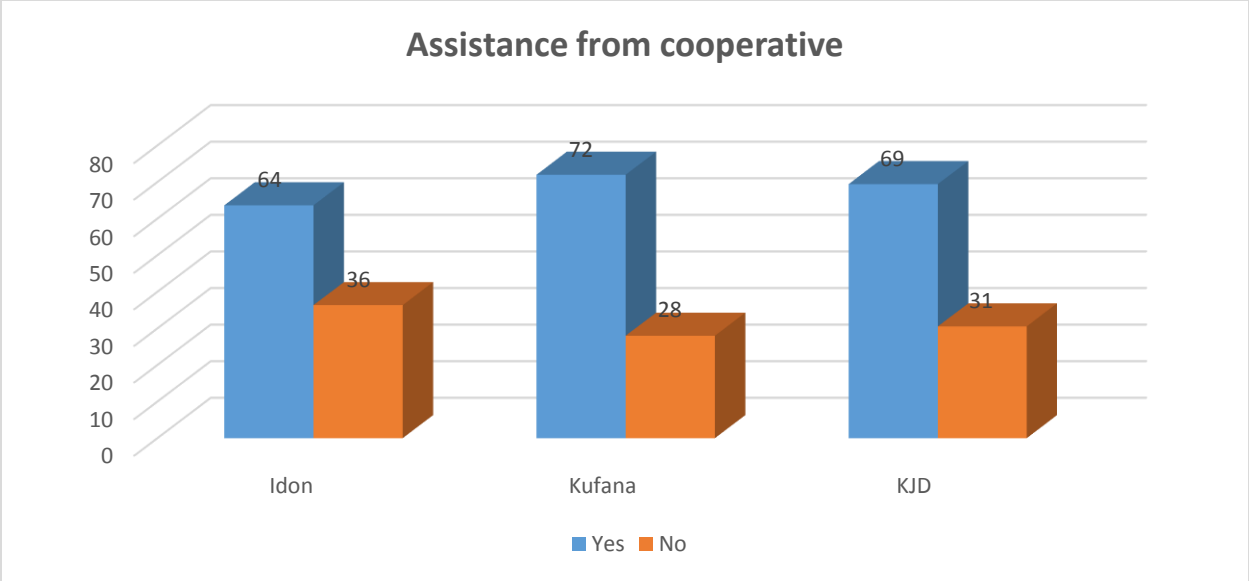
Figure 40: Assistance from cooperative

6. Discussion

The study revealed that 78% of the sampled household heads were male compare to while 22% was headed by female. Traditionally, households in Nigeria's setup are usually headed by male. Although with civilization and shift in traditional believe, there are quite a few cases where households are headed by female. The rise in women empowerment and the fight for gender equality has seen many women rising to take over household responsibilities in the absent of their husbands or in cases where their male counterpart cannot fulfill their duties due to sickness.

Majority of the household heads were between the ages of 35 to 55 years. The major implication of this result is that most of the sampled size were within the economically active age of their lives. This finding is similar to that of Adinya (2009) which stated that people within the ages of $40-60$ tend to be independent and more economically active those who are less than 20 years and above 60 years of age.

Literacy level amongst household head was quite high at 86%. This was attributed to their ability to obtain formal education as 55% of them indicated to have attended elementary school where they were able to learn how to read and write. In almost every research, education level is used as an indicator to measure the ability of the sampled population to process and utilize information available to them. Educated people tend to understand, process and utilize useful information that is significant in making decision related to input choice, input application and output marketing (Tabie et al., 2010). This ability according to Eterline (2003), can triggered the willingness to take part in several markets of their choice. On the other hand, education also serves as a complement to extension worker's advice in that most educated farmers can understand instructions on agricultural issues and be able to apply the knowledge and skills impacted on them effectively compare to their counterparts with no education Mangisoni (1989); Lanyintuo and Mekuria, (2005). It is believed that most educated farmers stand a better chance of understanding instructions related to extension services and adoption of new technology compare to uneducated farmers (Minde et al., 2008). Literacy level also stands as a barrier to farmer's managerial skills however most farmers in Idon and Kufana were able to exhibit their managerial skills due to high level of education.

Household size sometimes could have a positive or negative impact on family labor considering the fact that smallholder farmers depend on household labor Edriss and Simtowe (2003). The larger the household size, the higher the labor supply and vice versa. The family size in the study area was 5 members on average with 1 person as minimum and maximum 12 persons per household. Labor supply is usually linked to family size as smallholder farmers do not practiced mechanized farming system.

Farming was admitted to be the major source of household income as 70% of the sampled household admitted to that. Crop production generates about 25% of their income. However, majority of the household are growing crops on a subsistence level with low or no degree of market concentration. The study of Tilman and Bruck (2007) highlighted that involvement in more subsistence practices have a negative impact on family income because little is left to sold in the market to generate income. According to Maxwell et al., (1992) households earn income either by selling their farm produce or via off farm activities.

