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SPATIAL APPRAISAL OF PROBLEMS AND PROSPECTS OF FERTILIZER USE FOR AGRICULTURE ON THE ENVIRONMENT IN MBIERI, MBAITOLI LOCAL GOVERNMENT AREA, IMO STATE NIGERIA.

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ABSTRACT: *This study appraises the spatial problems and prospects of fertilizer use in agriculture on the Environment in Mbieri, Mbaitoli Local Government Area of Imo State. Structured questionnaires were sampled in the each villages randomly selected from the seven autonomous communities of Amaike-Mbieri, Awo Mbieri, Ezi-Mbieri, Ihitte Isi-Mbieri, Obazu Mbieri, Obi-Mbieri and Umueze-Mbieri for collection of data. The data were analysed using descriptive statistical tools of tables, charts and graphs. The outcome showed that 71.2% of the farmers do not have University Education. All the kinds of fertilizer in use in the study area contain Nitrogen with NPK 20-10-10 the most sought-after (35%). The major source of fertilizer in the study area is the open market while 54% of the farmers say they prefer the application of fertilizer NPK for replenishing lost soil nutrients. Finally, 60% of the Farmers in the study area use surface broadcast method in application of fertilizer NPK on their farms. However, some of this nitrogen compounds are washed down through surface runoffs causing pollution and eutrophication of the Ecosystems and water bodies. Government should set up research centre for Fertilizer use in Agriculture where farmers can be equipped with adequate knowledge of the best way to use fertilizer NPK while sustaining the environment.*

KEYWORDS: Fertilizer NPK, Farmers, Soil fertility, pollution of Ecosystem, Mbieri.

INTRODUCTION

In Nigeria agriculture is the main source of livelihood. As in most other developing countries it is dominated by small-scale farm producers (Oladebo, 2004). Throughout history, people have constantly been trying to find more efficient ways to provide food resources to match the demand of their increasing numbers.

One major difficulty facing agriculture in Nigeria today is that the fertility of most soils is generally low and the problem is how to improve soil fertility and increase food production (Azagaku and Anzaku, 2002). It is largely through the use of inputs such as soil amendments in the form of mineral fertilizer or organic manure that soil productivity can be improved (FAO, 2002).

Greater use of fertilizer has increased the global per capita food supply, reducing hunger, improving nutrition (and thus the ability of people to better reach their mental and physical potential) and sparing some natural ecosystems from conversion to agriculture (Waggoner, 1995).

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Agricultural practices can reduce the ability of ecosystems to provide goods and services. For instance, high application of fertilizer and pesticides can increase nutrients and toxins in groundwater and surface waters, incurring health and water purification costs, and decreasing fishery and recreational values. Agricultural practices that degrade soil quality contribute to eutrophication of aquatic habitats and may necessitate the expense of increased fertilization, irrigation and energy to maintain productivity on degraded soils (Cassman, 1999). Chemical fertilizers are a vital part of modern agriculture, the new high-yielding crop varieties which supply so much of the south east of Nigeria region's food perform well when they are provided with an adequate and timely supply of plant nutrients.

In most countries today, fertilizer NPK is supplied as chemical fertilizers, though this chemical fertilizer use have made farmers to be having increase crop yield, there are some problems in their use.

Fertilizer Use In Agriculture

Fertilizer enhance the growth of Plants in two ways, the traditional one done by applying additives that provide nutrients and the second by applying fertilizer which help to enhance the soil by modifying its water retention and aeration. Fertilizer provides nutrients to plants in varying proportion of the macronutrients format as follows; Nitrogen (N) for leaf growth, Phosphorus (P) for development of roots, flowers and fruits and Pottasium (K) for strong stem growth, movement of water in plants, promotion of flowering and fruiting. Though nature has a way of maintaining soil fertility through recycling of organic materials however, due to large increase in the demand for food caused by substantial increase in the world's population, the demand for improved diet has been met largely by improved agricultural productivity in which the use of fertilizer played an important role (FAO, 2006). World fertilizer use has increased almost five-fold since 1950-2000 (FAO, Ibid). According to Smil 2002, fertilizer (NPK) has contributed an estimated 40 percent to the increases in per capita food production within the year 1950-2000 even though there are local and regional differences with varying efficiencies. Since 1909 when a German Chemist Fritz Haber discovered how to use the molecular nitrogen abundant in air to synthesize ammonia, Nitrogen been the key elements in the production of fertilizer (NPK) has influence significantly the cultivation of crops and more yield.

