

ASSESSMENT OF SOIL FERTILITY PRACTICES AMONG ARABLE CROP FARMERS IN OYO STATE, NIGERIA

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ABSTRACT

Sustaining soil fertility is critical for ensuring food and livelihood security for present and future generations. Inadequate Soil Fertility Management Practices (SFMP) among arable crop farmers have reduced crop yields and it threatens food production and farmers' livelihoods. This study assessed the SFMP among arable crop farmers in Oyo State. A four-stage sampling procedure was used to select 240 farmers and data were collected through questionnaires. Mean, charts, frequency counts, Chi square and Pearson Product Moment Correlation were used for analysis. The results showed that the majority of farmers were male (72.5%), married (83.3%) and Christian (75.3%), with an average age of 52 ± 9.42 years and a mean of 11 ± 5.23 years of education. Over half (51.7%) of respondents reported significant benefits from SFMP use. Utilisation of SFMP was high (50.8%) among farmers. Mulching ($\bar{x}=2.72$), minimum tillage ($\bar{x}=2.59$) and crop rotation ($\bar{x}=2.40$) were most adopted practices. Key benefits include increased crop yield ($\bar{x}=194.9$), higher income ($\bar{x}=194.9$) and reduced crop failure ($\bar{x}=191.7$). The main constraints were inadequate supply of inputs ($\bar{x}=2.84$), limited agricultural land ($\bar{x}=2.79$) and insufficient finance ($\bar{x}=2.68$). Years of farming experience ($r = 0.183$) significantly influenced SFMP use, with farming experience ($\beta = 0.223$) and educational attainment ($\beta = 0.107$) being key predictors of utilisation. It is recommended that policies and interventions should focus on improving farmers' access to inputs, finance and extension education to enhance sustained adoption of soil fertility practices.

Keywords: Soil Fertility, Soil Management Practices, Arable crops, Sustainable Agriculture, Crop yield.

INTRODUCTION

Effective soil management is fundamental to sustainable farming practices. According to Alemu (2019), a farmer's success largely depends on efficient soil management and the climatic conditions of the area. Proper soil management enhances the agricultural value of land and prevents environmental and soil deterioration, which can lead to unsustainable land use (Zaman, 2023).

The growing population in developing countries has intensified the demand for agricultural produce, driving land use and the adoption of technologies to increase agricultural output (Bellon-Maurel *et al.* 2022). However, these efforts to meet food, wood, and other resource demands often result in biodiversity destruction. Over-cropping and the use of inappropriate technologies and farming practices exacerbate unsustainable land use among farmers (Greentumble, 2016). Factors such as biodiversity loss, climate change, and land degradation, driven by population pressure, poverty and inadequate agricultural practices, pose significant challenges to sustainable production in developing countries (Mafiana *et al.* 2022).

Maintaining soil fertility is essential for food and livelihood security for current and future generations. Soil fertility management involves practices to preserve or improve soil fertility (Akinbode *et al.*, 2024). Traditionally, farmers managed soil fertility through crop rotation, bush fallowing, and shifting cultivation. However, due to

reduced land availability from population growth and urbanization, these practices are becoming less viable (Iderawumi *et al.* 2022). Contemporary soil fertility management techniques now include organic fertilizers, minimum tillage, and crop residue management (Havlin and Heiniger, 2020).

Historically, research primarily focused on determining the appropriate types and amounts of fertilizers for specific soil types and agroecological zones, emphasising external inputs and costly technologies. This approach often overlooked the knowledge and resources of farmers. In response, research has shifted towards Integrated Soil Fertility Management (ISFM), which combines traditional practices with external inputs like mineral fertilizers. Kugedera *et al.* (2023) highlighted ISFM techniques such as the use of manure, compost, crop rotation, intercropping, mulching, reduced tillage, and appropriate application of mineral fertilisers to sustainably improve soil fertility.

