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SOIL CONSERVATION PRACTICES AMONG FARMERS IN DOMA LOCAL GOVERNMENT AREA, NASARAWA STATE, NIGERIA

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ABSTRACT
This research work assess the knowledge of soil conservation practices among farmers in Doma Local Government Area of Nasarawa State, Nigeria. Data for the study were sourced from several sources that that could be broadly be classified into two: primary and secondary data. Data collected for the study were analyzed using descriptive statistics in the form of simple percentage and presented in chart format. The result revealed that 79% of the farmers owned the farmland the cultivated. 88% of the respondents have admitted that they noticed soil fertility changes on their farm. This occurs as a result of depletion in soil components which contributes to soil fertility. 80% of farmers noticed crop yield change on their farm. The findings also reveals that 95% of farmers were of the opinion that the nature of change in their crop yield has be on a increase. Inorganic fertilizer is the most popular commodity employed by farmers as fertility measure within the study area. 83.02% of the respondents of the study were of the assertion the usage is beneficial. The study recommends that there is a need to look into the possibility of initiating provision of motivational incentives to raise the capacity of farmers by provision of loan and training to enable them adopt improved measures of soil fertility in the study area.
KEY WORDS: Soil, Conservation, Practices, farmers, degradation.

INTRODUCTION
One of the overriding assumptions driving current and informing development interventions across Africa is that soil fertility maintenance constitutes a major problem. Most agency reports and government publications highlights the degradation of soil as major development challenge. Soil and water conservation efforts in Africa have had a chequered history. Several efforts have been directed towards improving soil fertility by agricultural specialized interventions on soil fertility maintenance; however in the developing countries it has not achieved the desired outcome. As observed by Warren (1996) since the early colonial era to the present, attempts have been made to introduce soil and water conservation measures in a wide range of settings yet many have failed. As a result, combating land degradation have become a major challenge facing many countries indicating that soil and water

conservation issues should be accorded very high priority in land development programs. For close to a century, rural development policies and practices in Africa have taken the view that farmers are 'mismanages' of soil and water. Some even think that farmers are ignorant of the seriousness of soil erosion and are reluctant to implement changes (Hudson, 1991). Others argue that experts need to seek the existing knowledge, cooperation and opinions of farmers before encouraging or enforcing new recommendations (Shaxson, 1989).

Consequently, farmers in many countries have been advised or forced to adopt new soil and water conservation measures and practices, these efforts have however been undermined by many problems. Many have done so, and environment and economics have benefitted for a time. However, many problems have undermined these efforts in the name of conservations with financial and legal incentives bringing only short-lived conservation. Many efforts have been remarkably unsuccessful, often resulting in more degradation, and hence undermining the creditability of conservation. Over the last two decades many interesting and important factors have, come to light about farmers own stock activities, yet most experts are still largely unaware of the range of stock techniques used by the farmers. Part of the problem lies within the fact that there is no clear demarcation between indigenous and exotic (conventional or introduced) conservation measures. Indigenous conservation measures are the traditional conservation measures and farming practices that have evolved over the course of time, without any known outside institutional inventions and which have some soil conservation effects.

These measures are the result of gradual learning process and emerge from a knowledge base accumulated by rural people by conservation, experimentation, and a process of handling down through the generations, people's experiences and wisdom. Indigenous conservation system are often not only introduce to reduce soil loss or manage run-off, but also are often designed to improve productivity and the suitability of land for cultivation. One area of concern is the lack of appreciation of indigenous practices by soil conservation experts and policy makers resulting in lack in its record in soil

and water conservation efforts in many countries. If soil and water conservation practices have to succeed then there is the need to recognize farmers as potential solution rather than being a problem (Steiner, 1998).

The practices of designing and implementing interventions without involving local people can only succeed with coercion. Such enforced technologies may appear technically appropriate, but commonly rejected by local people when the external pressure is removed. Projects and programs must find a way on building on the skills, enthusiasm and knowledge of farmers as we continue to look for solution to development and technology problems that continue to confront not only the Africans but also other developing countries. Ruralities to which development efforts are directed have their own body of knowledge that enables them arrive at decision, which could help their lots (Kolawole, 2002). Bronkensha *et al.,* (1980) have argued that to ignore people's knowledge is almost to ensure failure in development. This is because local knowledge respects the expertise of indigenous people and has been regarded as major development thinking (Osunade, 1996).

According to Osunade (1996), the bane of agricultural development in Nigeria is poor soil management practices, which includes the application of wrong solutions by agricultural experts, introduction of structures that are alien to the farming communities and their non- adoption, prescription of having capital-intensive programs, which are presumed to bring about rapid transformation of agriculture and many more. The direct result of these errors is the declining crop yield and the consequent falling standard of living of the rural people. The rationale for the introduction of modem farming packages is the huge success that has attended their adoption in the developed countries and in particular the temperate environment.

It has been assumed that the miracle bumper harvest achieved in such areas will automatically be realized in our own environment. Instead it has dealt a detrimental blow to indigenous management practices which has sustained the environment before the introduction of packages of modem agricultural practices and which still have potency to achieve more today. Indigenous farm management practices, which have endured over the years, are now fast disappearing. The fact that the modem practices have failed to bring about a sustainable rural system in Nigeria calls for reappraisal in favor of indigenous systems. Thus, the recovery, recognition and harnessing of indigenous farming

practice in Nigeria will help to ameliorate land failures and increase in yield and enhance the quality of rural environment. It is therefore considerate to undertake this study in Lafia urban area, where indigenous soil conservation practices have been in place for a long time and with positive outcomes. It is therefore, hoped that revert to indigenous practices will greatly improve soil fertility and as such boost agricultural production.

Statement to the Problem

In Nigeria, soil fertility maintenance has been widely recognized as a major problem that greatly affects agricultural land development. Consequently, extensive researches such as the works of Kolawole, O.D (2002), Ismaila Ct *et al.,* (2012) etc. have been conducted in many areas on the rate of soil changes under different fertility management practices in many areas of the country. Because of the severe on-site and offsite degradation trends resulting from soil fertility management problems, successive governments in the country have made effort to conserve and rehabilitate degraded lands in many parts of the country. As in many other African countries, despite the heavy capital and human resources investment, results remain disappointing. Soil fertility decline level are still occurring in many areas and most farmers are not making much effort to construct and maintain Soil and Water Conservation (SWC) measures, and continue to behave as if they have been defeated in this regards. The quest for a solution to environmental problems like soil fertility decline might be approach by building on a foundation of what people already know and what they have been practicing since time immemorial. Just like in most developing countries, the paucity of documented information on fanner's soil fertility management strategies in Nigeria denies researchers and rural development practitioners a knowledge base from their activities.

