International Journal of Organic agricultural Research & Development
Volume 20 (4) (2025)

ASSESSMENT OF SOIL FERTILITY MANAGEMENT PRACTICES AMONG FARMERS IN THE NORTHERN AND SOUTHERN GUINEA SAVANNA ZONES OF KWARA STATE, NIGERIA

[1]Olabooye A.O. and [2]Owoade F.M.
[1]Department of Agricultural Technology, Federal Polytechnic Ayede, Ayede, Oyo State
[2]Department of Crop Production and Soil Science, Ladoke Akintola University of Technology, Ogbomoso, Oyo State.
Correspondence email: Olabooyeao@federalpolyayede.edu.ng
Tel: 08083862266

ABSTRACT

Declining soil fertility remains a major constraint to agricultural productivity and sustainability in Nigeria's Guinea Savanna zones. This study assessed soil fertility management practices among farmers in the Northern and Southern Guinea Savanna zones of Kwara State, Nigeria, with emphasis on the types of practices adopted, socio-economic factors influencing adoption, and major challenges encountered. A multistage random sampling technique was used to select 200 farmers across three local government areas. Primary data were collected through a well-structured questionnaire and analyzed using descriptive statistics and Pearson's Product Moment Correlation (PPMC). Results showed that most respondents were within the active age range (31–50 years), male, married, and moderately educated, with an average of 6 ha farm size and substantial farming experience. The majority belonged to farmer associations, indicating high potential for information sharing and innovation diffusion. Both organic and inorganic fertilizers were widely used; however, the Northern zone relied more on organic inputs due to livestock manure availability, whereas the Southern zone depended on inorganic fertilizers because of better access to input markets. Soil testing awareness was relatively high, but adoption remained low due to high costs, inadequate facilities, and limited technical knowledge. Fertilizer application and crop rotation were the most common soil fertility training topics, while organic manure management received less attention. Major constraints identified includes high input costs, inadequate extension support, soil erosion, and limited access to quality inputs. Farmers largely perceived fertilizers as the most effective fertility restoration method, showing preference for NPK over organic alternatives. The study concludes that although farmers recognize the importance of soil fertility management, their practices remain conventional and cost-driven. In conclusion, the study recommends that strengthening of extension systems, improving access to soil testing services and credit facilities, promoting integrated soil fertility management (ISFM), are required to enhance sustainable productivity across both Guinea Savanna zones and supporting farmer cooperatives.

Keywords: *Soil fertility, Fertilizers, Integrated Soil Fertility Management, Guinea Savanna, Adoption, Smallholder farmers.*

INTRODUCTION

Soil fertility plays a vital role in determining agricultural productivity, food security, and environmental sustainability across sub-Saharan Africa (Brady and Weil, 2019). In Nigeria, where over 70% of the population relies on agriculture for livelihood, declining soil fertility has become a major threat to sustainable food production (Adenle and Ifejika, 2020). The Guinea Savanna zone, covering large parts of Kwara State, is particularly vulnerable to environmental hazards due to continuous cropping, nutrient mining, and poor land management (Huising and Mesele, 2021). Fertility depletion, often caused by erosion, leaching, and reduced organic matter, is further exacerbated by climate change and inadequate soil management technologies (Sofo *et al.,* 2022). Historically, smallholder farmers have relied on traditional soil fertility enhancement techniques such as fallowing, crop rotation, and manure application. However, population pressure and reduced land availability have limited the sustainability of these practices (Osabohien *et al.,* 2024). Consequently, many farmers have turned to inorganic fertilizers, often applied without scientific guidance, leading to soil acidification and nutrient imbalance (Pahalyi *et al.,* 2021). The uneven adoption of integrated

soil fertility management (ISFM) across Nigeria reflects both institutional and knowledge barriers

Kwara State provides a unique context for studying soil fertility management because it encompasses two major agro-ecological zones i.e. the Northern and Southern Guinea Savannas each with distinct rainfall patterns, soil properties, and land-use systems (Sulaimon, 2024). The Northern Guinea Savanna (NGS) is characterized by low rainfall (900–1,200 mm) and lighter textured soils prone to erosion and nutrient depletion (Akinbode *et al.,* 2024). In contrast, the Southern Guinea Savanna (SGS) experiences higher rainfall (1,100–1,400 mm) and denser vegetation, supporting a wider variety of crops but facing challenges of nutrient leaching and declining organic matter (Wahab *et al.,* 2023).

Previous study by Owoade and Abolarin (2021) have confirmed that soils in Kwara State generally exhibit low organic carbon and available phosphorus, limiting crop yield potential. Despite numerous extension campaigns and government programs such as the Growth Enhancement Support Scheme (GESS), adoption of balanced nutrient management practices remains minimal (Garuba and Ololade, 2024). Farmers' decisions are influenced by socio-economic factors such as education, access to credit, land tenure, and availability of extension services (Aliu, 2018). Therefore, understanding farmers' management behaviors and the constraints they face is critical for designing location-specific interventions that promote sustainable soil fertility management (Yusuf *et al.,* 2021).

This study was designed to assess the types and extent of soil fertility management practices adopted by farmers in both Guinea Savanna zones of Kwara State, analyze the socio-economic factors influencing adoption and identify key challenges limiting effective soil fertility management.

