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Use of Conservation Practices among Arable Crop Farmers in Oyo State, Nigeria

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Abstract
Conservation practices are tools used to help conserve and improve natural resources necessary to maintain sustainable arable crop production. This study assessed the extent of use of conservation practices among arable crop farmers in Oyo State, Nigeria. A multistage random sampling procedure was used in selecting 200 arable crop farmers. Data were collected through the use of a structured interview schedule. Percentages and mean statistic were used in presenting the results. Findings showed that the major conservation practices adopted by arable crop farmers were mulching (100%), crop rotation (100%), ridging (100%), bush following (99.0%) and mixed cropping (99.0%). The most frequently utilized conservation practices were ridging (95.0%), mulching (91.0%) and mixed cropping (89.9%). Population pressure on land ($\bar{x}$ =3.77) and availability of funds ($\bar{x}$ =3.74) are factors influencing the effective use of conservation practices. The results further revealed that long-term continuity of yield from land ($\bar{x}$=2.84), long-term sustainability and productivity of land ($\bar{x}$=2.76) and increased yields ($\bar{x}$=2.69) were reasons for conservation practices by arable crop farmers. To ensure improvement in yields, arable crop farmers should be extensively encouraged through access to land and funds to promote the adoption of conservation practices.

Introduction
Depletion of natural resources is one of the major problems throughout the world (Belachew, *et al.,* 2020). Soil conservation is an important step to increase

productivity and ensure sustainability in agriculture and meeting basic human needs, particularly food (Savari, *et al.,* 2022). A continuously growing pressure to increase food, fiber, and fuel production to meet worldwide demand and achieve zero hunger has put severe pressure on soil resources. The continued use of degraded lands for agricultural production requires ever-increasing management interventions to enable high-yielding food production (Mosier, Córdova & Robertson, 2021). There is a need to conserve the soil since it is the medium for plant growth and all agricultural and other related primary production activities depend on the soil. As noted by Ahuchaogu, *et al.* (2022), soil erosion, soil toxicity, soil pollution and depletion of soil nutrients resulting from agricultural and non-agricultural practices cause soil degradation.

Agricultural practices such as soil and water conservation appear to be a step in the right direction to meet global food demands in a more environmentally sustainable manner (Fontes, 2020). Without soil and water conservation regulations, the cost of remediating soil degradation would increase. Productivity would continue to decline, and thereafter it would continue to lower agricultural export revenue and increase food insecurity (Darkwah *et al.,* 2019). Therefore, there is a need to augment the soil back. One of the ways to ensure this is by effectively utilizing conservation practices. Studies have explored and recommended conservation measures which can enhance soil fertility and increase crop yield sustainably in the wake of climate change (Kimaru-Muchai, *et al.*, 2020).

Conservation practices involve the application of practices that are economically viable, socially acceptable, environmentally friendly and technically appropriate for the planting of arable crops; which in turn reduces soil erosion, increases soil fertility, increases soil organic matter and improve agricultural productivity (Alhassan & Abu, 2019). Conservation practices include conservation tillage, crop rotations, use of legumes in rotation, mulching, agroforestry cover cropping, use of manure as a part of a crop nutrient management plan, intercropping, precision agriculture, integrated pest management and other conservation nutrient management practices, strip cropping, Contour farming (Ahuchaogu *et al,* 2022; Gong, Bergtold & Yeager, 2021).

Farmers in Techiman Municipality of Ghana implemented conservation measures such as mulching, crop rotation, and use of compost/manure (Kwasi, *et al.,* 2019). This is because the use of these conservation practices has positive effects on their yield; it increases the sustainability of farming and reduces soil erosion. Efforts aimed at bridging food production to meet the need of the growing population have made rural farmers in arable crop production in Nigeria engage in conservation practices. Also, the use of conservation measures is practised among rural farmers to enhance soil resource management to meet up with the food demand in the country but not all the conservation measures are effectively used. Examining the extent of use and factors influencing the effective use of conservation practices among rural arable crop farmers in Oyo State, Nigeria is paramount, hence, the need for this study.

The study assessed the use of conservation practices among arable crop farmers in Oyo State, Nigeria. Specifically, the study identified the different conservation practices embarked on by the arable crop farmers; determined the extent of use of conservation practices; determined the factors influencing the effective use of

conservation practices by the rural farmers; and determine the reasons for practising conservation practices in the study area.