One agricultural important community in Nigeria where farmers for several years have been carrying out agricultural activities with some significant use of indigenous soil conservation measures is in Lafia, Nasarawa state. This area is of particular important because it has a very long history of urban and pen-urban cultivation practices with the farmers having access to a number of governmental and non-governmental bodies having advisory on soil fertility maintenance. Because of the enormous strategic economic importance of this

area to the agricultural economy of the country, information is no doubt required on the farmer's knowledge of the use of maintenance measures for soil fertility and the need for such information constitutes the problem of research interest this study.

The Study Area

Doma Local Government is located between latitude 8°23′ N- 8°35 and longitude 6° 21E - 7° 30E. It shares boundary in the North by Nasarawa Eggon Local Government, in the east by Lafia Local Government, Awe Local Government in South-East, Keana Local Government in the north-west, Nasarawa Local Government in the west and Makurdi and Guma Local Government Area of Benue state in the south respectively. Doma is an undulating plain; the steepest slopes of about 8° – 15° are found in the south western part dipping northward and in the northern part. The area has gentle slopes (Offodile, 1991).

Doma Local Government is situated on the parents rocks type beneath the earth crust belongs to the two main rock types that are found in the central northern plates and the fringes of River Niger and River Benue respectively, these are the metamorphic and younger sedimentary rocks respectively. The area has a tropical type of climate. The area is characterised by tropical ferruginous soils. Doma LGA is a well-drained town, when it rains, Doma is drained by the two main streams Orumagye, that runs from north east, it takes it source from Akala hill about few 100 meters about 3 kilometers in between Lafia and Alwaza roads nears the present site of Aliyu Akwe (Oriya farm) in Doma and where it eroded into deep gully erosion about 200 metre away and opposite Doma L.G Secretariat at Dadin Kowa Doma, through Agyaragu by pass. The vegetation of Doma is that of the tropical savanna wood land that is characterised by trees and inter sparsed with tall grasses, the trees are mostly the deciduous types comprises of locus beans trees, share butters trees and under grown shrubs, that is why the area is easily cleared for farming purposes.

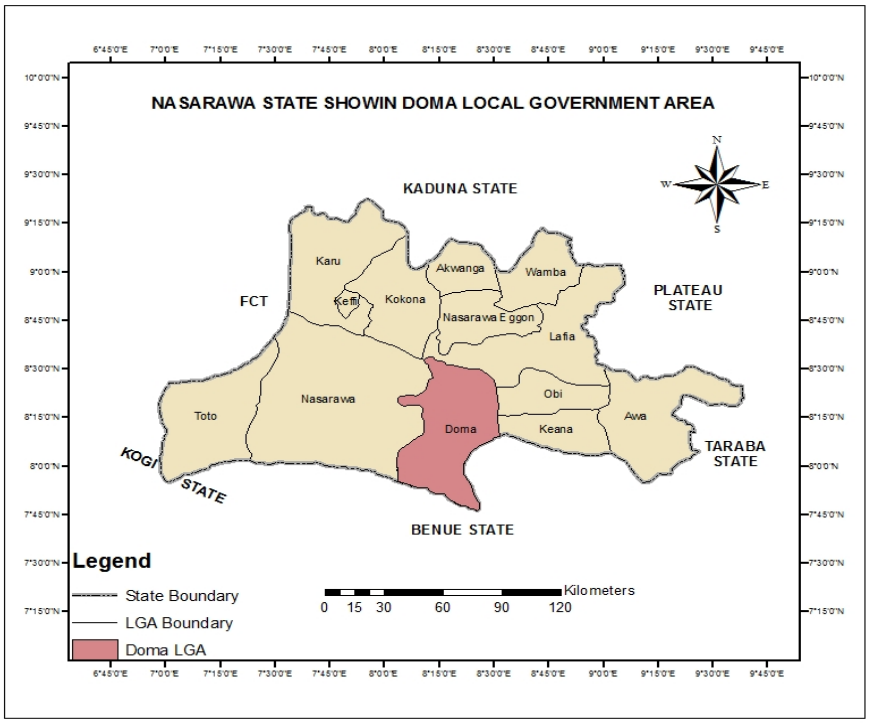

Figure 1.1: Map of Nasarawa State Showing Doma LGA
Source: AGIS, 2018.

Materials and Methods

Data for this study were gathered from several sources that could be broadly classified into two: primary and secondary data.

Primary Data

Primary data for this study was obtained through visits to various communities in the study area through reconnaissance survey, oral interviews and administration of questionnaires.

Secondary Data

Secondary data for this study wassourced from Nasarawa State Agricultural Extension Board reports, Nasarawa State Agricultural Development Program records, research seminars, newspapers and journals, internet and literature sources.

Method of Data Analysis

Data collected for this research were analyzed using descriptive statistics in the form of simple percentage and presented in a chart format.

RESULTS AND DISCUSSION

Knowledge of Soil Fertility and Crop Yield Change

Percentage of Farmers Owing their Farmland

Result from the chart below show response of the farmers on whether they are the owners of the farmland on which they are carrying out production. 79% of them admitted that the farmland is owed by them, only about 21% admitted not to owe the farmlands. These farmers may have cultivated on these pieces of land for long to tell if change have taken place in soil fertility and crop yield.

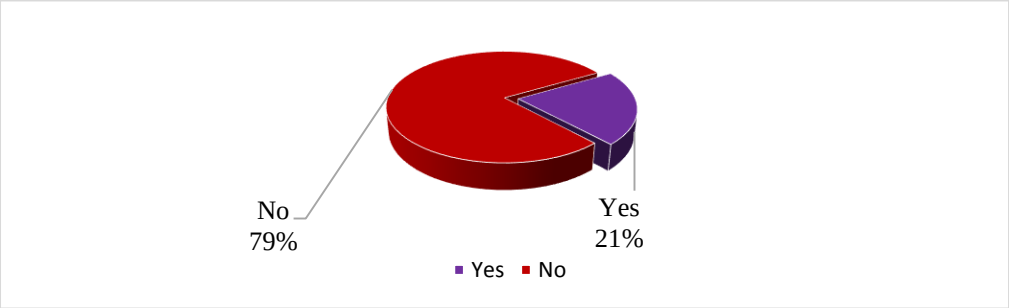

Figure 3.1: Percentage of Farmers Owing their Farmland
Source: Field survey, 2018.

Noticing Soil Fertility Change on Farm

Data analysis from figure3.2 below shows that about 88% of respondents have something noticed soil fertility change on their farm, 12% of them said have not yet noticed change of any sort to soil fertility. Soil fertility depletion occurs when the components which contribute to fertility are removed and not replaced and the conditions which support soil fertility are not maintained. Most of these farmers have cultivated on these farmland for so long and a prolong usage of a piece of land without replenishment to lead to decline in soil fertility. The most important perceived indicator of soil fertility loss in this area by the farmers were reduced crop yield, poor crop performance, yellowing of crop, and soil changing in appearance and becoming coarse.