Nevertheless, management of nitrogen fertilizer must be accompanied by a concern for the total nutrient balance. Otherwise, over application of it becomes detrimental to the environment. Unbalanced use of Nitrogen fertilizer in Asia has been considered the biggest factor leading to soil nutrient depletion in Asia (Ahmed, 1995). World fertilizer consumption increase as population increases. There is the need to increase crop yield as to meet human food requirement

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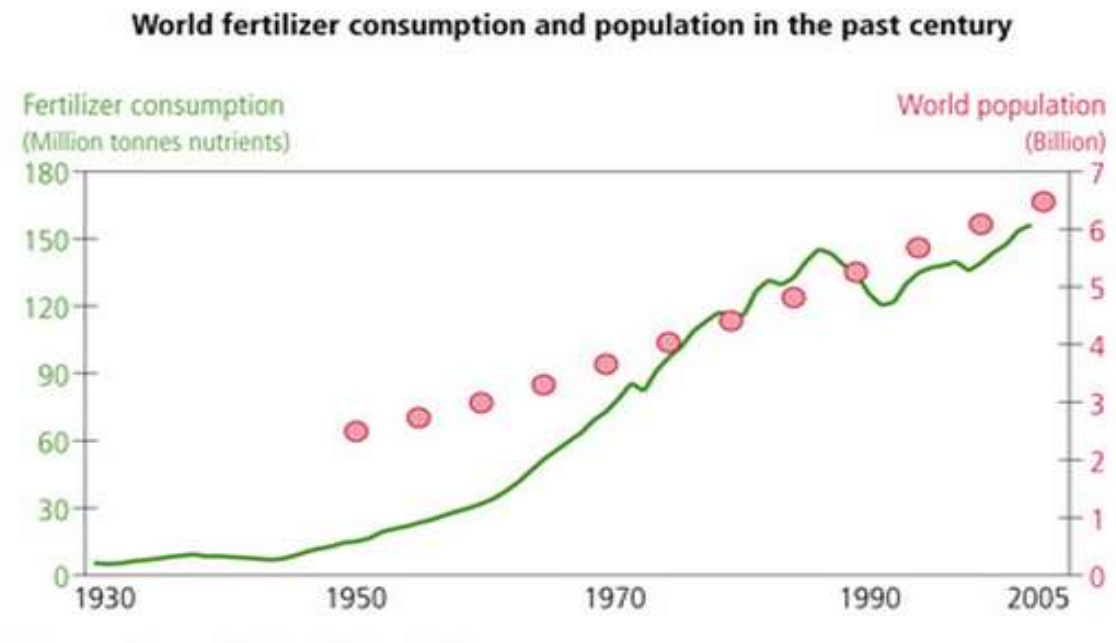
Figure 1: World Fertilizer consumption and population between 1930 and 2005



Source: FAO, 2011

We can deduce that world fertilizer consumption increase as population increases as well. Thus, there is the need to increase crop yield as to meet the food requirement.

World Distribution of Fertilizer Consumption rate

Fertilizer consumption rate vary from one continent to another. Asia is currently the world's biggest consumer of fertilizer (Ahmed, 1995). Due to a rapidly growing population and an increase in per capita wealth, concomitant growth in fertilizer use is required to increase agricultural input.

Impact of fertilizer application on crop productivity and the environment

Fertilizer use on a massive scale increases the probability of environmental pollution. Population growth and low fertilizer application suggest that fertilizer use will certainly rise in the future. The addition of nitrogen fertilizers, along with other changes in Agriculture, has greatly increased crop productivity in many parts of the world, allowing global food production to remain ahead of rapid population growth in the second half of the twentieth century (Vitousek *et al*., 2009). But areas where soils are exceptionally deficient in nitrogen, such as much of Africa (Sanchez, 2002), have not kept pace in producing enough food, and improvements in soil fertility are urgently needed. It is difficult to ascertain an appropriate amount of fertilizer application. There is danger of environmental damage even where fertilizer use is below maximum levels, especially if fertilizer is broadcast on the soil surface in a single application.