Methodology

The study was carried out in Oyo State, Nigeria. It lies on latitude and longitude 8.1574^0N and 3.6147^0E respectively. Oyo State is made up of thirty-three (33) Local Government Areas (LGAs). The major crops cultivated in the State include maize, yams, cassava and rice. All the arable crop farmers in the State constituted the population for the study. A multistage sampling procedure was used to select respondents. The first stage involved a random selection of five (5) LGAs from the 33 LGAs in the State. The second stage involved the random selection of four (4) communities from each of the LGAs selected, making a total of twenty (20) communities. The third stage involved a purposive selection of ten (10) arable crop farmers per community from the sampled communities because of their involvement in conservation practices. Hence, a total of 200 respondents constituted the sample size for the study. Primary data were collected from the respondents through the use of structured interview schedules that contained open and close-ended questions. The instrument for data collection was validated by experts in the field of agricultural extension and rural sociology.

To identify the conservation practices embarked on by the arable crop farmers, the respondents were provided with a list of various conservation practices to tick from the one applied to them, they also identified the available practices. The extent of use of conservation practices was determined by using the Likert type scale of always use = 3, occasionally use = 2, very rarely use = 1. The values were added together and divided by 3 to get a mean value of 1.5. A mean cut-off point of 1.5 was used. To determine the factors influencing the effective use of conservation practices by the arable crop farmers and reasons for practising conservation practices, a four-point type Likert-type scale of strongly agree=4, agree=3, disagree=2, and strongly disagree=1 was used. The values were added together and divided by 4 to get a mean of 2.5. A mean cut-off point of 2.5 was used. Data were analysed using percentage, mean statistic and standard deviation.

Result and Discussion

Conservation Practices Adopted by Arable Crop Farmers

The result in Table 1 shows the distribution of the respondents according to the type of conservation practices adopted. All (100.0%) of the respondents interviewed practised mulching (placing materials on the soil surface for protection), crop rotation (growing different crops in succession on a piece of land to avoid exhausting the soil) and ridging (long narrow elevation of land). This finding agrees with the findings of Tsado *et.al.,* (2021). In their findings, mulching, crop rotation, and cover crop were the major conservation practices adopted by small-scale yam farmers in Osun State on their farmland. Also, Nyirahabimana *et al* (2021) noted that mulching is widely adopted among farmers in Kenya and Uganda. The result of this study further shows that all (100.0%) of the respondents practiced ridging because most of the farmers cultivate arable crops like maize, cassava, and yam among other crops, which demands them to make ridges for planting and erosion reduction, hence making it an

affordable and useful practice. This finding is in tandem with Akplo *et. al* (2019) that ridging is significantly adopted and practiced to control soil erosion in the Republic of Benin.

The result further shows arable farmers were involved in crop rotation as a conservation practice. This helps to return nutrients to the soil and also interrupts pests and diseases. This finding is in agreement with the findings of Remigio *et. al.* (2022) that crop rotation is dominant and 51% of the farmers in Eastern Uganda indicated that they practiced crop rotation by succeeding different crops on the same piece of land seasonally. From the result also, 99.0% of the respondents practice bush fallowing (allowing land to fallow, leaving it for a long period to regain its fertility) and mixed cropping (planting of many crops on the same piece of land), while 98.0% of the respondents practiced conservation tillage and 97.0% of the arable crop farmers planted cover crops and at the same time leaving crop residues in the field to decay.

Table 1: Conservation practices adopted by arable crop farmers

Conservation practices*	%
Mulching	100.0
Planting cover crops	97.0
Crop rotation	100.0
Ridging	100.0
Bush fallowing	99.0
Mixed cropping	99.0
Alley cropping	81.5
Agroforestry	38.5
Conservation tillage	98.0
Contour farming	38.5
Application of animal manure	61.0
Leaving crop residues in the field to decay	97.0
Application of green manure	61.0

**multiple responses*

Use of Conservation Practices by Arable Crop Farmers

Table 2 shows the extent of use of the conservation practices by arable crop farmers. Among the conservation practices adopted, ridging is the most frequently used by the arable crop farmers ($\bar{x}$ =2.96). The reason for the use of ridging is to improve the structure of the soil thereby allowing the crop planted to be healthier. This result agrees with the findings of Geant *et. al*., (2022) that ridging is well-known and commonly used by farmers. The arable crop farmers always used mulching ($\bar{x}$ =2.91) because of its low cost of practice since it involves slashing the grasses and leaving them to decay on the ridges/heaps which adds to the soil nutrients thereby increasing their productivity. This finding is in agreement with Kehinde *et al.,* (2022) that mulching is the most adopted soil conservation practice among smallholder farmers in Oyo State, Nigeria.

It is also evident from the result that the respondents always adopted mixed cropping ($\bar{x}$=2.86) while some of the arable crop farmers allow the farm to go fallow by leaving it for some time to regain its fertility ($\bar{x}$ =2.70). Mixed cropping involves the

combination of different crops on the same piece of land. This practice will help to improve the physical, biological and chemical properties of the soil. According to Aliyu *et. al* (2021), if this practice is fruitfully utilized, it will help to enhance crop productivity and reduce pests and diseases for small farmers.