Materials and Methods

Study Area

The study was conducted in the Northern and Southern Guinea Savanna zones of Kwara State, Nigeria. Kwara lies between latitudes 7°45′N and 9°30′N and longitudes 2°30′E and 6°25′E, covering approximately 36,825 km² (Olanrewaju, 2009). The state has a tropical climate with distinct wet (April–October) and dry (November–March) seasons. Rainfall averages between 1,100 and 1,400 mm in the SGS and 900 to 1,200 mm in the NGS. Vegetation varies from open woodland in the north to denser savanna in the south. Major crops include maize, cassava, yam, rice and cowpea.

Sampling Procedure and Data Collection

A multistage random sampling technique was employed to select the respondents for this study. In the first stage, 25% of the total local government areas (LGAs) in each zone were randomly chosen. Moro LGA was purposively selected to represent the Northern Guinea Savanna zone, while Ifelodun and Irepodun LGAs were purposively selected to represent the Southern Guinea Savanna zone. In the second stage, 1% of the total number of villages within the selected LGAs was randomly sampled. Specifically, five village namely Shao, Jokolu, Olooru, Eleja Nla, and Bode-Sa'adu were selected from Moro LGA; five villages which are Koko-Araromi, Amoyo, Idofian, Igberi-Owode, and Jimba Oja were chosen from Ifelodun LGA; and one village i.e., Ajase-Ipo was selected from Irepodun LGA. At the final stage, 20% of the farming households in each selected village were randomly chosen based on their availability and willingness to participate in the study, resulting in a total of 200 respondents.

Primary data were obtained using a well-structured questionnaire designed to capture relevant information on farmers' socio-economic characteristics (such as age, gender, education, household size, farm size, and farming experience), soil fertility management practices (including organic and inorganic input use, cropping systems, and conservation techniques), sources of agricultural information, and the major constraints affecting soil fertility management.

Analytical Techniques

Data were analyzed using descriptive statistics (frequency, percentage, mean) to summarize socio-economic variables and management practices. Pearson's Product Moment Correlation (PPMC) was used to test the existence of relationship between the pairs of variables.

Conceptual Framework

This study is anchored on the Technology Adoption Theory (Rogers, 2003), which posits that adoption of innovation depends on factors such as relative advantage, compatibility, and perceived complexity. Farmers' decisions to adopt soil fertility management technologies are shaped by their socio-economic status, knowledge, access to extension services and perceived benefits (Teklewold *et al.,* 2019)

Results and Discussion

Socio-Economic Characteristics of Respondents

The socio-economic profile of respondents across the Northern and Southern Guinea Savanna zones revealed that most farmers were within the active age range of 31–50 years, with mean ages of 42 years in the North and slightly higher in the South, indicating that the majority were in their productive years and capable of adopting improved soil fertility management practices. Most respondents were within the productive age bracket (31–50 years), indicating high potential for innovation and adoption of improved soil fertility practices. Similar findings were reported by Olanrewaju et al. (2023) and Mustapha et al. (2021), who observed that middle-aged farmers tend to be more receptive to agricultural innovations due to their combination of physical capability and accumulated experience. Males dominated farming activities (about 78–80%), reflecting the gendered structure of rural labour in Nigeria, though increasing female participation was also evident consistent with Adamu et al. (2022) and FAO (2022), who noted a gradual rise in women's involvement in soil fertility and crop management. Most respondents were married (over 84% in the North and 91% in the South), providing household stability and shared labour resources, which enhance decision-making in farm management (Kassie *et al.,* 2020). Educational attainment was generally moderate to high, over half of the respondents in the North and about two-thirds in the South had at least secondary education implying that literacy levels could positively influence their understanding and adoption of soil fertility technologies. Education enhances comprehension of fertilizer recommendations and soil management practices (Adeboye *et al.,* 2022; Akinbile *et al.,* 2020). Farming was the main occupation for the majority in the Northern zone, while farmers in the Southern zone tended to diversify income sources by combining farming with non-farming activities, which improves resilience and investment capacity (Noma *et al.,* 2024). The majority (over 85%) of respondents belonged to associations or cooperatives an important platform for accessing agricultural information and input credit (Kamara *et al.,* 2021; FAO, 2022).

Farmers also had considerable experience, averaging 19 years in the NGS and 14 years in the SGS, aligning with Kassie et al. (2020), who found that experience enhances the likelihood of adopting sustainable intensification practices. Most respondents owned their farmland, which promotes long-term soil investment and conservation (Adjei-Nsiah, 2020; Vanlauwe *et al.,* 2019). Farm sizes averaged 6 ha, suggesting semi-commercial orientation and the potential to implement improved fertility management techniques (Adenuga *et al.,* 2022). Cereal crops dominated production in both zones, reflecting their economic importance but also their high nutrient demand, which can accelerate soil nutrient depletion if not managed properly (Mustapha *et al.,* 2021; Bationo *et al.,* 2021). Overall, these characteristics suggest that the farmers possess favourable demographic, institutional, and experiential attributes—such as literacy, association membership, and tenure security—that can significantly enhance the adoption of sustainable soil fertility management practices when properly supported by extension and enabling policies.