Fertilizer (Nitrogen compounds) when added to agricultural ecosystems are also some of the most important sources of pollution nationally and globally (Gurian-Sherman and Gurwick, 2009). The consequences of nitrogen pollution include toxic algal blooms, oxygen depleted

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dead zones in coastal waters, and the exacerbation of global Climate change, acid rain, and biodiversity loss (Krupa, 2003, McCubbin *et al*., 2002).

The reactive nitrogen from farmland which enter the Mississippi River comprises about 42 percent of the nitrogen causing the dead zone in the Gulf of Mexico at 16,500 km^2 (Environmental Protection Agency, 2008), an area the size of Delaware and Connecticut combined.

Again, gaseous ammonia released from nitrogen fertilizer contributes to fine particulate matter that causes respiratory disease and acid rain (Krupa, 2003). Further, nitrate concentrations above 10 parts per million in drinking water have been implicated as a cause of methemoglobinemia or "blue baby syndrome" (Fan and Steinberg, 1996). In recent times, it has been suggested that the rate of disruption of the global nitrogen cycle, the complex web in which nitrogen is exchanged between organisms and the physical environment caused by added nitrogen now exceeds the planet's capacity to maintain a desirable state for human survival and development (Rockstrom *et al*., 2009). Obviously in Imo state, excess nitrogen is having adverse effect on our environment.

Certainly, it will be vital to examine how increased fertilizer use can be sustained with minimum impact on the environment by better timing of applications, deep placement and improved formulations such as slow-release fertilizers.

Study Area

Location/Extent: Mbieri is one of the communities that make up Mbaitoli Local Government Area (LGA) in Imo State. The Local Government Area is bounded on the north by Nkwerre and Isu LGAs, on the south by Owerri Municipal and Owerri North LGAs, on the east by Ikeduru LGA and on the west by Ohaji Egbema, Oguta and Oru East and Oru West LGAs. Fig. 4 is map of Imo State showing Mbaitoli LGA and Fig. 3 shows the communities in Mbaitoli LGA.

Geology/Relief: Mbaitoli is located within the northern margins of the coastal plains of Southeastern Nigeria, and lies at an altitude of about 121.92m above sea level (Mbah, 2001). Its terrain is generally level with swells and depressions in which large volumes of sand accumulate. The main geological formation is the coastal plain sand which is largely porous. The porosity of the rock is partly responsible for there being many surface streams in Mbaitoli.

Climate: Temperatures are usually high throughout the year with no monthly average below 70^{oc} and annual range of about 50^{oc}. The hottest period is between January and April just before the rain sets in. Relative humidity is about 90%, except December to February when the harmattan brings in dry conditions.

Rainfall is the most vital climatic factor in Mbaitoli because the people depend on it for their water requirements. Rainfall water is particularly used for agriculture until the provision of pipe-borne water for their domestic and other uses. The total annual rainfall is heavy about 2,540mm in most places. The amount is concentrated in eight months, lasting from March to October. Each of these months has more than 155mm of rainfall but the greatest monthly total of about 200 to 350mm are recorded from April to October (NIMET, 2008). There is short dry season, the August break that last for about two weeks and occurs between July and August but it may be absent in some years. The dry season lasts from November to March. During this period, the sun shines very intensely, transpiration is high and crop growth is at the minimum.