It was observed that arable crop farmers leave crop residues in the field to decay ($\bar{x}$ =2.43). Materials are left on cultivated land after the crop has been harvested. Valenzuela (2020) noted that crop residue could include leaves, twigs, pods and other plant litter that are left on the field, before, to planting a new crop in the field. The essence of this is to add nutrients to the soil. In addition to this, crop residue absorbs raindrop impact and keeps the wind off the soil surface. This reduces soil particle detachment, reducing erosion from the forces of water and wind. By protecting the soil surface, surface crusting is also reduced, improving infiltration and decreasing runoff. The use of crop residues has potential benefits in terms of soil quality and fertility, nutrient and water management, and pest management. Although, the release of nutrients that occurs as plant residues degrade has several effects on soil. The enhanced microbial activity causes an increase in soil structure, which affects most of the physical properties of soil, such as aeration and infiltration.

Table 2: Use of the conservation practices by arable crop farmers

Conservation practices	Mean ($\bar{x}$)	SD
Ridging	2.96	0.22
Mulching	2.91	0.29
Mixed cropping	2.86	0.44
Bush fallowing	2.70	0.55
Planting cover crops	2.44	0.52
Leaving crop residues in the field to decay	2.43	0.61
Crop rotation	2.42	0.56
Contour farming	2.16	0.61
Alley cropping	1.88	0.53
Agroforestry	1.52	0.68
Application of animal manure	1.52	0.63
Application of green manure	1.44	0.62

Factors Influencing Effective use of Conservation Practices

The result in Table 3 reveals the distribution of respondents based on the factors influencing the effective use of conservation practices. The major factors influencing the effective use of conservation practices include population pressure on land ($\bar{x}$ =3.77), availability of funds ($\bar{x}$ =3.75) and availability of labour ($\bar{x}$ =3.74). Conservation practices are inherently long-term, requiring land for an extended period. As population of community increases, the land resources become scarce, because the population is greater than the available land, hence resulting in increased exploitation of resources to provide food and water to the growing population, and this in turn would result in soil degradation in the form of soil erosion, loss of vegetation, drying of rivers and loss of biodiversity. This finding also collaborated with the findings of FAO (2021) that population pressure on the world's land is a factor limiting food production.

Availability of funds is an important factor in effectively using conservation practices on farmland because farmers need funds to purchase inputs and materials needed to practice conservation techniques on their farmland. They also need funds to pay extra labour when the practice requires activities during peak periods of normal fieldwork. Farmers' may be unable to raise sufficient funds to invest in the practice (because of lack of capital, limited access to credit, or temporary cash flow problems) and when this happens, such farmer would not be able to use conservation practices. This finding is in agreement with the findings of Oluwamayokun (2022) that finance is a key factor in adopting technology among farmers in Nigeria.

Labour availability is one of the most important types of diagnostic information that aid in selecting appropriate conservation practices and in defining farmers with high usage potential. Some conservation practices require extra work to effectively carry out the practice. If labour is scarce at a particular period that will hinder farmers from practising such conservation practices. This finding is supported by the findings of Etsay *et. al* (2019) that the availability of labour force was found to have a significant positive influence on farmers' decision to continuously use conservation measures in Ethiopia.

Other factors are farmers' experience ($\bar{x}$=3.73), management ability ($\bar{x}$=3.69), and knowledge of the practices ($\bar{x}$=3.66). Farmers' experience is a factor in conservation practices because highly experienced farmers have more tendencies to effectively utilize these conservation practices and take on risks and uncertainties, unlike inexperienced farmers. Some farmers are risk takers while some do not like taking a risk, they watch and learn from the experience of those that have utilized the conservation practices, and if it turns out well then they get to try out the practices. Knowledge about conservation practices goes a long way to use effective practice as being informed or having an idea about the practices will give a hedge to farmers about how to carry out the practices.

Table 3: Factors influencing the effective use of conservation practices by arable crop farmers

Factors	Mean	S.D
Population pressure on land	3.77	0.46
Availability of funds	3.75	0.56
Availability of labour	3.74	0.53
Farmers experience	3.73	0.49
Management ability	3.69	0.51
Knowledge of the practices	3.66	0.53
The information available about the practices	3.60	0.57
Climatic condition	3.60	0.59
Issue of the land tenure system	3.59	0.63
Fertilizer and input cost	3.58	0.56
The skill of the farmer	3.48	0.59
Fertilizer and input cost	3.47	0.63
Availability of conservation materials	3.33	0.66
Government policy	3.33	0.65