Table 1: Distribution of Respondents in the Northern Guinea Savannah according to Socio-economic Characteristics

Zone	Characteristics	*Frequency	Percentage
Northern Guinea Savanna Zone	**Age**		
	<30	15	17.1
	31-40	26	29.5
	41-50	28	31.8
	Above 50	19	21.6
	Sex		
	Male	70	79.5
	Female	18	20.5
	Marital Status		
	Married	74	84.1
	Unmarried	14	15.9
	Education		
	Primary education	15	17
	Secondary education	46	52.3
	Tertiary education	7	8.0
	No formal education	20	22.7
	Source of livelihood		
	Farming	75	85.2
	Non farming	10	11.4
	Combination of both	3	3.4
	Membership of association		
	Yes	80	90.9
	No	8	9.1

Source: Field survey, 2025
* Multiple responses

Table 2: Distribution of Respondents in the Northern Guinea Savannah according to Socio-economic Characteristics

Zone	Characteristics	*Frequency	Percentage
Northern Guinea \Savanna Zone	**Age**		
	<30	9	8.2
	31-40	32	29.1
	41-50	37	33.6
	Above 50	34	29.1
	Sex		
	Male	87	77.7
	Female	25	22.3
	Marital Status		
	Married	102	91.1
	Unmarried	10	8.9
	Education		
	Primary education	18	16.1
	Secondary education	37	33.0

Tertiary education	31	27.7
No formal education	26	23.2
Source of livelihood		
Farming	20	17.9
Non farming	61	54.5
Combination of both	31	27.6
Membership of association		
Yes	89	79.5
No	23	20.5

Source: Field survey, 2025 * Multiple responses

Access to evaluation of soil fertility

Result in Table 3 revealed that for the Northern Guinea Savanna, majority (65.9%) of the respondents had access to soil fertility while 34.1% of the respondents do not have access to soil fertility. Whereas for the Northern Guinea Savanna zone, it was revealed that 79.4% of farmers in the study area indicated they had access to soil fertility while 20.6% do not have access to soil fertility. The higher rate of soil fertility evaluation in the Southern Guinea Savanna reflects the influence of stronger extension networks and proximity to agricultural research institutions in that zone. Similar trends were observed by Adeboye et al. (2022), who noted that frequent extension contact enhances awareness and adoption of soil testing practices.

Table 3: Distribution of respondents according to access to fertility of the soil before planting each season

Zone	Access to fertility of the soil	*Frequency	Percentage
Northern Guinea Savanna Zone	**Yes**	**58**	**65.9**
	No	**30**	**34.1**
	Total	**88**	**100.0**
Southern Guinea Savanna Zone	**Yes**	**89**	**79.4**
	No	**24**	**20.6**
	Total	**112**	**100**

Source: Field survey, 2025 * Multiple responses

Methods of evaluating soil fertility

Result in Table 4 shows the distribution of respondents based on methods of evaluating soil fertility. According to the findings for the Northern Guinea Savanna zone, majority (94.3%) of the respondents indicated observation as means of evaluating soil fertility, 90.9% indicated soil testing while 70.5% of the respondents indicated visual inspection. For the Southern Guinea Savanna zone, 83.9% of the respondents indicated visual inspection as a method of evaluating soil fertility, 64.3% of the respondent indicated soil testing while 72.3% of the respondent indicated observation. The result implies that most of the respondents in the Southern evaluate their soil fertility via visual inspection while respondent in the Northern zone evaluate their soil fertility via observation. Although soil testing was acknowledged by many respondents, its low adoption indicates barriers such as cost, lack of access to laboratories, and limited awareness (Okebiorun *et al.,* 2023). Farmers' reliance on visual observation supports findings by Mustapha et al. (2021) that smallholders often depend on experiential indicators such as leaf colour and soil texture, which can be subjective and less precise.

Table 4: Distribution of respondents according to methods of evaluating soil fertility

ZONE	Method of evaluation	*Frequency	Percentage
Northern Guinea Savanna Zone	Visual inspection	62	70.5
	Soil testing	80	90.9
	Observation	83	94.3
Southern Guinea Savanna Zone	Visual Inspection	94	83.9
	Soil Testing	72	64.3
	Observation	81	72.3

Source: Field survey, 2025 * Multiple responses

Types of training received on soil fertility

Result in Table 5 shows the distribution of respondents based on training received on soil fertility. For the Northern Guinea Savanna zone, Majority (94.3%) of the respondents indicated fertilizer application method, 90.9% indicated crop rotation, 70.5% indicated testing technique while 58.0% of the respondents indicated use of organic manure as training received on soil fertility. For the Southern Guinea Savanna zone, majority of the respondent i.e 87.5% and 83.9% indicated fertilizer application method and crop rotation respectively as the training received on soil fertility, 58% indicated use of organic manure while 52.7% indicated soil testing techniques as training received on soil fertility. The result implies that respondents sampled in the study area received various training on soil fertility, but majority of the respondent identified crop rotation and fertilizer application methods as the major training received on soil fertility and management practices in the two zones. The predominance of training on fertilizer application and crop rotation shows that most extension interventions emphasize conventional nutrient management. Olanrewaju et al. (2023) similarly reported that government and NGO programs in the savanna zones mainly focus on inorganic fertilizer use. Limited training on organic manure and soil testing implies a knowledge gap in sustainable soil management.