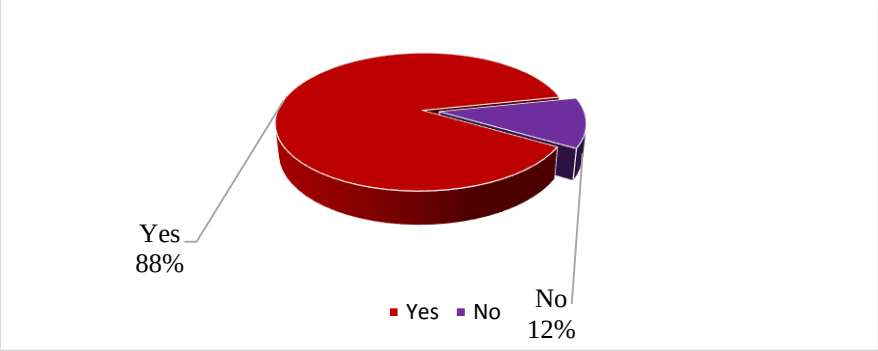

Figure 3.2: Noticing Soil Fertility Change on Farm
Source: Field Survey, 2018.

Nature of Changes in Soil Fertility

Majority of the respondent (88.07%) has been noticing an increasing level of this negative change to soil fertility. 6.81% said these change are decreasing and 5.11% said these change remained the same judging from their own perception of what they understands by soil depletion. Responses to questions put forward to farmers on how they managed these negative conditions or soil depletion revealed their understanding of soil fertility deficiency, in which they further said, can only be ameliorated through fertility improvement measures, by investing in fertility maintenances aimed at promoting increase in soil fertility and subsequent crop yield.

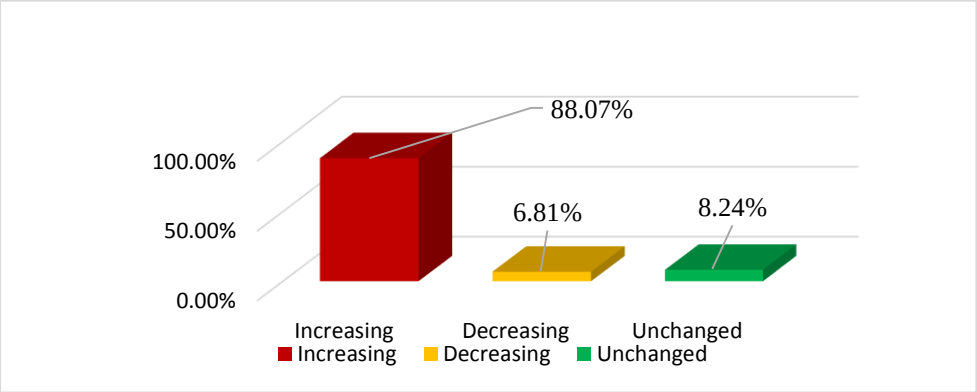

Figure 3.3: Nature of Change in Soil Fertility
Source: Field survey, 2018.

Noticing Crop Yield Change Form

the farmer are actively involved in soil replenishment measures as a result of fertility deficiency experienced by them on their farmlands and this has been

yielding positive result to some extent. From figure 3.4 below, 80% of farmers admitted to have noticed crop yield change on their farm, while 20 percent of the respondents have not noticed any such change to crop yield from their farmland.

Figure 3.4: Noticing Crop Yield Change on Farm `
Source: Field survey, 2018.

Nature of Change of Crop Yield

Most of the farmers, (95%) admitted that the nature of the change in crop yield has been on increase. despite the decline in soil fertility said to have been observed by them, only about 5% of them expressed declining changes in crop yield, a probable reason why few farmers indicate not cultivating some crops due to decline in soil fertility.

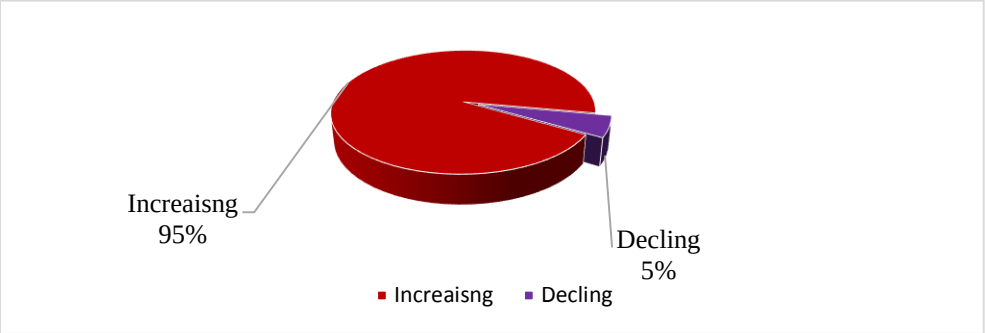

Figure 3.5: Nature of Changes in Crop Yield
Source: Field survey, 2018.

Not Cultivating Some Crops due to Decline in Soil Fertility

Majority of the farmers, (87%) admitted that they are still able to cultivate all types of crops on their farmland. only 13% of the farmers admitted to not being able to cultivate certain types of crops as a result of soil fertility decline. Example of some of these crops include; cassava, sorghum and maize.

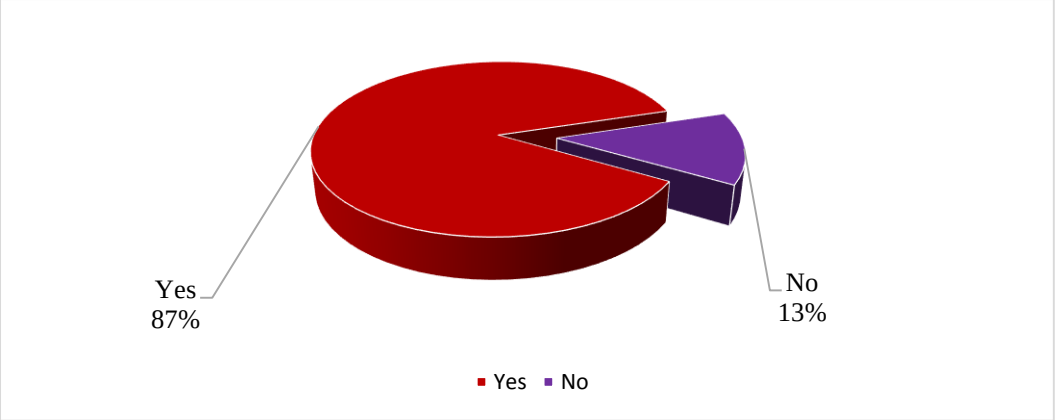

Figure 3.6: Not cultivating some crops due to decline in soil fertility. Source: Field survey, 2018.