Majority of the households (87%) indicated to have possessed at least a hectare of farmland. This means on average each household owned about 2.50 hectare which a larger part of it is dedicated to crop production. The percentage of land dedicated to crop production is an important factor for household when making decision on marketing of their product because a percentage increase in production leads to a percentage increase in output marketing (Eterline (2013). Therefore, farmers who cultivate more land, stand the chance of producing excess beyond their personal household consumption needs and are likely to sell their excess crop output in the market and in large quantity.

Fertilizer use has been linked to high productivity Liverpool-Taste (2012). The use of fertilizer is indirectly connected to higher economic growth and poverty reduction because increase in agricultural productivity has the tendency to grow the economy and reduce poverty Dethier and Effenberger, (2011). Result from the sampled area indicated that (90%) of the farmers admitted to using fertilizer while 10% said they do not use fertilizer. The reason for using fertilizer according to the respondents was to increase yield and support the weak nature of the soil. In a similar study Bumb and Baanante (1996) stressed that fertilizer use has the ability to increase yield, replenish the soil and enable the adoption of high-yielding variety of seed. In additional, the Green Revolution across Asia was credited to increase in input use such as fertilizer and seed and it was

reported that growth in production grew to 3.57% annually during the period between 1967 to 1982 Hazell (2009). However, 10% of the respondents reported not using fertilizer often while none of the respondents admitted not using fertilizer at all. This single reason has highlighted the importance of fertilizer in crop production and agriculture in general.

Fertilizer availability was discovered as a major constrain because crop production depends on factors such as fertilizer availability, its level of availability and price level. Due to the unstable policy environment, private sector invests little in fertilizer supply as compare to other sector. 81% of the total household interviewed admitted to non-availability of fertilizer at the time it is needed most. This scarcity they admitted sometimes affects their output especially for crops like maize and sorghum that requires fertilizer at least twice before harvest. 10% indicated not be sure while just 9% admitted to have always obtain fertilizer at the time they needed it. Fertilizer availability is somehow linked to the state of infrastructure which links villages to major fertilizer markets around. According to Ahmed and Hossain, (1990) improvement in infrastructure such as road, can increased the intensity in the use of modern agricultural technologies, fertilizer, improved seeds and irrigation facilities in rural developed villages than underdeveloped ones. The availability and easy access to road networks is crucial in agricultural production process because road networks provide easy access to input and output markets Okoboi and Barungi (2009).

Distance to fertilizer market was identified as one of main constraints that affects farmer's fertilizer purchasing power. 38% of the respondents identified distance to fertilizer market as a challenge as they have to travel between 30km to 40km rough road to look for fertilizer, 23% travelled between 20km to 30km and 17% travelled a distance 10km to 20 which is the shortest distance while 22% travelled a distance of above 40km. The study of Olwande et al., (2009) described distance to fertilizer as a constraint that is able to affect farmer's fertilizer consumption leading to decrease in total output of major crops such as maize and sorghum. The role of distance to market was also highlighted in the study of De Clerk and Ross (2012) where they described distance as a factor capable of affecting farmer's ability to buy or sell their products in the market. The result identified similar constraints in the study of Adinya (2009) and Hamidu et al., (2006) whose findings revealed similar factors militating against effective marketing in the groundnut industry. It is believed that households with easy access to market spend less time and less money getting their products to the market or buying input from the market to their place of residence. Hence the

correlation between distance and high cost of transport creates a barrier to farmer's participation in the market as confirmed in the study of Alene et al., (2000).

The share of fertilizer on major indicated that 50% of the total fertilizer goes to maize production while sorghum takes a share of 34%. Millet and rice shares a small portion of just 10% and 6% respectively. The farmers confirmed that maize unlike other crops, requires to be fertilized at least per farming season. In their study in Sub-Saharan Africa, Heisay and Mwangi (1996) gathered that maize derives fertilizer consumption in many African countries accounting for the majority of total fertilizer consumption which the larger part is caused by large increase in consumption in Nigeria.

Access to fertilizer serves as a key to ensuring high productivity. Farmers with easy access to fertilizer tend to enjoy the benefit that comes with it. However, farmers cited access to fertilizer as a constraint but also indicated that they were able to access fertilizer although access to fertilizer via the government subsidy program was quite low as only 26% admitted to benefit from the federal government fertilizer program. 74% of the total respondent claimed they have not benefited from the program while 7% were not sure. Most of the farmers were unable to provide major reasons for not benefiting from the federal government fertilizer program however, the common reason given for that was corruption on the part of those in power. It should be noted that Nigerian government has allocated a large portion of agricultural capital spending on fertilizer Mogues et al. (2012) aiming at alleviating the suffering of local farmers rendering the program inefficient Takeshima et al. (2013). Farmers also reported to have obtain fertilizer either through the state government, private market or mixed market.