Table 5: Distribution of respondents according to type of training you received regarding soil fertility

Zone	Type of training	*Frequency	Percentage
Northern Guinea Savanna zone	Soil testing technique	62	70.5
	Fertilizer application method	80	94.3
	Crop rotation	83	90.0
	Use of organic manure	51	58.0
Southern Guinea Savanna Zone	Soil testing technique	59	52.7
	Fertilizer application method	98	87.5
	Crop rotation	94	83.9
	Use of organic manure	65	58.0

Source: Field survey, 2025 * Multiple responses

3.5 Soil fertility management practices

Result in Table 6 revealed that majority (94.3%) of the respondents used organic fertilizer for soil fertility management practices, 93.3% used mulching, 90.5% used crop rotation, 58.0% used cover cropping, 70.5% used synthetic fertilizer while 52.3% of the respondents used intercropping for soil fertility management practices. The result implies that different soil fertility management practices were adopted by the sampled respondents, but the use of organic fertilizer was common among the respondents. This could be true because the use of organic fertilizer is the most popular way of managing soil fertility. As highlighted by Vanlauwe et al. (2019) and Bationo et al. (2021), integrating organic and inorganic nutrient sources (ISFM approach) is critical to maintaining soil fertility and resilience in sub-Saharan Africa. The widespread use of both organic and inorganic fertilizers demonstrates farmers' adaptive strategies to sustain productivity.

Table 6: Distribution of respondents according to soil fertility management practices

Zone	Soil fertility management practices	*Frequency	Percentage
Northern Guinea Savanna	Use of synthetic fertilizer	6 2	70.5
	Use of organic fertilizer	8 0	94.3
	Use of crop rotation	8 3	90.5
	Cover cropping	5 1	58.0
	Mulching	8 2	93.3
	Intercropping	4 6	52.3
	Use of synthetic fertilizer	7 6	67.9
	Use of organic fertilizer	3 2	28.6
	Use of crop rotation	8 1	72.3
	Cover cropping	6 2	55.4
	Mulching	3 9	34.8
	Intercropping	79	70.5

Source: Field survey, 2025 * Multiple responses

Type of fertilizer mostly apply to soil

Result in Table 7 revealed that for the Northern Guinea Savanna zone, majority (94.3%) applied organic fertilizer mostly on soil while 58.0% applied inorganic fertilizer on soil. The result implies that organic fertilizer was mostly apply to soil by the respondents because organic fertilizer especially animal manure is cheaper inorganic fertilizer. For the Southern Guinea Savanna zone, majority (96.4%) applied inorganic fertilizer mostly on soil while 41.1% applied organic fertilizer to the soil. Higher organic fertilizer use in the Northern Guinea Savanna could be attributed to greater livestock ownership and manure availability, consistent with findings by Suleiman et al. (2020). Conversely, the higher dependence on mineral fertilizers in the Southern Guinea Savanna may be linked to better market access and availability through commercial input dealers (Ayoola et al., 2022). However, the dominance of inorganic fertilizers without adequate organic supplementation risks long-term soil degradation and nutrient imbalance (FAO, 2022).

Table 7: Distribution of respondents according to the type of fertilizer mostly apply to soil

	Type of fertilizers	*Frequency	Percentage
Northern Guinea Savanna	Organic fertilizer	83	94.3
	Inorganic fertilizer	51	58.0
Southern Guinea Savanna	Organic fertilizer	46	41.1
	Inorganic fertilizer	108	96.4

Source: Field survey, 2025 * Multiple responses

Means of determining quantity of fertilizer to apply

Result in Table 8 shows that majority (84.1%) of the respondents in the Northern Guinea Savanna determined quantity of fertilizer to apply based on personal experience, 77.3% based on recommendation from input suppliers, 65.9% don't apply fertilizer, 62.5% based on recommendation from extension agents while 47.7% of the respondent's determined quantity of fertilizer to apply based on soil test results. For the Southern Guinea Savanna, majority 92.9% determine quantity of fertilizer to apply based on personal experience, 48.2% based on recommendation from input supplier, 45.5% based on soil test results while 33.0% determine based on recommendation from extension agents. The results shows that quantity of fertilizer to apply based on personal experience was the major means of determining quantity of fertilizer to apply as identified by the respondents in the two agroecological zones. Farmers' heavy reliance on personal judgment to determine fertilizer quality suggests weak linkages between farmers and regulatory agencies. Similar patterns were reported by Noma *et al.*, (2024), who found that most Nigerian smallholders lack access to certified input information and often depend on informal sources. This could lead to suboptimal nutrient application, counterfeit fertilizer use, and reduced productivity.

Table 8: Distribution of respondents according to mean of determining quantity of fertilizer to apply

Zone	Quantity determinant	*Frequency	Percentage
Northern Guinea Savanna Zone	Based on personal experience	74	84.1
	Base on soil test results	42	47.7
	Base on recommendation from input suppliers	68	77.3
	Base on recommendation from extension agents	35	62.5
	Don't apply	58	65.9
Southern Guinea Savanna Zone	Based on personal experience	104	92.9
	Base on soil test results	51	45.5
	Base on recommendation from input suppliers	54	48.2
	Base on recommendation from extension agents	37	33.0
	Don't apply	60	53.6

Source: Field survey, 2025 * Multiple responses

Challenges faced during soil fertility management

Result in Table 9 shows the distribution of respondents based on the challenges faced during soil fertility management. For the Northern Guinea Savanna zone, majority (85.2%) of the respondents claimed inadequate knowledge on soil fertility management as the challenges faced during soil fertility management, 68.2% claimed soil erosion or degradation, 66.2% claimed high cost of fertilizer 52.5% of the respondents

claimed limited access to soil testing service. The result implies that respondents sampled in the study area faces different challenges during soil fertility management, but inadequate knowledge on soil fertility was identified by the respondents as the most challenging among others. High input costs, inadequate technical knowledge, and soil erosion emerged as major constraints across both zones. These issues are consistent with those reported by Kassie et al., (2020) and Adenuga et al., (2022), who identified similar barriers to fertilizer use efficiency among smallholders. The economic burden of fertilizer purchase continues to discourage consistent application, especially under inflationary conditions. Soil erosion and continuous cultivation without adequate organic matter input exacerbate fertility decline (Mustapha et al., 2021), underlining the need for conservation-oriented soil management.