Fertility Measures Used by Respondents to Improve Soil Fertility

Whether using some Fertility Maintenance Practice

All of the respondents interviewed agreed to have one time or the other employed soil fertility measures to check soil depletion. Soil depletion occurs when components which contribute to fertility are removed and not replaced, leading to poor crop yield. Depletion in this regard is caused due to excessively intense cultivation and inadequate soil management practices.

Figure 3.7: Whether using some fertility Maintenance practice.
Source: Field Survey, 2018.

Kinds of Fertility Maintenance being used

The fertility maintenance measures employed by the respondents are presented in figure 3.8 below. All the respondents exhibited some level use of fertility maintenance practices on their farm, of which inorganic fertility (90.34%), Un-burnt solid waste (84.09%), and Animal manure (81.82%), urban waste Ash (79.55%) and inter cropping (43.18%) were the most patronized. From discussions on field, it was found out that, the constant use of inorganic and organic fertilizer promotes rapid growth and high yield of crop. Some of the farmers, on a low scale practice, employed other fertility measures e.g. mulching/composting (24.43%) and Aroforestry (17.05%). The reason they gave for this low patronage is that in composting for example, the rigorous method involve in preparing compost is tiresome, consumes time, not always available and the use of Urban waste seem to have been a batter option as substitute to composting Aroforestry has been recognized as an important system that controls soil erosion and fertility decline in tropical soil (Kang, 1993). Questions throw to respondents on these shows that they find it hard to believe that the planting of tree is an aspect of soil fertility maintenance measure. Reason because they consider tree as source of food, medicine and wood, therefore it has to be exploited when needs arise. In Nigeria and Africa at large, tree planting has always been promoted foremost as a source of construction timber and fuel wood but not for soil erosion control. The work of (Tydall, 1996) in the central highland of Kenya found that farmers were not willing to adopt threes within cultivated field as SWC measures, only on boundary niches primarily because they ensure land tenure security. Farmers argue that tree within cropped area because nutrient competition and soil erosion, due to splash effect generated under tree canopies.

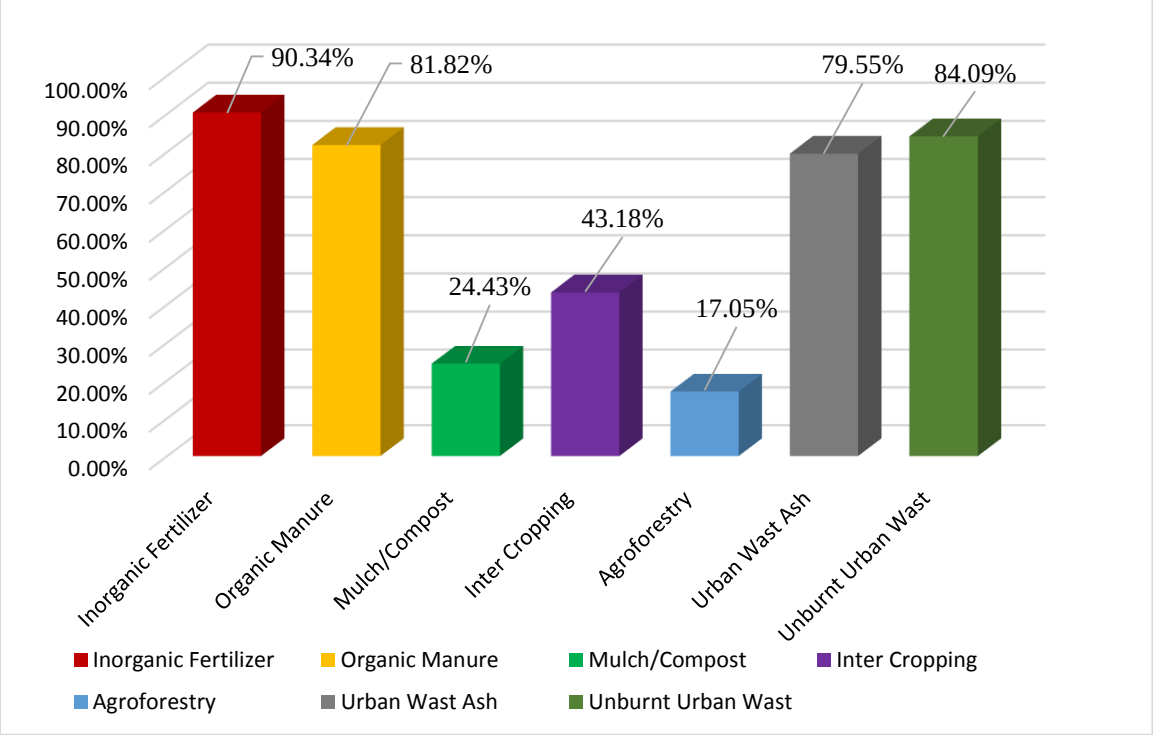

Figure 3.8: Kinds of Fertility Maintenance being used.
Source: Field survey, 2018.

Change in use of Fertilizer

Inorganic fertilizer is the most popular commodity employed by farmers as fertility maintenance measure within the study area, (83.02%) of respondent said its usage is beneficial (see figure 3.9 below). Inorganic fertilizer has higher concentration of nutrients than organic fertilizer. Also, since nitrogen, phosphorus and potassium generally must be in the inorganic form to be taken up by plants, inorganic are generally immediately Bioavailable to plants without modification (Brady N, Weil R, 2002). Another advantage of inorganic fertilizer over organic is that the bulky nature of organic fertilizer attracts high transportation cost and requires sorting before use. Notwithstanding its popularity, there is a growing decrease in the patronage of inorganic fertilizer. Form figure 3.9 below, 71.70% of the respondents have stopped using inorganic fertilizer on their farms, and (18.80 %) has maintenance the level of their usage, only a fraction of about 9.43% of the farmers were still investing rigorously in its use. Increase in price and the

difficulty in its procurement because of unavailability were among the reasons given for the decline in inorganic fertilizer usage.

Another reason for low adoption of inorganic fertilizer could be blame on the absence of government program, extension services or media campaign to promote its use in fertility maintenance, which Hudson (1991) and Tenge, *et al.,* (2004) identified as some of the most important factors influencing the adoption of soil and water conservation measures in the tropics.