Despite Nigeria's substantial land area for arable crop production, which is critical for staple food production, productivity remains low (Nwuba and Okoli, 2022). To meet the food security needs of Nigeria's growing population, enhancing soil fertility management among arable farmers is essential. Therefore, this study assesses the extent of soil fertility management practices among arable crop farmers in Oyo State. Previous studies have largely focused on technical fertiliser recommendations, often neglecting the

socioeconomic factors, indigenous knowledge, and the integration of traditional and modern practices such as Integrated Soil Fertility Management (ISFM) (Ojediran *et al.*, 2023; Owolabi *et al.* 2024). This study fills this gap by investigating the level of utilisation, constraints, and benefits of soil fertility practices among arable crop farmers, providing evidence-based insights for targeted interventions and policy recommendations.

The specific objectives of the study were to: describe the socio-economic characteristics of the arable crop farmers; determine the extent to which respondents make use of soil fertility management practices; examine the benefits derived by respondents in the use of soil fertility management practices and identify constraints encountered by respondents to the use of soil fertility management practices

The hypothesis tested was: Ho1 – There is no significant relationship between selected socio-economic characteristics and the extent of soil fertility management practice usage

METHODOLOGY

The study was conducted in Oyo State, southwestern Nigeria, with Ibadan as its capital. The state covers a land area of approximately 28,454 square kilometers, situated between latitude 7°N and 9°N and longitude 3°E and 5°E, and is bordered by Kwara, Osun, Ogun, and the Republic of Benin. Oyo's tropical climate includes a wet season from April to October, with rainfall between 1,200 mm and 1,500 mm, and a dry season from November to March, with temperatures from 25°C to 35°C. Its vegetation ranges from tropical rainforests in the south to savannah in the north, supporting diverse agriculture, with crops such as maize, cassava, yam, plantain, and vegetables. Rivers like Ogun and Oba enhance irrigation and water supply. Oyo State's population exceeds 8 million, primarily Yoruba-speaking, with rural areas focused on subsistence and commercial farming, while urban centres drive trade and services. The state's extensive agricultural activity and varied farmer population make it a fitting location for examining soil fertility management practices, addressing both land use intensification challenges and opportunities for adopting advanced agricultural techniques.

Data for this research were gathered through the use of structured questionnaire. Oyo State comprises thirty-three Local Government Areas (LGAs), which have been officially organised into four Agricultural Zones under the Oyo State Agricultural Development Programme (OYSADEP). These zones are Ibadan/Ibarapa, Oyo, Saki/Iseyin and Ogbomosho. For administrative efficiency, the Ibadan/Ibarapa zone consists of fourteen LGAs/Blocks, while Oyo and Ogbomosho zones each

have five LGAs/Blocks, and the Saki/Iseyin zone comprises nine LGAs/Blocks.

In the first stage of the sampling procedure, a simple random sampling technique was employed to select 70% of the four agricultural zones in the study area. This resulted in the selection of three zones. In the second stage, two blocks were randomly selected from each selected zone were randomly selected, totaling six blocks. In the third stage, one cell was selected from each of these blocks, resulting in six cells. Subsequently, simple random sampling was used to select two villages from each cell, from which 20 arable crop farmers were randomly chosen per village. This process yielded a total sample size of 240 respondents.

Data were obtained using a structured questionnaire administered through face-to-face interviews to collect information on variables like socioeconomic characteristics, extent of use of Soil Fertility Management Practices, benefits derived, constraints faced in the use of SFMP in the study area. Frequency, percentage, standard deviation and the mean. Chi-square and PPMC were used to analyse the data. Benefits derived by respondents were measured on a 3-point Likert-type scale of not at all, to a lesser extent and a larger extent with scores of 0, 1 and 2 assigned respectively. The mean score was computed and used to categorise benefits derived into high and low categories using the 'above and below the mean' criterion. Constraints to the adoption of soil fertility management practice was measured using three point scale of 'Not a constraint', 'minor constraint' and 'major constraint' with scores of 0, 1, and 2 respectively. A weighted score was obtained for each constraint option and used to identify the major constraints affecting the adoption of soil fertility management practices in the study area. The extent of use of soil fertility management practices was measured as not at all, to a lesser extent and a larger extent, with scores of 0, 1, and 2 assigned respectively. An index score of the level of use of soil fertility management was computed and used to categorise the level of utilisation as either high or low.