Reasons for Conservation Practices by Arable Crop Farmers

It is evident in Table 4 that, long-term continuity of yield from land ($\bar{x}$=2.84), long-term sustainability and productivity of land ($\bar{x}$ =2.76) and increased yields ($\bar{x}$ =2.69) were the utmost reasons for conservation practices by the respondents in the study area. As an approach, conservation measures are important to improve crop yield increment, particularly in highly degraded areas. Conservation practices are to improve crop yield by enhancing soil moisture and controlling erosion. The practice improves the retention of moisture and soil particles, together with fertilizer, within cropland which might otherwise be washed away by water erosion. In the absence of physical conservation structures and ecological agriculture, the entire cropland area might be seriously eroded and degraded and crop yield would be expected to decline. This finding is in agreement with the findings of Barrera (2019) that, conservation in agriculture increases yields. Conservation practices also help to replenish soil nutrient thereby aiding productivity and sustainability. This finding is also supported by the finding of Savari *et.al.,* (2022) that conservation is an important step to increase productivity and ensure sustainability in agriculture.

The findings also affirm that practising conservation practices improved soil structure ($\bar{x}$=2.70), enhanced soil fertility ($\bar{x}$=2.69), serves as erosion control ($\bar{x}$ =2.67), recycled soil nutrients ($\bar{x}$ =2.65), decreased food safety risks on the farm ($\bar{x}$ =2.63), serves as soil and water conservation ($\bar{x}$ =2.60), and increased soil water holding capacity ($\bar{x}$ =2.60). Conservation practices improve soil structure through the formation of soil aggregates and increased porosity resulting in better aeration and water retention. Enhanced soil fertility is the ability of soil to sustain plant growth and optimize crop yield and this is achievable through practising bush fallowing conservation practices. Erosion control is the prevention of wind and water, planting cover crops helps to achieve this benefit. Recycled soil nutrients are the return of the nutrients used by plants back into the soil through the direct application of animal manure conservation practices. Conservation practices decrease food safety risks on the farm through the making of vegetative barriers on the farmland as this will prevent contaminated water or runoff from contacting the edible portion of crops. Applying green manure to conservation practices helps in soil and water conservation. Increased soil water holding capacity is also one of the reasons for practising conservation practices in that application of organic matter enhances soil's ability to absorb water, leading to less water stress during both dry and wet periods.

The findings also show that conservation practices increased the resilience of farmers against climate variability ($\bar{x}$=2.60), higher soil water storage ($\bar{x}$ =2.54), enhanced soil water ($\bar{x}$ =2.50), controlled pests, insects and diseases on farmland ($\bar{x}$ =2.48), controlled weeds ($\bar{x}$=2.25) and reduced production costs ($\bar{x}$=2.23) were also the reason for practising conservation practices by the rural farmers. Application of conservation practices on the farmland leads to increased resilience of farmers against climate variability by helping farmers to prepare for hazardous events or disturbances related to climate such as planting of cover crops against erosion. It also helps in higher soil water storage through the application of zero tillage as this will increase the

total amount of water stored in the soil within the plants' root zone. In addition, it helps in enhancing soil water by increasing the number of micro and macro pores in the soil. Practising crop rotation on the farmland helps to control pests, insects and diseases on farmland. Weeds are controlled through the application of mulches on the soil, this will prevent sunlight from reaching the soil surface, and thereby preventing the growth of weeds as light is required for the germination of certain weeds.

Table 4: Reasons for practising conservation practices by the rural farmers

Reasons	Mean	S.D
It ensures long-term continuity of yield from the land	2.84*	0.43
It ensures long-term sustainability and productivity of land	2.76*	0.51
It leads to increase yields	2.69*	0.58
Improves soil structure with positive effects on water-holding capacity and nutrients retention	2.70*	0.60
It enhances soil fertility	2.69*	0.60
It helps in erosion control	2.67*	0.60
It helps to recycle soil nutrients	2.65*	0.59
Plays an important role in decreasing food safety risks on the farm	2.63*	0.66
Promotes soil and water conservation	2.60*	0.59
It increases soil water holding capacity	2.60*	0.60
It helps in increasing the resilience of farmers against climate variability	2.60*	0.764
It helps in higher soil water storage	2.54*	0.65
It enhances soil water storage	2.50*	0.70
It helps in controlling insects, pests and diseases	2.48	0.74
It helps in controlling weeds	2.25	0.71
It reduces production costs	2.23	0.75

**major reasons*

Conclusion and Recommendation

Arable crop farmers in the study areas adopted various conservation practices namely, mulching, crop rotation and ridging among others on their farms. Meanwhile, ridging, mulching and mixed cropping were frequently used because of their attributes. The major factors influencing the effective use of conservation practices include population pressure on land, availability of funds and availability of labour. Therefore, to ensure improvement in yields, arable crop farmers should be extensively encouraged through access to land and funds to promote the adoption of conservation practices.

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