Table 9: Distribution of respondents according to challenges faced during soil fertility management

Zone	Challenges	*Frequency	Percentage
Northern Guinea Savanna Zone	Inadequate knowledge on soil fertility management	75	85.2
	Limited access to soil testing service	26	29.5
	High cost of fertilizer	53	60.2
	Lack of access to organic input	46	52.3
	Soil erosion or degradation	60	68.2
Southern Guinea Savanna Zone	Inadequate knowledge on soil fertility management	81	
	Limited access to soil testing service	32	
	High cost of fertilizer	79	
	Lack of access to organic input	62	
	Soil erosion or degradation	43	

Source: Field survey, 2025 * Multiple response

Frequency of use of soil fertility management practiced

Result in Table 10 shows the distribution of respondents based on the frequency of use of soil fertility management practiced. It was measured on 3-point rating scale of Always, sometimes, rarely and never and the weighted mean score was captured. The result for the Northern Guinea Savanna Zone shows that inorganic fertilizer had the highest weighted mean score of (2.26) ranked 1st, followed by animal manure with weighted mean score of (2.17) ranked 2nd while compost was the least with weighted mean score of (2.06) ranked 3rd. The result for the Southern Guinea Savanna Zone shows that inorganic fertilizer had the highest weighted mean score of (2.4) ranked 1st, followed by animal manure with weighted mean score of (1.88) ranked 2nd while compost was the least with weighted mean score of (1.81) ranked 3rd. the above result implies that inorganic fertilizer is frequently use for soil fertility management practices among the respondents of the two zones. The preference for fertilizers over compost or green manure shows that farmers prioritize short-term yield responses over long-term soil health benefits. Kamara et al. (2021) noted that visible crop responses to fertilizers encourage repeated use even when soil degradation risks increase.

Table 10: Distribution of respondents according to frequency of use of the soil fertility management practiced

Soil fertility management practices		Always	Sometimes	Rarely	Never	WMS	Rank
Northern Guinea Savanna Zone	Animal Manure	35(39.8)	36(40.9)	14(15.9)	3(3.4)	2.17	2nd
	Inorganic Fertilizer	29(33.0)	56(63.6)	-	3(3.4)	2.26	1st
	Compost	26(29.5)	51(58.0)	1(1.1)	10(11.4)	2.06	3rd
Southern Guinea Savanna Zone	Animal Manure	30(26.8)	51(45.6)	11(9.8)	20(17.9)	1.81	2nd
	Inorganic Fertilizer	56(50.0)	42(37.5)	12(10.7)	2 (1.8)	2.4	1st
	Compost	40(35.7)	32(28.6)	27(24.1)	13(11.6)	1.88	3rd

Source: Field survey, 2025 WMS: Weighted Mean Score

Soil fertility restoration methods

Result in Table 11 revealed that for the Northern Guinea Savanna, majority (84.1%) of the respondents indicated fertilizer as soil fertility restoration methods, 77.3% indicated manure, 65.9% indicated follow, 61.4% indicated crop rotation, 48.9% indicated intercropping, 40.9% indicated agroforestry while 30.7% of the respondents indicated alley farming as soil fertility restoration methods. For the Southern Guinea Savanna, 98.2% of the respondent indicated fertilizer as soil fertility restoration methods, 70.5% indicated crop rotation, 69.6% indicated intercropping, 45.5% indicated manure, 28.6% indicated agroforestry, 17.9% indicated fallow while 8.9% indicated alley farming.

Table 11: Distribution of respondents according to soil fertility restoration methods

	Soil fertility restoration methods	*Frequency	Percentage
Northern Guinea Savanna Zone	Fallow	58	65.9
	Intercropping	43	48.9
		36	40.9
	Agroforestry	54	61.4
	Crop rotation	74	84.1
	Fertilizer	68	77.3
	Manure	27	30.7
	Alloy farming	20	17.9
Southern Guinea Savanna Zone		78	69.6
	Fallow	32	28.6
	Intercropping	79	70.5
		110	98.2
	Agroforestry	51	45.5
	Crop rotation	10	8.9
	Fertilizer		
	Manure		
	Alley farming		