RESULTS AND DISCUSSION

Socioeconomic characteristics of the respondents

The age distribution of the respondents as shown in Table 1 indicates that 35% were between the age range of 50 and 59 years, 29.2% were between the age of 40 and 49 years and 28.3% were between the age of 60 and 69 years. With the mean age at 53±8.71 years, majority of the respondents were in their active and productive age during which they could withstand the rigor required for farming operations. This result is in line with the findings of Ashimolowo *et al.* (2023) that people in their active ages tend to perform their tasks effectively and efficiently as they painstakingly endure the stress

and rigors of exerting and fatigue-laden assignments. Farming activities was dominated by men as 72.5% of the respondents were males while females accounted for the remaining 27.5%. Which implies that the majority of crop farmers were male. The results also show that 83.3% of the respondents were married, 12.5% were divorced and 3.3% were single. This indicates that the majority of the farmers that were involved in arable crop production were married. This could be because this category of people has more responsibilities than the unmarried, so the need to be involved in income-generating activities becomes necessary to meet up with the challenges of meeting family responsibilities. Results further reveal that 94.2% attained between 5 and 15 years of formal education, while 5% attained between 16 and 26 years of education. With the

mean years of formal education at 7.6 ± 4.76 years, it shows that majority of the respondents had fair level of formal education and were fairly literate. The literacy level of respondents could enhance better understanding of the importance of SFMP. Oyelere *et al.* (2020) stated that the literacy level of the respondents is a very important variable as it influences the ability to properly comprehend new techniques and methods required to bring about positive changes to the knowledge, attitude, skill and aspiration of the respondents. It is expected that they perform and operate more effectively, efficiently and know more about natural resources and environmental sustainability than those who had no formal education. Most (84.2%) of the respondents had farming as their primary occupation, which is a characteristic of the rural environment.

Table 1: Socioeconomic characteristics of the respondents.

Variable	Frequency	Percentage	mean
Age			
30-39	16	6.7	5±8.71
40-49	70	29.2	
50-59	84	35.0	
60-69	68	28.3	
>69	2	0.8	
Sex			
Male	174	72.5	
Female	66	27.5	
Marital Status			
Married	200	83.3	
Single	10	4.2	
Divorce	30	2.5	
Years of formal Educational			
1-6	120	50.0	7.6±4.76
7-12	86	35.8	
>12	34	14.2	
Primary Occupation			
Farmers	202	84.2	
Traders	26	10.8	
Civil servant	12	5.0	
Tribe			
Christianity	176	73.3	
Islamic	62	25.8	
Tribe			
Yoruba	216	90.0	
Hausa	22	9.2	
Igbo	2	0.8	
Monthly Income			
30,000-70,000	216	90.0	55,600.00±15527.36
71,000-111,000	10	8.3	
112,000-120,000	2	1.7	
Farming Experience			
1-10	88	36.7	24±11.12
11-20	111	42.2	
>20	41	17.1	

Source: Field Survey, 2023.

More (73.3%) respondents were Christians while 25.8% practice Islam and 8% were traditional worshippers. This implies that Christianity was the dominant religion in the study area with Yoruba (90.0%) as the major tribe. The table also shows that 90% of the respondents earn between ₦30,000 and ₦70,000 monthly, 8.3% earn between ₦71,000 and ₦111,000 and 1.7% earn between ₦112,000 and ₦120,000 with monthly mean income of 55,600 ±15527.36. This result suggests a high income for respondents, and it suggests that respondents were able to sustain their families. The mean years of experience was 24±11.12 years, suggesting that members were more experienced in their livelihood activities, which may have broadened their knowledge and put them in good position to adopt and make use of SFMP to improve their productivity.