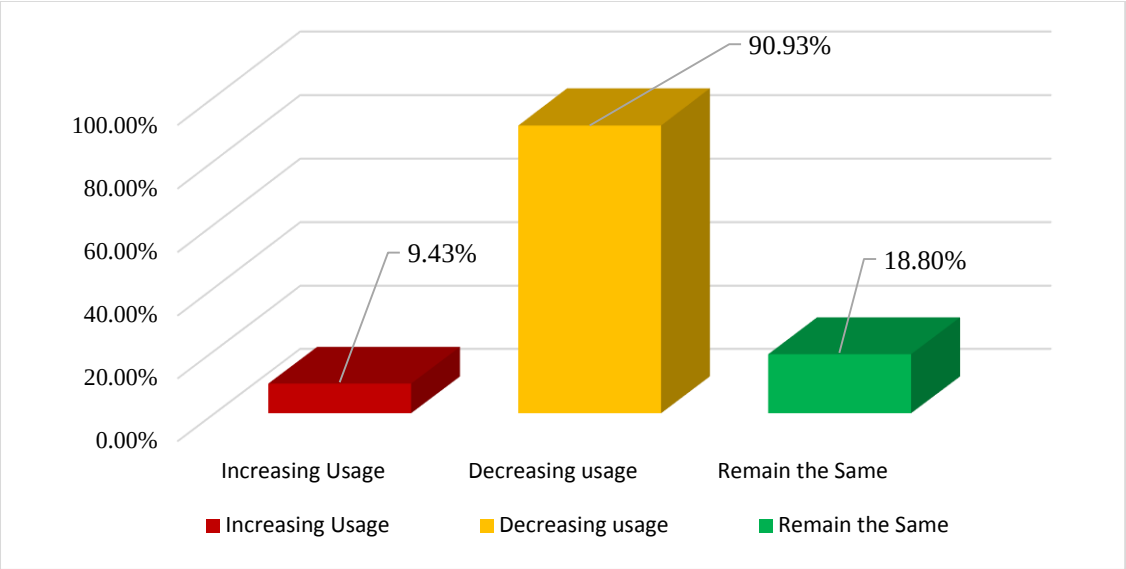

Figure 3.9: Change in Use of Fertilizer.
Source: Field Survey, 2018.

Whether Investment in Fertilizer is Beneficial and Fertilizer Availability

About (83.02%) of the farmers were of the opinion that it is beneficial to use inorganic fertilizer to improve soil fertility that is if it readily available. This is not always so because figure 3.10 below shows that (68.55%) of respondents said fertilizer is always hard to come by and very expensive to invest in as a soil fertility measures to improve soil fertility as result the utilization of organic manure has received wide spread application.

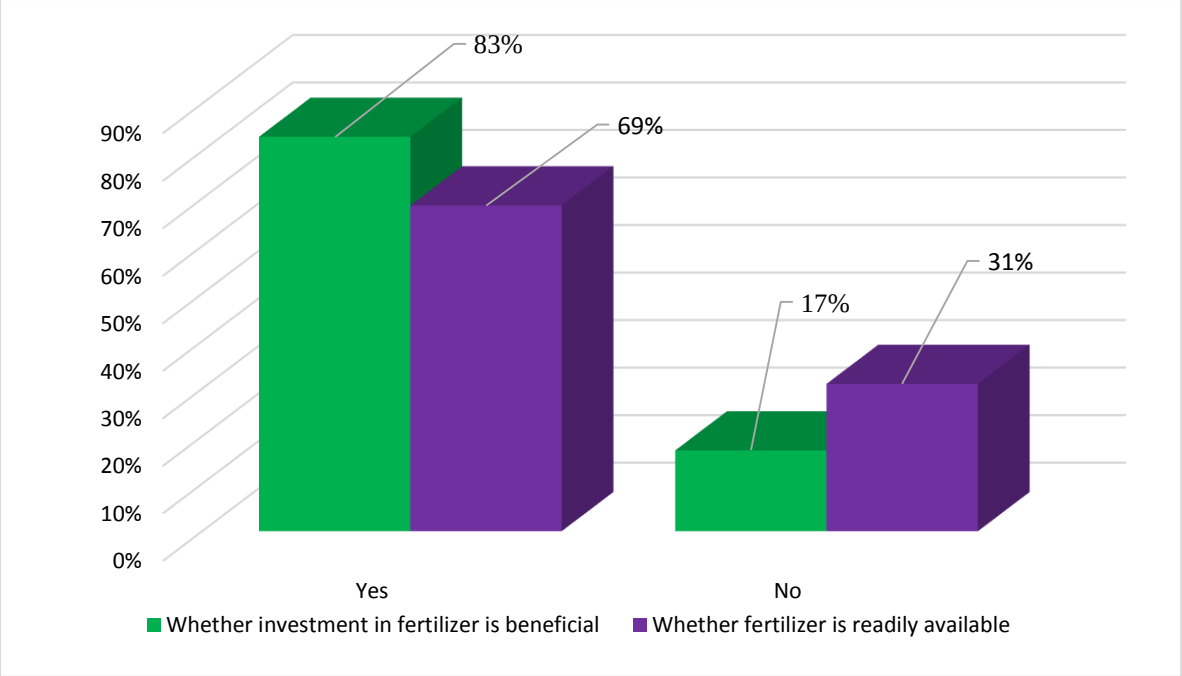

Figure 3.10: Whether Investment in Fertilizer is Beneficial and whether it is readily available. Source: Field survey 2018.

SOIL CONSERVATION PRACTICES EMPLOYED BY RESPONDENT WITHIN STUDY AREA

Types of Indigenous Soil Conservation Measures

To improve soil fertility and crop yield on their farmlands, indigenous soil conservation practices were highly used by most of the farmers. Popularly of this practice are crop rotation, using crop mixtures, on farm residue retention, on-farm residue burning, use of legumes, use of animal manure, and increasing use of urban waste, measures which Hudson (1991) observed are being very effective.

Figure 3.11 below shows that 71.02% of the farmers were increasing their use of urban waste; 68.75% were patronizing no-farm residue burning; the use of crop mixture (61.45%); increasing use of animal manure (53.14%); crop rotation (28.41%) and use of legumes (17.04%). Further investigation revealed that farmers perceived these practices as the measures that have been used by their ancestors, passed down generations after generations and have proved to be very effective in soil fertility maintenance. This supports the view of Diala (1994) which states that, farmers trust practices they have used to for years

and that they are likely to keep away from new techniques that requires investment of resources and time. Other conservation farming techniques such as hillside terraces, stone-line and bunds, trash-lines, sand-bag line, earth-contour bunds, rice-bran mulch and vegetation-barriers which utilize natural ecological processes to conserve moisture, improve soil structure, curtail soil erosion and enhance soil fertility as outlined by Morgan, (1986) were also employed at some point within the study area.