On a general note, the ability of farmers to be able to acquire fertilizer is perhaps the most important factor which many literatures have not capture well in many cases.

Price is essential and plays a crucial role in marketing decision for both the buyer and the seller. From the sampled size, 40% reported buying fertilizer between N3000 to N4000 ($9-$12) per bag while 42% admitted buying fertilizer between N5000 - N6000 ($15 - $18) and 18% reported buying it above N7000 ($20). Some consider this price high above normal which is usually attributed to high transaction cost such case was also reported in Gregory and Bumb (2006) where they recorded that high transaction cost of fertilizer caused by high transportation cost and high interest rate could lead to high price of fertilizer. With limited resources, farmers are left tough choice sometimes to make which could lead to buying fertilizer in small quantity. Torero and

Chowdhury (2004) and Morris et al. (2007) affirms that, the price of fertilizer and farmer's inability to raise the needed resources to purchase fertilizer in large quantity is regarded as one of the problem that pushed farmers into paying an exorbitant amount on fertilizer. Because if farmers are aware of the importance of fertilizer to them, they may not be able to acquire it if they have limited resources Morris et al. (2007). Despite the hike in price majority of the farmers consider non-availability of fertilizer as constraint compare to price in that 59% of them admit to making fertilizer available to them at the time of need compare to 30% who consider price when making fertilizer purchasing decision while 11% consider quality.

Urea and NPK 15-15-15 was reported as the preferred brand. 48% of the famers chose Urea and 35% went for NPK 15-15-15 while 8% and 7% went for Potassium Nitrate and Ammonium Sulphate.

Problems related to soil quality, bad road network and lack of government support was identified as major constraints affecting agriculture in these communities as 56% of the farmers indicated that lack of government support is one among their major. Government support according to most the farmers covers a lot of areas including some that were presented as option. 18% indicated soil quality and bad road, 14% admitted low input use while lack of irrigation and technical as well as lack of organized market accounted for just 5%. And farmers admitted that all of the listed problems in the communities has an adverse impact on agricultural productivity.

7. Conclusion and recommendation

This research investigated the impact of fertilizer use on agricultural production with a specific attention to factor that affects farmer's ability to access fertilizer taking into consideration their socio-economic characteristics of the farmers. Although all the sampled households shared similar constraints, however, their perception about fertilizer differs as they tend to view the constraints in a different way which reflects on most of their answers. The researcher was able to identify few factors that seems pressing to farmers. Fertilizer availability, the price of fertilizer, distance of fertilizer market was among the major constraints farmers were able to identify. The role of government was considered weak and ineffective leading to farmers paying more at the private market to purchase fertilizer.

Community issues such bad road was blamed for the hike in fertilizer price. However, there was no bias in fertilizer use against women. The sample area also shared a common feature in the sense that they were all subsistent farmers with market orientation.

On a general note, the ability of farmers to be able to acquire fertilizer is perhaps the most important factor which many literatures could not capture well in this case. Because even if farmers are aware and have confidence that fertilizer consumption is profitable to them, they may not be able to acquire it if they have limited or no cash at all and if access to credit is limited too (Morris et al., 2007). In an average agricultural household, the major source of income includes earnings from wages, selling of farm products and livestock.

In conclusion, the options left for Nigeria to increase food production are quite limited in both the supply of land area and water. Therefore, the country must either place more of its land under intensive cultivation, increase yields on existing land, or do both.

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1. **Appendix**

Draft Questionnaire Survey

Fertilizer Access and Distribution

1. **Are you a practicing fulltime farmer?**

❖ Yes   (   )

❖ No   (   )

2. **Do you use fertilizers in your farming activities?**

❖ Yes   (   )

❖ No   (   )

3. **What type(s) of fertilizers do you use?**

❖ Organic fertilizer   (   )

❖ Inorganic (chemical or synthetic) fertilizer   (   )

❖ Not sure of the type   (   )

4. **What is the main reason for your use of fertilizer in your farming activities?**

❖ To increase yield in crops output   (   )

❖ To augment for climatic failures   (   )

❖ To provide nutritional support for the soil type   (   )

❖ To support seed variety   (   )

5. **Do you consider the availability of fertilizer as a determinant of the quantity and quality of your farming output?**

❖ Yes   (   )

❖ No   (   )

❖ Not sure   (   )

6. What is the level of fertilizer availability in your region of the country?

❖ Always available on demand   (   )

❖ Rarely available on demand   (   )

7. How many bags of fertilizer do you purchase per farming season?

❖ ½ - 5 bags   (   )