The extent of use of soil fertility management practices by the respondents

The extent of use of Soil Fertility Management Practices (SFMP) among respondents indicates that mulching is the most frequently employed method, with a majority of respondents (75.0%) using it every season, resulting in a mean score of ($\bar{x} = 2.72$).

This suggests that mulching is highly favoured due to its effectiveness in maintaining soil moisture and improving soil fertility. The second most commonly used practice is zero tillage, with a mean score of ($\bar{x} = 2.42$), indicating that over half of the respondents (51.7%) of the respondents employed this method every season. Minimum tillage helps in reducing soil erosion and preserving soil structure, making it a vital practice in sustainable farming.

Crop rotation ranks third in usage with a mean score of ($\bar{x} = 2.34$), where 62.5% of the respondents adopt this practice once every two seasons. This method is essential in preventing soil depletion and managing pest and disease cycles. Ridging ($\bar{x} = 2.28$), is the fifth most used practice, though 57.5% applied it only once in two seasons. The consistent use of these SFMPs reflects their importance in enhancing soil fertility, although the varying levels of adoption suggest that some practices may be less accessible or require more resources, influencing their extent of use among the farmers. The data in Table 5 was further summarised to high and low extent of use. It reveals that majority (50.8%) had a high extent of use of SFMP while 49.2% had a low extent of use of SFMP.

Table 2 Distribution of respondent by their extent of use of Soil Fertility Management

SFMP	Not at all	Once in two seasons	Every season	Mean	Rank
Mulching	3.3	21.7	75.0	2.72	1 st
Minimum tillage	10.0	38.3	51.7	2.42	2 nd
Crop rotation	1.7	62.5	35.0	2.34	3 rd
Ridging	7.5	57.5	35.0	2.28	5 th
Mineral fertilizer	5.8	65.0	29.2	2.23	4 th
Bush fallowing	1.7	75.0	23.3	2.22	6 th
Organic manure (Poultry, cow and decomposed plants)	6.7	68.3	25.0	2.18	7 th
Use of cover crop	5.8	76.7	17.5	2.12	8 th
Planting of leguminous crop	9.2	70.8	20.0	2.11	9 th
Organic manure and mineral fertilizer	20.0	50.0	30.0	2.10	10 th
Compost	11.7	73.3	15.0	2.03	11 th

Source: Field Survey, 2023

Table 3 Distribution of respondents based on the Level of use of soil fertility management practices

Level of use of SFMP	Frequency	Percentage
Low	118	49.2
High	122	50.8
Total	240	100.0

Source: Field survey, 2022

Benefits derived from the use of soil fertility management practices

The most significant benefit derived by respondents from the use of Soil Fertility Management Practices (SFMPs) was an increase in crop yield (194.9). This suggests that the implementation of SFMPs is highly effective in boosting agricultural productivity, which is critical

for both subsistence and commercial farmers. The increase in crop yield directly translates to an increase in income (194.9), which also ranked highest among the benefits (Table 4). This outcome reflects the economic advantage of adopting SFMPs, as higher crop yields typically lead to greater financial returns for farmers, enabling them to improve their livelihoods.

Furthermore, the reduction in crop failure (191.7) as a key benefit emphasises the role of SFMPs in enhancing crop resilience and stability, reducing the risks associated with unpredictable climatic conditions and poor soil health. This benefit is particularly important in ensuring consistent agricultural output, which is vital for food security and income stability. Enhancing family food security (184.9) was also highlighted as a major

benefit, underscoring the impact of SFMPs on household nutrition and well-being. By securing adequate food production, these practices contribute to reducing hunger and malnutrition among farming families. These findings align with the research of Aghabeygi *et al.* (2024), who also found that the use of soil management practices, such as mineral fertilizers, crop rotation, and organic manures, significantly increased farming productivity.