Source: Field survey, 2025 * Multiple responses

Level of preference for soil fertility restoration methods

Level of preference for soil fertility restoration methods

Result in Table 12 shows the level of preference for soil fertility restoration methods and it was measured on 3point rating scale of most prefer, preferred and not prefer. The weighted mean score was determined and computed accordingly. The result reveled that for the Northern Guinea Savanna zone, N.P.K fertilizer had the highest weighted mean score of (1.80) ranked 1st, followed by compost with weighted mean score of (1.49) ranked 2nd, next to it was sheep and goat manure with weighted mean score of (1.22) ranked 3rd, green manure was ranked 4th with weighted mean score of (1.05), Pig dungs was ranked 5th with weighted

mean score of (1.05), poultry manure with weighted mean score of (0.95) ranked 6th while cow dungs was the least with weighted mean score of (0.77) ranked 7th. While for the Southern Guinea Savanna zone, N.P.K fertilizer had the highest weighted mean score of (1.97) ranked 1st, followed by compost with weighted mean score of (1.41) ranked 2nd, next to it was green manure with weighted mean score of (1.25) ranked 3rd, sheep and goat manure was ranked 4th with weighted mean score of (1.15), Poultry manure was ranked 5th with weight mean score of (1.00), cow dungs with weighted mean score of (0.69) was ranked 6th while pig dungs was the least with weighted mean score of (0.55) ranked 7th. The result implies that there was preference for soil fertility restoration method among the respondents with the use of NPK fertilizer being the mostly preferred methods across the two zones. The preference for certain soil fertility restoration method could significantly influenced their utilization for evaluating soil fertility and management practices.

Table 12: Distribution of respondents according to level of preference for soil fertility restoration methods

Zone	Soil fertility restoration methods	Most prefer	Preferred	Not prefer	WMS	Rank
Northern Guinea Savanna Zone	Compost	59(67.00)	13(14.8)	16(18.2)	1.49	2nd
	Poultry manure	26(29.5)	32(36.4)	30(34.1)	0.95	6th
	Cow dungs	21(23.9)	26(29.5)	41(46.6)	0.77	7th
	Pig dungs	35(39.8)	22(25.0)	31(35.2)	1.05	5th
	Sheep and goat manure	40(45.5)	27(30.7)	21(23.9)	1.22	3rd
	Green manure	47(53.4)	12(13.6)	29(33.0)	1.20	4th
	N.P.K	73(83.0)	12(13.6)	3 (3 . 4)	1.80	1st
Southern Guinea Savanna Zone	Compost	65 (58.0)	28(25)	19(17.0)	1.41	2nd
	Poultry manure	35(31.3)	42(37.5)	35(31.1)	1.00	5th
	Cow dungs	20(17.9)	37(33.0)	55(49.1)	0.69	6th
	Pig dungs	23(20.5)	15(13.4)	74(66.1)	0.55	7th
	Sheep and goat manure	42(37.5)	32(28.6)	38(33.9)	1.15	4th
	Green manure	48(42.9)	45(40.2)	19(17.0)	1.25	3rd
	N.P.K	109(97.3)	3(2.7)	0	1.97	1st

Source: Field survey, 2025 WMS: Weighted Mean Score

Effectiveness of soil fertility management practices

Result in Table 13 shows the level of effectiveness of soil fertility management practices.

The result revealed that for the Northern Guinea Savanna, fertilizer had the highest weighted mean score of (3.01) ranked 1st, followed by manure with weighted mean score of (2.00) ranked 2nd while compost was the least with weighted mean score of (1.98) ranked 3rd. while for the Southern Guinea Savanna, fertilizer had the highest weighted mean score of (3.4) ranked 1st, followed by manure with weighted mean score of (2.7) ranked 2nd while compost was the least with weighted mean score of (2.1) ranked 3rd. The above result implies the fertilizer was seen as the most effective soil fertility and management practices as identified by the respondents of the two zones. The low perceived effectiveness of compost suggests inadequate processing methods or lack of technical guidance on compost application. According to Vanlauwe et al. (2019), when properly managed, compost enhances cation exchange capacity, soil structure, and nutrient availability—factors that sustain fertility beyond immediate crop cycles.

Table 13: Distribution of respondents according to effectiveness of soil fertility management practices

	Soil fertility management practices	Very effective	Effective	Mild effective	I don't know	WMS	Rank
Northern Guinea Savanna Zone	Compost	7(8.0)	19(21.6)	27(30.7)	35(39.8)	1.98	3rd
	Manure	8(9.1)	19(21.6)	26(29.5)	35(39.8)	2.00	2nd
	Fertilizer	27(30.7)	36(40.9)	24(27.3)	1(1.1)	3.01	1st
Southern Guinea Savanna Zone	Compost	14(12.5)	19(17.0)	47(41.9)	32(29.5)	2.1	3rd
	Manure	34(3.04)	31(27.7)	27(24.1)	20(17.9)	2.7	2nd
	Fertilizer	60(79.5)	38(33.9)	12(10.7)	2(1.8)	3.4	1st

Source: Field survey, 2025 WMS: Weighted Mean Score

Constraints encountered with the use of soil fertility management practices

Result in Table 14 revealed that for the Guinea Savanna zone, majority (89.8%) of the respondents stressed that some of the methods are costly (expensive), 83.0% stressed that not all the methods are effective, 76.1% stressed that most of the methods are stressful while 10.2% of the respondents stressed that required production materials are not readily available for some of the methods. For the Southern Guinea Savanna, majority (92.0%) of the responded stressed that some of the methods are costly, 70.5% stressed that not all methods are effective, 66.1% stressed that most of the methods are stressful while 15.2% of the respondents stressed that required production materials are not readily available for some of the methods. The result implies that the major constraints encountered with the use of soil fertility management practices was some of the methods are too costly as identified by the respondents.

