

Research Article

Soil Fertility Management Practice Among Arable Crop Farmers in Ifedore Local Government, Ondo State, Nigeria

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Abstract

The research was conducted to understand the farming system with regards to soil fertility management practices among rural food crop growers in the local government of Ifedore in Ondo State. A multistage, random, and cluster technique of sampling was employed to choose 120 respondents for the research, descriptive and inferential statistics were both utilized to analyze results. Investigations showed that the average age was 47.5 years which implies that a significant number of arable crop farmers are active and predominantly in their Middle Ages, the overall farm average was 3.7 hectares, indicating that the majority of respondents were small-scale farmers, the average number of crop growers' children was 4 children, the average farming experience in years is 18.7 years, indicating that most farmers had significant experience in arable crop production. A majority of the farmers practiced crop rotation and alley cropping. A majority (71.7%) of farmers received information on soil fertility management through radio. 58.3% of the farmers practiced intercropping as an indigenous soil fertility management practice. The correlation outcome showed that years of farming experience and soil fertility management techniques are significantly correlated. The chi-square result indicated that no significance exists between the source of soil fertility knowledge and the management techniques for soil fertility. As a result, it is necessary that considering the significance, programs should be implemented to improve soil fertility management techniques among arable farmers in the research region.

Keywords

Soil Fertility Management, Arable Crop Farmers, Agricultural Practices, Crop Productivity

1. Introduction

The term "soil fertility management" involves the coordinated application of crop rotation, cover crops, soil amendments, and other agronomic techniques to progressively improve soil fertility and productivity. It entails using water, organic matter, and nutrients [8] sparingly in order to max-

imize crop production while minimizing harmful environmental effects. Nigerian agriculture is at a crossroads, with little progress in educating and implementing innovative soil fertility management practices among small-scale farmers to improve profitability as well as productivity [4].

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Soil fertility is defined as the capacity of soil to sustain agricultural plant growth, offering a habitat for plants and consistently producing high-quality yields. According to Vanlauwe et al [23], the persistent decline in soil fertility is the main biophysical root cause behind the decreasing per capita food availability on crop farms in Nigeria. The constant cycling of nutrients between organic and inorganic fertilizer forms is a complicated process [5]. This includes mineralization, which occurs when organic matter such as animal wastes, crop residues, and decaying plant matter breaks down in the soil and releases inorganic nutrients like phosphorus and potassium [14].

Soil fertility management is essential not only for the maintenance of sustainable food production but also for safeguarding the environment [21]. Furthermore, effective soil management to promote mycorrhizal fungi contributions will favour biological fertility processes, resulting in a more balanced integration of the soil's biological, chemical, and physical fertility components [9]. In addition, in areas dedicated to agriculture and other human endeavors, ensuring soil fertility necessitates the implementation of soil conservation practices. This is essential because soil erosion and other forms of degradation tend to diminish the overall quality of the soil [17]. However, insufficient soil fertility not only leads to reduced crop yields but also contributes to the prevalence of various plant diseases [13]. When soil fertility is compromised, crops are unable to thrive optimally, rendering them more vulnerable to diseases and pests.

As per the Food and Agricultural Organization's (FAO) report [7], efficient management of soil fertility practices promotes sustainable agriculture by minimizing nutrient runoff and soil erosion. This contributes to the preservation of soil quality and reduces the negative environmental impact of agricultural activities. It has been recognized beyond all doubt to be a key element of sustainable soil management [19].

Enhancing productivity requires an understanding of the significance and effects of the practices of soil fertility management for farmers of arable crops [2]. It is crucial to investigate how farmers can learn about practical methods to enhance their agricultural output quality. In the world of agriculture, managing soil fertility is crucial, especially for growers of arable crops. Farmers can maximize their soil's fertility by using the right techniques, which will increase crop yields and overall productivity [12]. Therefore, recognizing the significance of effectively managing soil fertility and its profound impact on the productivity and sustainability of arable crop farmers is essential.