Table 4 Distribution of the respondent based on the benefits derived from the use of SFMP

Benefits derived	Larger extent	Lesser extent	Not at all	Weighted score	Rank
Increase in crop yield	95.8	3.3	8.0	194.9	1 st
Increased income	95.8	3.3	8.0	194.9	1 st
Reduce crop failure	91.7	8.3	0.0	191.7	2 nd
Enhance family food security	85.8	13.3	8.0	184.9	3 rd
Improve the health of soil	85.0	13.3	10.0	183.3	4 th
Promote sustainability of farmland	79.2	20.8	0.0	179.2	5 th
Reduce misuse of harmful chemicals on soil	70.8	28.3	8.0	169.9	6 th
Encourage the involvement of youth in farming	59.2	35.8	5.0	154.2	7 th
Reduce environmental pollution	61.7	35.0	3.3	153.6	8 th
Reduce poverty	31.7	51.7	16.7	115.1	9 th

Source: Field Survey, 2023

Constraints encountered by respondents in the use of soil fertility management practices

The analysis of constraints faced by respondents in the use of Soil Fertility Management Practices (SFMP) as shown on Table 5 reveals that the most significant barrier is the inadequate supply of necessary inputs ($\bar{x} = 2.84$). This highlights the substantial difficulty farmers face in accessing essential inputs required for effective soil fertility management. This is followed by inadequate availability of agricultural land ($\bar{x} = 2.79$), indicating the pressure on land resources, suggesting that many farmers may struggle with land scarcity. Inadequate

finance ($\bar{x} = 2.68$) emerges as the third most critical constraint. Limited financial resources can significantly hinder farmers' ability to invest in necessary soil management practices, leading to reduced soil fertility and lower crop yields. The implication is that without sufficient funding, farmers may not adopt the necessary practices to maintain soil health. This aligns with the findings of Arifalo and Ilesanmi (2022), who identified inadequate funding as a major constraint faced by farmers in adopting sustainable soil management practices in Oyo State, Nigeria.

Table 5 Distribution of respondents based on constraints encountered to the use of SFMP

Constraints	Mean	Rank
Inadequate supply of necessary inputs	2.84	1 st
Inadequate availability of agricultural land	2.79	2 nd
Inadequate finance	2.68	3 rd
Shortage supply of human labour	2.56	4 th
High cost of soil management practices	2.52	5 th
Transportation problem of fertility inputs	2.02	6 th
Lack of knowledge of SFM utilisation	1.58	7 th

Source: Field Survey, 2023

Relationship between respondents' socio-economic characteristics and extent of use of Soil Fertility Management Practices

Years of farming experience ($r = 0.183$, $p < 0.05$) shows a significant positive correlation with the extent of SFMP usage. This implies that farmers with more experience are more likely to employ effective soil fertility management practices, likely due to their accumulated knowledge and practical

understanding of the benefits. This supports the findings of Daudu *et al.* (2017), that farmers with more years of farming experience tend to adopt more soil fertility management practice than those with few years of experience. Other variables such as sex, marital status, religion, age and educational attainment do not have a significant association with the extent of SFMP usage. This suggests that these demographic factors do not play a crucial role in

determining how frequently or extensively farmers adopt soil fertility management techniques.

Table 6: Chi-square and correlation analysis between some selected socio-economic characteristics and the extent of soil fertility management practices

Variable	Chi-square value	df	p-value	r- value
Sex	0.828	1	0.363	
Marital status	0.362	2	0.164	
Religion	2.957	2	0.228	
Age			0.110	0.147
Educational attainment			0.707	0.351
Years of farming experience			0.047	0.183
Monthly income			0.457	-0.69

Source: Field Survey, 2020

CONCLUSION AND RECOMMENDATIONS

The study underscores the importance of Soil Fertility Management Practices (SFMPs) in boosting agricultural productivity, economic stability, and food security. Key benefits of SFMPs include increased crop yield, increased income, reduced crop failure and improved family food security, demonstrating their role in sustainable agriculture. However, challenges such as inadequate inputs, limited land access, financial constraints, and labour shortages hinder the full utilisation of SFMPs. To overcome these barriers, it is recommended that the Ministry of Agriculture improves input availability, the Land Use Committee enhances land access, financial institutions offer better credit facilities, and agricultural departments invest in machinery and farmer education on SFMPs.

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