❖ 5 – 10 bags   (   )

❖ 10bags and above   (   )

8. What are the major crops fertilizer are used on mainly?

❖ Maize and Sorghum   (   )

❖ Rice and Millet   (   )

❖ Beans and Soya beans   (   )

❖ Yam and Cassava   (   )

9. Have you ever benefited from any FGN fertilizer assistance program?

❖ Yes   (   )

❖ No   (   )

10. Have you benefited from any FGN fertilizer program?

❖ Yes   (   )

❖ No   (   )

11. If your answer is 'Yes' above, what type of government fertilizer program did you benefit from?

❖ FGN fertilizer subsidy program   (   )

❖ FGN fertilizer registration program   (   )

❖ Not sure   (   )

12. Are you aware of any fertilizer assistance program in your state or local government?

❖ Yes   ( )

❖ No   ( )

13. If your answer to the above question is 'Yes', which state and local government program are you aware of? Please list two:

(i)   _____

(ii)   _____

14. What are the other sources of you obtained fertilizer from?

❖ State government

❖ Private market

❖ Mixed market

15. What state program did you benefit from?

❖ State subsidy

❖ Mobile registration

❖ Not sure

16. Do you think the constant changes in government policy on agriculture affects fertilizer distribution in your area?

❖ Yes

❖ No

❖ Not sure

17. What do you consider as the most important determinant of your fertilizer purchasing decision?

❖ Price of the fertilizer   ( )

❖ Availability of fertilizer   ( )

❖ Quality of fertilizer   ( )

18. How far do you have to travel to purchase the fertilizer you required for your farming activities?

❖ Between 0 - 5km   ( )

❖ Between 5 - 15km   ( )

❖ Between 16 - 30km   ( )

❖ Above 30km   ( )

19. How long have you been farming?

❖ <5 years

❖ 5 – 10 years

❖ 10 – 20 years

❖ 21 and above

20. What are the major problems farmers in your community faced?

❖ Poor soil quality

❖ Bad road

❖ Lack of irrigation facilities

❖ Lack of technical support

❖ Low input use

❖ Lack of government support

❖ Lack of organized market

21. Do all of the above mentioned issue affect agricultural productivity in your area?

❖ Yes

❖ No

22. What brand of fertilizer do you usually use?

❖ Urea

❖ NPK 15-15-15

❖ Potassium nitrate

❖ Ammonium sulphate

❖ Others

23. Which of the crops consumed more fertilizer?

❖ Maize

❖ Millet

❖ Sorghum

❖ Rice

24. How can you describe your yield per hectare in tonnes?

❖ 1

❖ 1.5 – 2

❖ 2.5 – 3

❖ 3.5 and above

25. How much does a bag of fertilizer cost in your region? (In Naira)

❖ N3000 – N4000

❖ N4000 – N5000

❖ N5000 and above

26. Do you consider the cost reasonable?

❖ Yes   (   )

❖ No   (   )

27. What is your source of income?

❖ Farming

❖ Casual Job

❖ Sales of vegetable

❖ Pension

❖ Remittance

❖ Business

28. Which income group do you belong to?

❖ N5000 – N10000

❖ N10000 – N15000

❖ N15000 and above

29. Do you belong to any farmers cooperative?

❖ Yes

❖ No

30. If Yes. Have you ever received any assistance from this group?

❖ Yes

❖ No

31. What determine high productivity for you? (Multiple options)

❖ Fertilizer

❖ Improved seed

❖ Rainfall

❖ Farm size

❖ Soil quality

32. What is the size of your farm in ha?

❖ <1

❖ 1 – 2

❖ 3 – 4

❖ 5 and above

33. How did you obtain the farm?

❖ Family inheritance

❖ Purchased

❖ Renting

34. Is there any differences in output in the season you apply fertilizer and the season you do not?

❖ **Yes**

❖ **No**

35. What is the deference?

a. when you apply

❖ **Decrease ( )**

❖ **Increase ( )**

b. when you do not

❖ **Decrease ( )**

❖ **Increase ( )**

Demographic Information

36. Age?

❖ Between 18 – 25years   ( )

❖ Between 26 – 35years   ( )

❖ Between 36 – 45years   ( )

❖ Between 46 – 55years   ( )

❖ Above 56years   ( )

37. Gender?

❖ Male   ( )

❖ Female   ( )

38. Location in the country?

❖ Northern region   ( )

❖ Southern region   ( )

39. Educational background?

❖ University educated   ( )

❖ High school educated   ( )

❖ Elementary school educated ( )

❖ Not formally educated   ( )

40. Marital Status

     ❖ Married

     ❖ Divorced

     ❖ Widow

     ❖ Single

41. Household Size

❖ 1 – 5

❖ 6 – 10

❖ 10 and above