Table 14: Distribution of respondents according to constraints encountered with the use of soil fertility management practices.

Zone	Constraints	*Frequency	Percentage
Northern Guinea Savanna Zone	Most of the methods are stressful	67	76.1
	Not all the methods are effective	73	83.0
	Some of the methods are costly (expensive)	79	89.8
	Required production materials are not readily available for some of the methods	9	10.2
Southern Guinea Savanna Zone	Most of the methods are stressful	74	66.1
	Not all the methods are effective	79	70.5
	Some of the methods are costly (expensive)	103	92.0
	Required production materials are not readily available for some of the methods	17	15.2

Overall, the results reveal a dual pattern of knowledge and practice: while farmers recognize the importance of fertility management, their practices remain largely conventional and cost-driven. To achieve sustainable fertility restoration, emphasis should shift towards integrated soil fertility management (ISFM), combining mineral fertilizers with organic inputs and agroecological practices (Adjei-Nsiah, 2020; Bationo *et al.,* 2021). Enhancing farmer access to soil testing services, capacity-building programs, and affordable input financing schemes can significantly improve adoption and long-term productivity in both Guinea Savanna zones.

Conclusion

The study revealed that farmers in both the Northern and Southern Guinea Savanna zones of Kwara State possess favourable socio-economic characteristics such as being within the productive age group, having moderate educational attainment, substantial farming experience, and strong association membership that collectively enhance their capacity to adopt improved soil fertility management practices. However, despite awareness of soil fertility importance, the overall adoption of diagnostic and sustainable practices such as soil testing and organic nutrient management remains limited. The dominance of fertilizer-based nutrient management and reliance on visual indicators for soil assessment indicate a persistence of conventional methods. High input costs, inadequate technical training, and weak extension support systems continue to constrain adoption. While the Southern zone benefits from better access to extension and input markets, the Northern zone demonstrates stronger reliance on organic inputs due to livestock manure availability. The imbalance between inorganic and organic nutrient use poses a long-term risk to soil quality and productivity. Hence, there is a need for deliberate strategies to promote integrated soil fertility management (ISFM) that combines organic and inorganic inputs to ensure sustainable nutrient cycling and improved soil health (Vanlauwe *et al.,* 2019; Bationo *et al.,* 2021).

Recommendations

To promote sustainable soil fertility management in the Guinea Savanna zones of Kwara State, agricultural extension services should be strengthened to provide regular training on integrated soil fertility management (ISFM), compost preparation, and soil testing techniques to improve nutrient use efficiency (Adeboye *et al.,* 2022; Olanrewaju *et al.,* 2023). Government and private actors need to enhance access to soil testing by subsidizing and decentralizing laboratory services to make them affordable for smallholder farmers (Okebiorun et al., 2023). Farmers should also be encouraged to increase the use of organic manure, compost, and crop residues to boost soil organic matter and long-term fertility (FAO, 2022; Mustapha et al., 2021). Furthermore, strengthening regulatory frameworks and farmer linkages with certified input dealers is crucial to prevent adulterated fertilizer circulation and improve input quality (Noma et al., 2024). Expanding access to agricultural credit and input subsidies would reduce the financial burden associated with adopting improved soil management practices (Adenuga et al., 2022). Strengthening farmer cooperatives can further enhance knowledge sharing, group-based training, and collective access to quality inputs (Kamara et al., 2021). Finally, the adoption of agroecological practices—such as cover cropping, crop rotation, and residue incorporation—should be promoted through extension support and policy incentives to mitigate soil erosion and fertility decline (Adjei-Nsiah, 2020; Kassie et al., 2020).

References

Adamu, M., Hassan, M., and Yakubu, M. (2022). Gender roles and participation in soil fertility management among rural farmers in Northern Nigeria. Journal of Rural Social Research, 14(2), 25–38.

Adeboye, M. A., Lawal, A. O., and Usman, S. A. (2022). Influence of extension contact on soil fertility evaluation among maize farmers in Kwara State, Nigeria. *Journal of Agricultural Extension*, 26(3), 67–79.

Adenle, A. A., and Ifejika, S. (2020). Agricultural sustainability in Nigeria: Challenges and prospects. *African Journal of Agricultural Economics*, 12(3), 45–58.

Adenuga, A. H., Omotesho, O. A., and Adedokun, B. (2022). Economic analysis of fertilizer use efficiency among arable crop farmers in Nigeria. *Nigerian Journal of Agricultural Economics*, 9(1), 25–37

Adjei-Nsiah, S. (2020). Sustainable soil fertility management for African smallholders. *Agronomy*, 10(12), 1936. https://doi.org/10.3390/agronomy10121936

Akinbile, C. O., Mustapha, A., and Alabi, T. (2020). Evaluation of farmers' knowledge and practice of integrated soil fertility management in Northern Nigeria. *Nigerian Journal of Soil Science*, 30(1), 34–45.

Akinbode, O. A., Adege, T., and Olayemi, K. (2024). Adoption of integrated soil fertility management practices among maize farmers in Southwest Nigeria. *Nigerian Journal of Soil Science*, 34(1), 67–78.

Aliu, A. (2018). Farmers' access to agricultural inputs and technology adoption in Nigeria. *Journal of Rural Development Studies*, 6(2), 45–56.

Ayoola, G. B., Akinyemi, O., and Kolade, F. (2022). Fertilizer use patterns and constraints among smallholder maize farmers in Southwest Nigeria. *West African Journal of Applied Ecology*, 30(2), 15–28.