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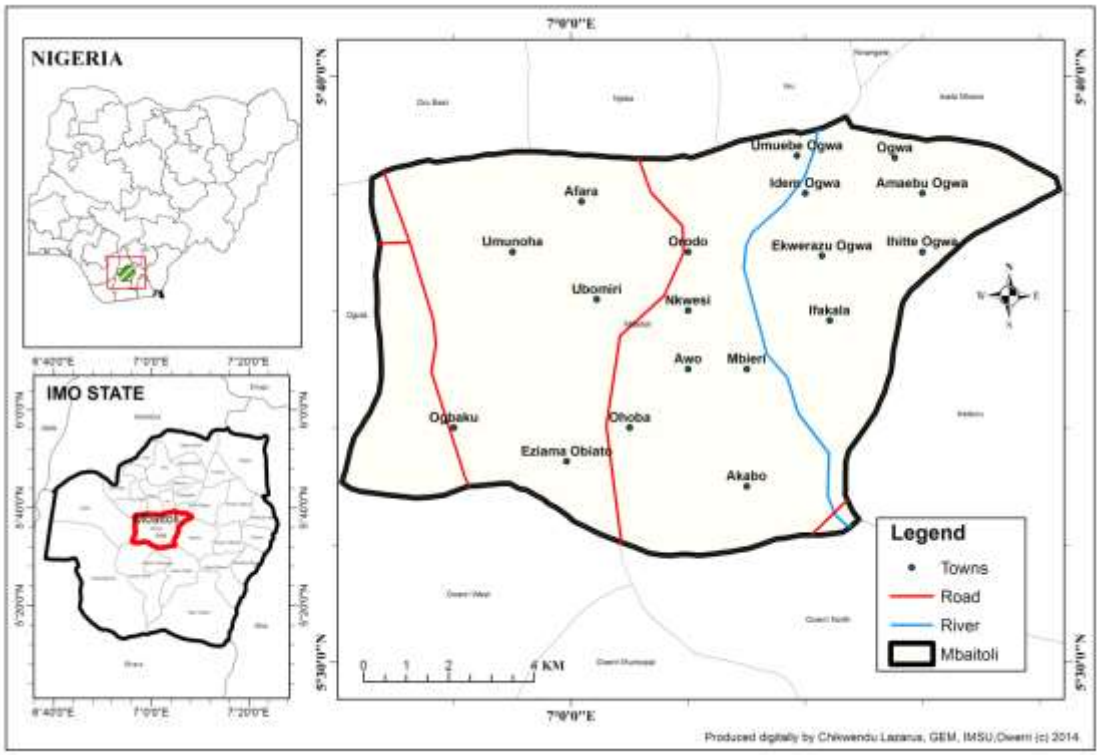
Vegetation: The area has luxuriant forest with some secondary vegetation hence; Mbaitoli belongs to a typical equatorial zone. The type of vegetation present is rain forest vegetation with semi giant trees of various species. Economic trees found include: *Milicia excelsa* (iroko), *Elaeis guineensis* (oil palm tree), *Enthandrophragma spp* (mahogany), *Pentaclethra macrophylla* (oil bean tree), *Cocus nucifera* (coconut), *Bambussa vulgaris* (bamboo trees) etc. The natural vegetation has been greatly modified by human action. Recently the high demand for timber had led to the ruthless felling of the trees. There is also the presence of dense riparian forest with *raffia hookeri*, (raffia palm) which are important source of palm wine, roofing mats and bamboo.

Figure 2: Map showing the study area



Statement of Problem/Methodology

Agricultural practices determine the level of food production and to some extent the state of global environment. Agriculturist is the chief managers of "useable" lands. About half of global useable land is already in pastoral or intensive agriculture (Tilman, *et al*, 2001).

In Mbieri which is considered as rural setting majority of the people are farmers and almost all useable land is in agricultural use. Most farmers practice subsistence agriculture. Continures cropping, mono cropping and mixed cropping are practiced. The land tenure by inheritance practice which involves the division of land from one descent to the other has further caused decrease in agricultural land. The result of all these is that agricultural output is low. The use of fertilizer NPK to improve soil fertility is common sight in Mbieri community. The outcome is more nitrogen, phosphorus and potassium for the crops and hence increased yield at the end. It is pertinent to note that majority of this farmers are not properly educated so in most cases

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there is an abuse of the application of this all important compound. However, in addition to causing the loss of natural ecosystems, agriculture adds globally significant and environmentally detrimental amounts of nitrogen and phosphorus to terrestrial ecosystems (Vitousek, *et al*, 2009). In villages like Umuahi-Amankuta, Umuoganihu, Obazu, Umuodu, Umuchoke, Umuahi and Awo etc as would be used in this study, Most farmers do not show good knowledge of the application of fertilizer NPK as regard to exact quantity to apply at any point in time. Such unbalanced application has adverse effect on the environment especially water bodies. Again, the common sight of fertilizer NPK sprinkled on the soil surface by prospective farmers especially in slopy area in Mbieri implies that agent of erosion can wash it down the slope where it can contaminate water bodies. Obviously, improper use of fertilizer can have detrimental effects on the ecosystems and environment.