Little investment in term of capital is required in the patronage of these measures of soil conservation, as such; they are cheap and accessible to farmers. These practices has been observed to be effective in maintaining soil fertility gradually over a considerable length of time thus increasing crop yield and thus scored a good point on the use of inorganic fertilizer which is costly, scarce and its misuse could be harmful to the ecosystem. Inorganic fertilizer, could be harmful to the ecosystem in the sense that waste soluble nitrogen content of fertilizer doesn't provide for long term need of plant, they leach out nutrient into surrounding area thereby creating water pollution

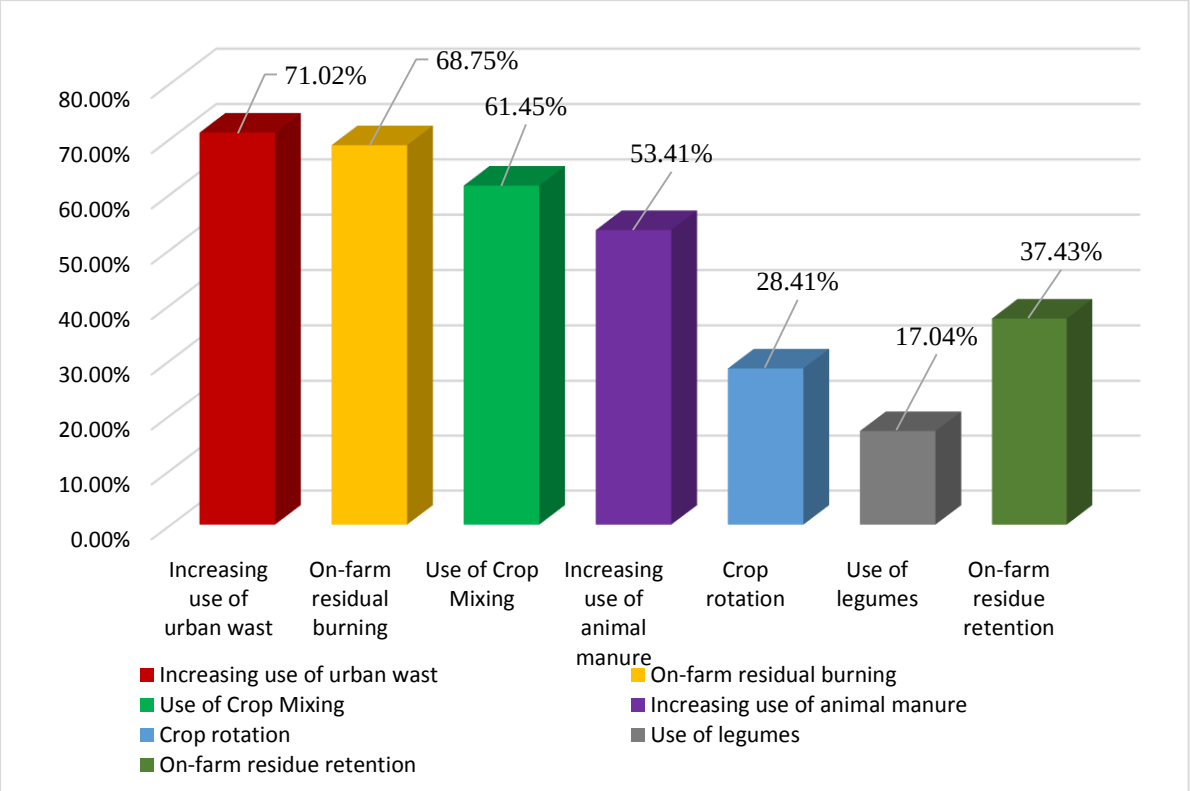

Figure 3.11: Types of Indigenous Soil Conservation Measures.
Source: Field Survey 2018.

Use of Organic Fertilizer by Respondent Farmers

Source of Organic fertilizer

Result from figure 3.12below shows that majority (44.59%) of the framers admitted that organic fertilizer were source near their houses, (34.07%) said they source them form residential area while (21.34%) them were purchasing the organic fertilizer.

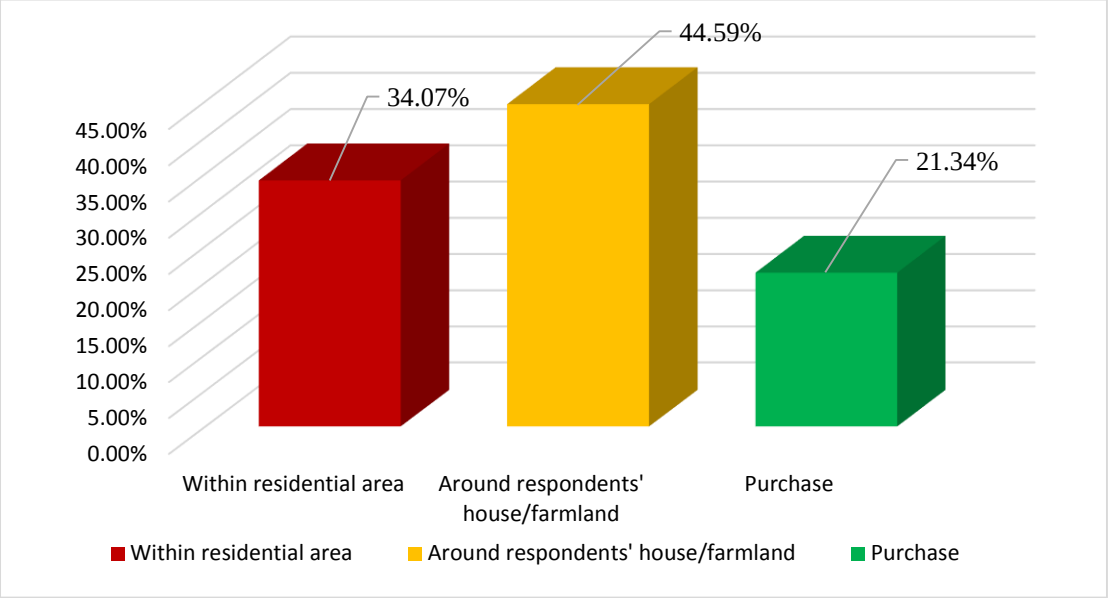

Figure 3.12: Source Organic Fertilizer.
Source: Field Survey, 2018.

Cost of Manure its Availability and whether it's Investment is Beneficial

Organic manure are realty available around the farmers house, farmland and within residential area. The increase in demand of organic residue in agriculture as a substitute to the limited inorganic fertilizer has resulted in an emerging business, whereby people collect in polythene bags manure from houses, night soil from dug-out toilets and urban waste from waste dumps and sell to interested farmers at relatively cheap prices, most farmers therefore view these commodities as being inexpensive to purchase when compared to the inorganic fertilizer (Ismaila K.I*et al.,* 2012). Form figure 3.13a below, majority (48.22%) of the respondents agreed to the fact that organic fertilizer come at a very cheap rate (85.80%) of respondents also confirms organic matter availability and (96.02%) said the investment in organic fertilizer on their farmlands has been very beneficial (figure 3.13 below).