Bationo, A., Kihara, J., and Vanlauwe, B. (2021). Soil fertility management in sub-Saharan Africa: Concept and practice. Nutrient Cycling in Agroecosystems, 121(1), 1–20

Brady, N. C., and Weil, R. R. (2019). *The Nature and Properties of Soils* (15th ed.). Pearson Education.

FAO (Food and Agriculture Organization of the United Nations). (2022). State of food and agriculture 2022: Leveraging smallholder innovation for sustainable transformation. Rome: FAO.

Garuba, A., and Ololade, O. (2024). Constraints to adoption of soil fertility management practices in Kwara State, Nigeria. *Journal of Agricultural Extension*, 28(1), 89–104.

Huising, J. E., and Mesele, S. A. (2021). Land and soil suitability evaluation for sustainable production in the Guinea Savanna of Nigeria. *Nigerian Journal of Soil Science*, 31(2), 123–136.

Kamara, A. Y., Tofa, A. I., and Chikoye, D. (2021). Adoption and impact of fertilizer use on cereal productivity in Nigeria's savanna agro-ecologies. Agricultural Systems, 189, 103070

Kassie, M., Teklewold, H., Jaleta, M., and Marenya, P. (2020). Understanding the adoption of sustainable intensification practices in African smallholder systems. Land Use Policy, 101, 105145.

Lawal, A. O., Adeboye, M. A., and Adigun, J. A. (2021). Factors influencing soil testing adoption among maize farmers in Nigeria. Journal of Agricultural and Environmental Management, 12(4), 245–257.

Mustapha, A., Akinbile, C. O., and Abdullahi, J. (2021). Soil fertility challenges and sustainable nutrient management in the Nigerian Guinea Savanna. Nigerian Journal of Soil Science, 31(2), 19–33.

Noma, S. S., Jibrin, J. M., and Yusuf, S. D. (2024). Fertilizer quality perception and adoption of improved nutrient management practices among Nigerian farmers. Journal of Soil and Tillage Research, 236, 105444. https://doi.org/10.1016/j.still.2023.105444

Ogunjimi, L. A., Adefalu, L. L., and Adebo, G. M. (2021). Knowledge and utilization of soil management practices among smallholder farmers in Southwestern Nigeria. African Journal of Agricultural Research, 17(12), 1623–1634.

Ojo, T. S., Adewale, O. A., and Ibitoye, S. J. (2022). Crop diversification and smallholder farmers' livelihoods in Southwest Nigeria. Journal of Agricultural Extension and Rural Development, 14(8), 120–131.

Olanrewaju, D. O. (2009). Physical geography of Kwara State. *Kwara State Ministry of Information Bulletin*, 12(1), 8–16.

Olanrewaju, S. O., Oladipo, T. O., and Fadare, A. S. (2023). Constraints and opportunities in soil fertility management among smallholder farmers in Nigeria. Nigerian Journal of Soil Science, 33(1), 57–69.

Okebiorun, A. I., Lawal, M. O., and Adeyemi, A. J. (2023). Determinants of soil testing adoption among crop farmers in Nigeria. Nigerian Journal of Agricultural Extension, 27(1), 45–56.

Osabohien, R., Adeleye, B., and Edeh, H. (2024). Agricultural intensification and soil degradation in Nigeria: Policy implications. *Journal of Sustainable Agriculture and Development*, 7(1), 55–70.

Owoade, M., and Abolarin, A. (2021). Effect of land use systems on soil fertility in parts of Kwara State, Nigeria. *Nigerian Journal of Ecology*, 28(2), 55–69.

Pahalyi, F., Vanlauwe, B., and Tenywa, M. (2021). Fertilizer use efficiency in smallholder systems of West Africa. *Soil Use and Management*, 37(4), 887–899.

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). Free Press.

Sofo, A., Wakene, T., and Chukwu, U. (2022). Soil fertility decline in sub-Saharan Africa: Causes, effects, and management options. *African Journal of Environmental Science and Technology*, 16(3), 109–122.

Suleiman, A., Mustapha, S., and Musa, H. (2020). Manure management practices and nutrient recycling in Northern Nigerian farming systems. International Journal of Agricultural Sustainability, 18(5), 378–391.

Sulaimon, K. O. (2024). Comparative analysis of soil fertility status in Northern and Southern Guinea Savanna of Kwara State. *Nigerian Journal of Soil and Environment*, 19(2), 98–113.

Teklewold, H., Kassie, M., and Shiferaw, B. (2019). Adoption of sustainable agricultural practices in Africa: Evidence from micro-level data. *Journal of Agricultural Economics*, 70(2), 550–568.

Vanlauwe, B., Coyne, D., and Giller, K. (2019). Integrated soil fertility management in sub Saharan Africa: Concepts and challenges. *Experimental Agriculture*, 55(2), 1–20.

Wahab, T., Oyeleke, J., and Shittu, O. (2023). Spatial variability of soil nutrients under different land use systems in the Southern Guinea Savanna of Nigeria. *Soil and Tillage Research*, 232(1), 105–113.

Yusuf, A., Ibrahim, R., and Oba, A. (2021). Constraints to adoption of sustainable soil management in Nigeria's Savanna agro-ecologies. *Journal of Environmental Management and Food Production*,