The researcher used questionnaire tool to examine the impact of fertilizer application in Mbieri community of Mbaitoli LGA, Imo State. A total of one hundred and Thirty two structured questionnaires were retrieved of the one hundred and fourty systematically distributed in the seven autonomous communities of the study area. Tables, percentages and descriptive statistical tool of measurement were employed.

Data Analysis And Presentation

Distribution of farmers by level of education

The outcome of the findings on Table 1 below shows that 9.8% of the farmers are without formal education. In the same vein, 24.2%, 37.2% and 28.8% of the farmers are those who spent 1-6 years, 7-12 years and 13-17 years in school respectively. We can also deduce that those that fall into secondary school age 7-12 years are in majority (37.2%). Obviously, farmers in the study area lack the appropriate Educational knowledge necessary for the application of fertilizer in Agriculture.

Table 1: Table showing Percentage distribution of farmers by level of Education

No of years at school	Frequency	Percentage (%)
No formal education	13	9.8
1 – 6	32	24.2
7 – 12	49	37.2
13 – 18	38	28.8
Total	**132**	**100**

Source: Author's Field Work, 2015.

Kinds of Fertilizer used in the study area.

Different kind of NPK fertilizers in the varying ratio of the contents of the Nitrogen-Phosphorus-Potassium (NPK) are used in the study area. From the bar graph below, 35% of the respondents make use of Fertilizer NPK 20-10-10, 27% make use of Fertilizer NPK 27-13-13, 24% uses fertilizer NPK 15-15-15 while the remaining 14% uses fertilizer (Nitrogen pure). Farmers make use of Fertilizer with high Nitrogen because it enhances the health of the plant

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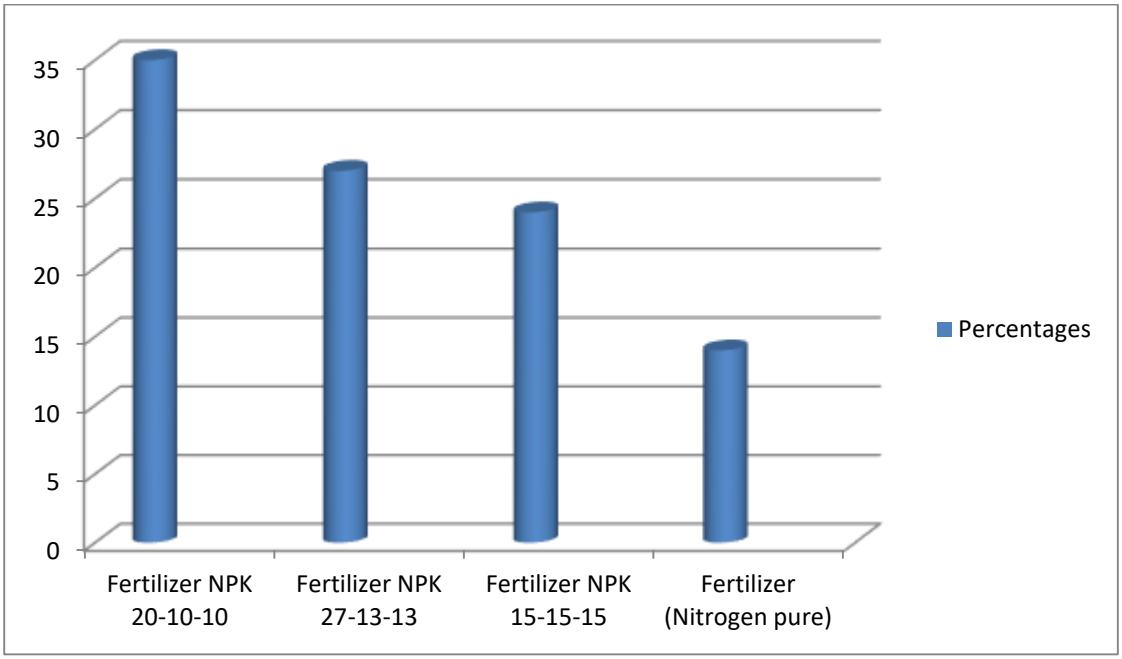
by making the leaves of the plant to be very green, those who prefer a healthy and improved stem, tubers and fruiting goes for the one with high proportion of Phosphorus and Potassium respectively.