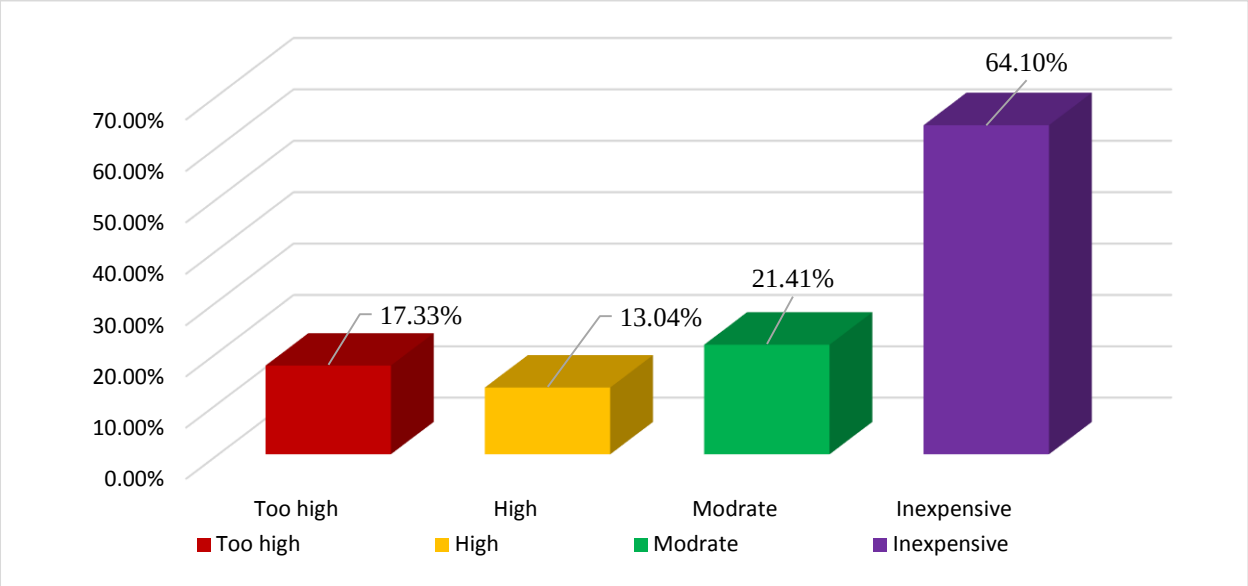

Figure 3.13a: Cast of Manure if Purchased
Source: Field Survey, 2018.

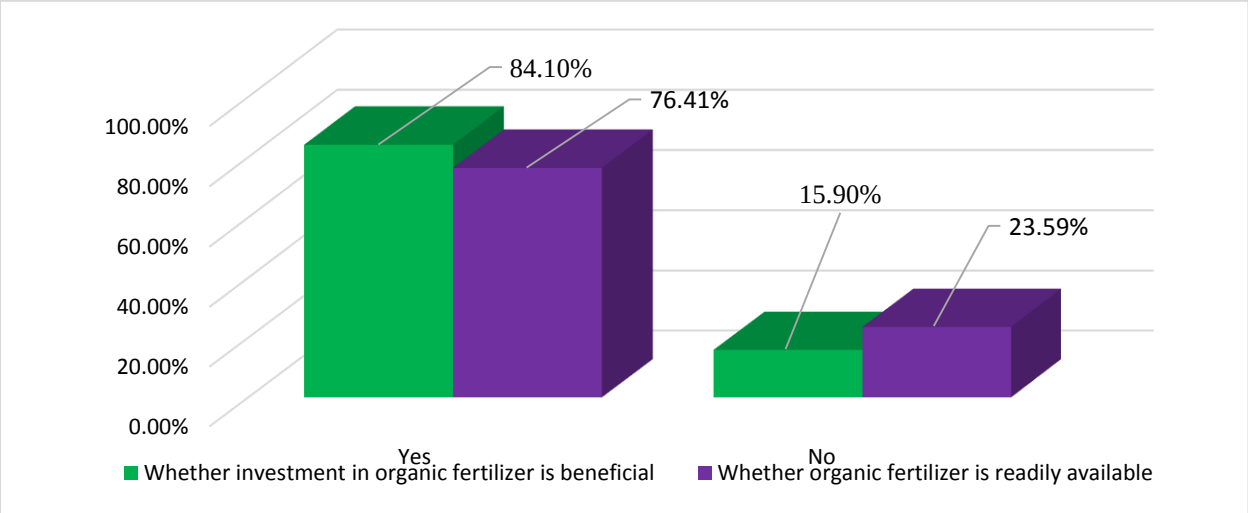

Figure 3.13: Whether Investment in Organic Fertilizer is Beneficial and if it is readily available.
Source: Field Survey, 2018.

Problem in the Use Organic Fertilizer

Indigenous conservation practices are those aimed at improving soil fertility of which organic residue make up the major measure use by most farmers. Organic fertilizer usage is not without problem. Common problem farmers encounter in the patronage of organic fertilizer are show in figure 3.14 below. These are organic matter being too heavy to carry by self (29%), about (20%) of them expressed it requires high transportation cost, (12%) said it requires

sorting before it could be put to use, other problem in could, organic matter being filthy and smelly (8%), requires burning (14%) and requires treatment before being put to use (17%). Not minding the fact that organic matter is readily available and an efficient measure to the farmers, they could also pose serious health problem if not carefully handled, because of its pollution of air, water bodies, farmlands and even household.Majority of the farmers expressed their concern that inorganic fertilizer is a better option to organic manure especially when abundantly available and inexpressive because it offers steady short term replenishment for effective soil fertility management. Organic fertilizer is however, a nature way of which fertility is returned back to the soil through a gradual process

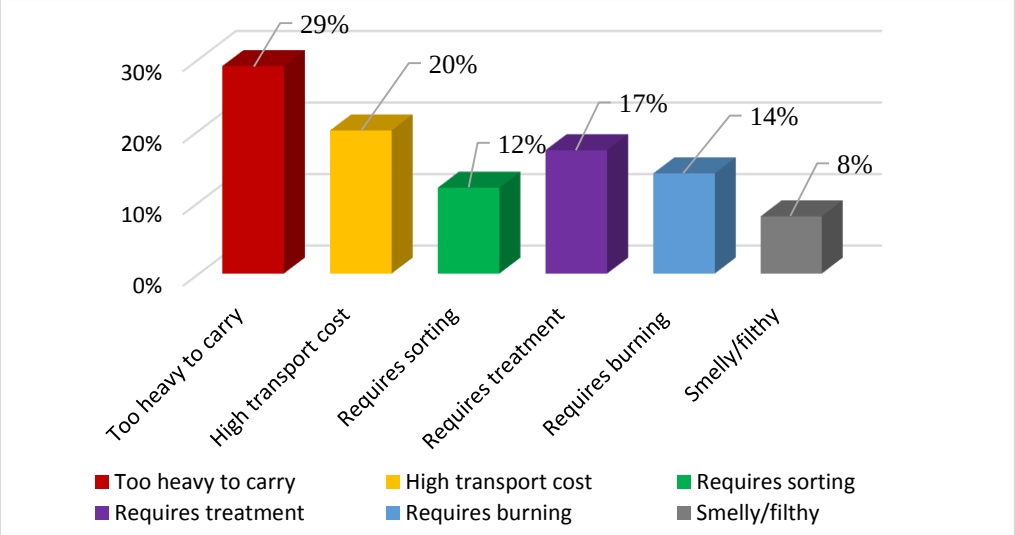

Figure 3.13: Problem in the Use of Organic Fertilizer
Source: Field Survey, 2018.