Figure 3: Bar chart showing kinds of Fertilizer use.



Source: Author's fieldwork, 2015.

Sources of Fertilizer use for Agriculture in Mbieri.

The sources of fertilizer use in the study area are mainly from the open market, though Government distributes fertilizer through the Agricultural development programme (ADP), it is often hijacked and diverted. This could be the reason for majority of the farmers (58%) sourcing for the product from the open market. However, 26% get fertilizer through Cooperatives while 16% eventually, gets it from ADP. (See Table 2 below).

Table 2: Table showing Sources of Fertilizer in Mbieri.

	Frequency	percentages
Agricultural Development project (ADP)	21	16
Cooperatives	34	26
Open Market	77	58
Total	**132**	**100**

Source: Author's fieldwork, 2015.

How fertilizer is applied in the study area.

Feedback from the respondents reveals that, 60% of the farmers uses surface broadcasting method to apply fertilizer to crops while, 40% uses localized placement to apply fertilizer to their crops.

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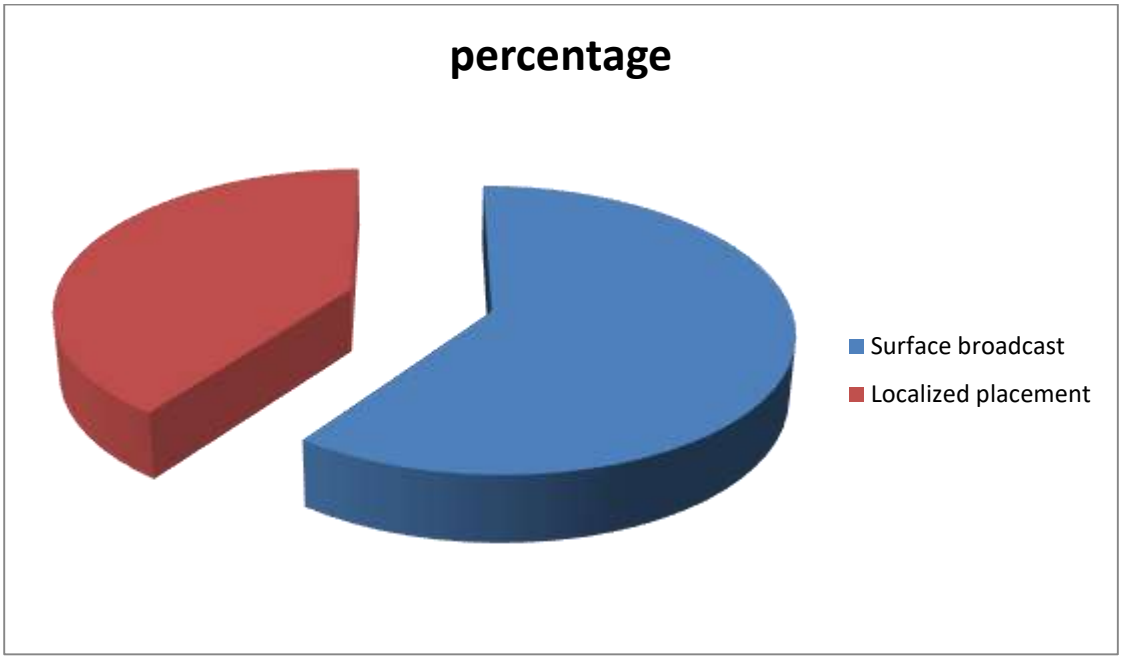
Figure 4: Pie chart showing how fertilizer is applied.