Measures to Improve the Use of Fertilizer as soil Fertility Maintenance Whether Receiving Assistance in the Procurement of Inorganic Fertilizer

Attempts were made to find out from farmers on whether they are currently receiving assistant in the procurement of inorganic fertilizer. (76%) indicated that they do not receiving any of such assistance. (24%) however said they had in the past receiving assistance in term of subsidy, free supplies, loans to purchase fertilizer etc. from state government, NGOs, community based organization, individuals and professional bodies but most of these assistances were never consistent, this is an major reason why most farmers

find it difficult to use inorganic fertilizer in the area as a fertility maintenance measure. All those interviewed however agreed that assistance in inorganic fertilizer procurement would highly improve soil fertility maintenance and crop yields.

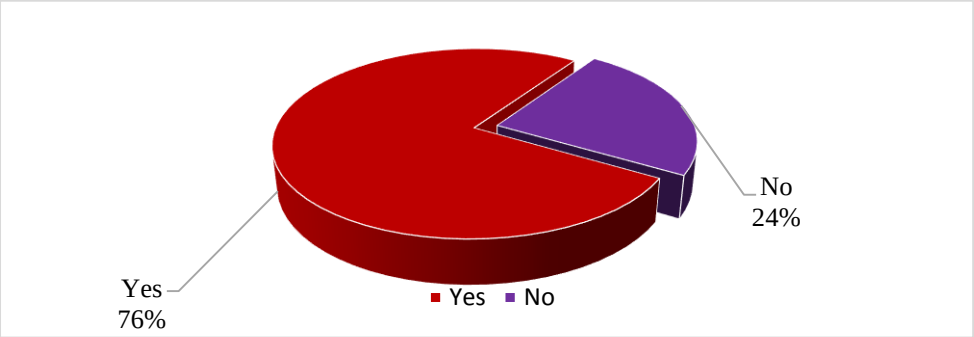

Figure 3.14: Whether Receiving Assistance in the Procurement of Inorganic Fertilizer

Source: Field Survey (2018)

Suggestions by Farmers on the Type of Subsidy to Encourage the Use of Inorganic Fertilizer

The farmers suggested that assistance of different forms such as prices subsidy (34.09%); free supply of fertilizer (43.04%) and loans to purchase fertilizer (22.87%) are all measures that are likely to raise the adoption of inorganic fertilizer usage. This therefore indicates that should government, NGOs and commercial institution assist the farmers by making the price of this commodity affordable, there is likely to be a shift from their high dependence on organic fertilizer. On further investigation most farmers were of the opinion that inorganic fertilizer produce immediate positive effects in the soil resulting in high crop yields. They also express the belief that the product is much health to use and may reduce the health hazards associated with the use of organic fertilizer.

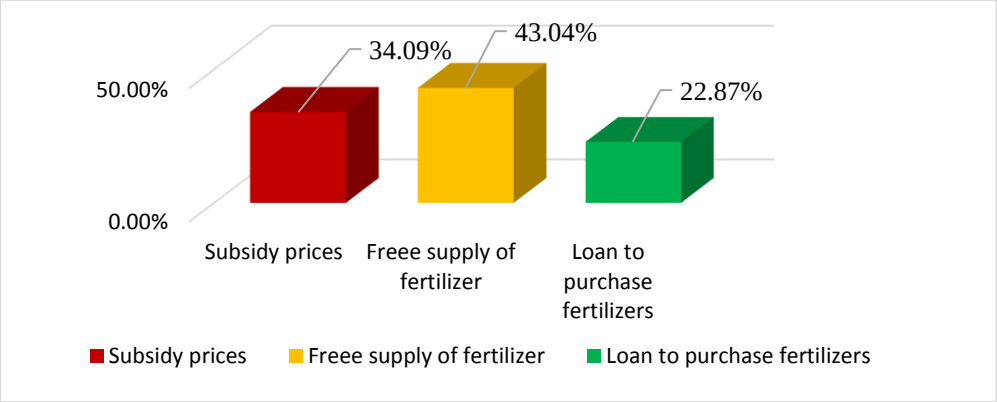

Figure 3.15: Suggestion by Farmers on the type of Subsidy to Encourage the Use of Inorganic Fertilizer.
Source: Field Survey, 2018.

CONCLUSIONS

In conclusion, result obtained from this study has supported the theory that farmers are to be given consideration by government and relevant stake holders in future planning and design of interventions to combat soil fertility and land degradation problem in Nigeria. This result has kicked against the assertion that majority of the farmers are resource poor, illiterate and are reluctant to implement government policies on soil conservation rather it has been discovered that farmers are resource person with a stock pile of effective indigenous conservation knowledge that has been put into beneficial practices. Government therefore in collaboration with relevant stake holders in the agriculture sectors and the farmers in particular should seek to develop indigenous soil and water conservations measures known to the local farmers for years to combat soil degradation on a large scale rather than always depending on borrowed technology which most time may not be effective in our region.

This study has shown that farmers are actively employing soil conservation measure to ensure fertility of farmers because of its numerous advantages and because of the lack of inorganic fertilizer of farmers. Organic fertilizer on the other hand is associated with low productivity when put into commercial farming. If agriculture is to keep pace with the increasing population demand for agriculture produce, then effective soil fertility maintenance has to be provided of which the inorganic fertilizer may be a better option. As it stands presently there is a near absence of external intervention to help framers overcome crisis associated with the use of inorganic fertilizer in this area, thereby the loss of interest to its use. To raise their interest once again the following suggestions should be taken into considerations; subsidy in prices, provision of loan and free distribution of the commodity. There should also be the need of government, NGOs, commercial institutions and relevant authorities to invest heavily in the procurement of inorganic fertilizer so as to make it cheap and available to farmers

RECOMMENDATION

Based on the result obtained and conclusions reached, the following recommendations are considered as being quite appropriate. There is the need to evolve are integrated cooperation approach to soil fertility maintenance in the area that shall bring together the farmers, community leaders, local authorities, state and federal government. Leaving the farmer to tackle the problem alone can never be effective There is the need to look into the possibility of initiating provision of motivational incentives to raise capacity of farmers by the provision of loan and training to make them adopt improve measures of soil fertility in the study area. In the short term, incentives may be required to encourage farmers' poverty trap is being worsen by increasing population pressure and food security.

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