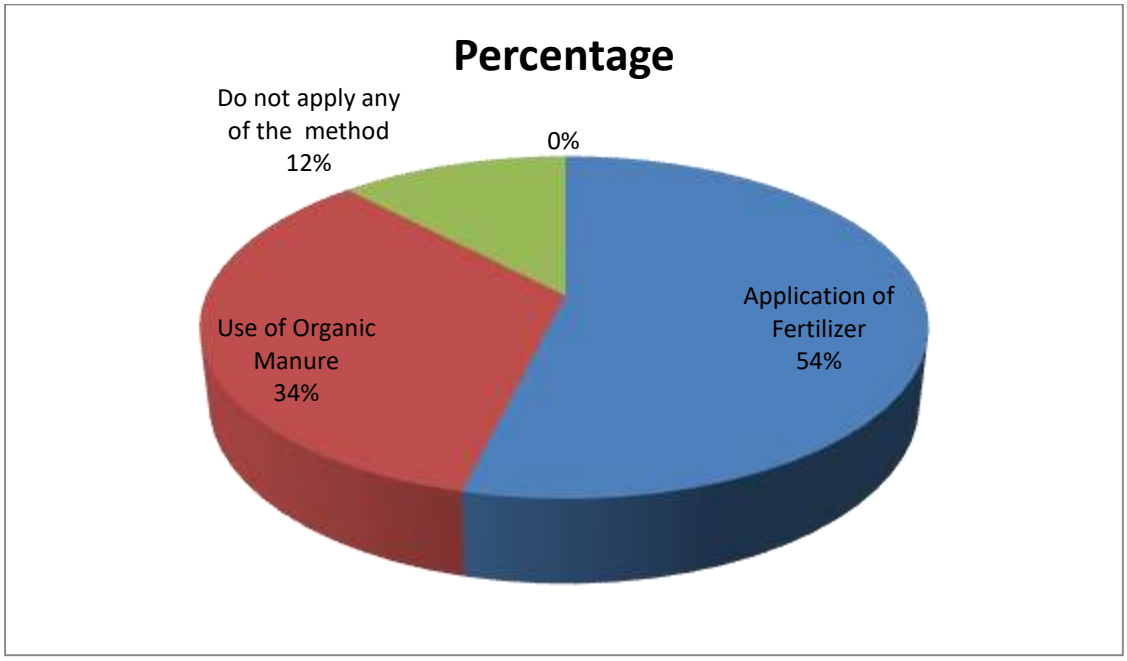


Source: Author's fieldwork, 2015.

Method of improving the Soil for high crop yield in Mbieri.

Figure 5 below shows that 53.8% of the respondent use fertilizer to improve Agriculture, 34.1% uses organic manure like animal droppings etc while 12.1% do not apply any method to enhance crop yield in the study area.

Figure 5: Percentage distribution of respondent method of improving the soil.



Source: Author's Field Work, 2015

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CONCLUSION / RECOMMENDATION

Those involved in agriculture in the study area are majorly the secondary school cadre with 37.2%. They cannot understand comprehensively the problem of fertilizer application and its adverse impact on the Ecosystem.

Findings also show that fertilizer NPK 20-10-10 with high proportion of Nitrogen is mostly in use (35%) in the study area. Definitely, since the farmers lack the proper educational qualification while making use of fertilizer NPK with high proportion of Nitrogen, Ecosystem and water bodies in Mbieri community faces contamination and eutrophication.

Most farmers (58%) source of fertilizer NPK is mostly from the open market since many of them do not have access directly to the one provided by government.

The research shows that farmers prefer the use of application of fertilizer NPK to replenish soil fertility for improve crop yield. Findings also shows that 60% of the farmers uses surface broadcast method in applying fertilizer NPK on their farms, this exposes the nitrogen compounds to agents of erosion like running water and eventually pollution of rivers and water bodies. This is an important source of pollution to the environment both nationally and internationally as asserted by (Gurian-Sherman and Gurwick, 2009). The implication is that water bodies and ecosystems in the study area is at risk of been contaminated.

However, Government should set up a Research centre for Fertilizer use in Agriculture to provide information on the appropriate ways of fertilizer application and Ecosystem sustainability in the study area.

Trained Environmentalist should be employed by Government in the Agricultural Development Project (ADP) office for enlightenment on environment friendly agriculture.

The Agriculture extension workers should create a programme on how, when and what type of soil to apply the Fertilizer NPK so as to get maximum returns on crop yield without harming the environment.

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