It is against this background that this research was carried out to achieve the broad objective which was to understand the farming system with regards to soil fertility management practices among rural food crop producers in Ifedore local government area in Ondo State, Nigeria.

The following are the specific objectives which;

1. Ascertained the socio-economic characteristics of participants of respondents.

2. Identified the soil fertility management practices among the arable crop farmers.
3. Identified sources of information on soil fertility management to the arable crop farmers.
4. Identified the benefits of soil fertility management to arable crop farmers.
5. Identified the indigenous soil management practices among arable crop farmers.

Research Hypotheses

Ho₁: There is no notable connection between some of the respondents' socio-economic factors and practices of soil fertility management.

Ho₂: There is no notable connection between the information sources and practices of soil fertility management.

2. Methodology

The research was conducted in Ifedore Local Government Area, Ondo State, Nigeria. The local government is located on the border between Ondo State and the eastern part of Osun State. It has an Area of 295 km² and a density of 807.1/km² and is located in the southwestern part of Nigeria. The state lies within latitudes 5°45' and 8°15' North and longitudes 4°45' and 6°5' East. With an approximate population of 176,327 at the 2006 census [15], the people living in these areas are predominantly Yorubas, they are mostly small-scale farmers engaging in the growing of yam, cassava, maize, cocoyam, vegetables, cowpea, cocoa, Oil palm, plantain as the major food crops and fruits such as cashew, mango, and orange.

Respondents were selected using a multistage random sampling technique. The initial stage involved randomly selecting Ifedore Local Government Area from among the 18 Local Government Areas in Ondo State. In the second stage, six (6) communities were randomly chosen from a total of eight (8) communities in Ifedore Local Government Area which include; Ibule-soro, Ipogun, Ilara-mokin, Igbara-oke, Ijare, and Ero. The third step involved selecting one cluster through the use of cluster sampling from each of the local government clusters. Finally, at the cluster level, simple random sampling was applied to choose 20 farmers across each cluster. Hence, a total of 120 respondents made up the study's sample size.

Descriptive statistical analysis, including measures like frequencies, means, and percentages, was used to analyze the data in order to examine the respondents' socioeconomic status, the methods used to control soil fertility, the sources of information about soil fertility management, the benefits of soil fertility management practices and the indigenous farmers' strategies for managing soil fertility in the research area. Pearson Product Moment Correlation (PPMC) was used as an inferential statistic to test the link between the respondents' social and economic characteristics of arable crop producers and soil fertility management practices and Chi-square was utilized to test the connection between the sources of infor-

mation and soil fertility management practices.

3. Results and Discussions

3.1. Socioeconomic Characteristics of Respondents

The results presented in the first table demonstrate the chronological age distribution of arable crop farmers. According to the results, 34.2% of the farmers fell within the age bracket of 35-44 years, while 30.8% were aged between 45-54 years. Additionally, 17.5% of the crop growers were in the 55-64 age group, 12.5% were aged 25-34 years, and 5% were in the 65-74 age range. The respondents' average age was 47.5 years. These results support Sahara et al.'s [18] assertion that the majority of arable crop producers are active and predominantly in their Middle Ages.

Regarding the sex of the farmers, Table 1 reveals that 73.3% were male, while 26.7% were female. This indicates that men dominated arable crop farming in the study area. This outcome aligns with the findings of Edafe et al. [6], which suggests that men are more likely to engage in physically demanding tasks associated with farming compared to women.

In terms of religion, the findings in Table 1 show that 71.7% of the farmers identified as Christians, 19.2% as Muslims, and 9.2% as Traditional worshippers. This implies that the study area is predominantly Christian.

Analyzing farm size, Table 1 indicates that 98.3% of the farmers had farmland ranging from 1 to 10 hectares. Only 0.8% had between 11 to 20 hectares, and another 0.8% had 21 to 30 hectares. A farm's average size was 3.7 hectares, indicating that many of the respondents were smallholder farmers. This finding aligns with the research conducted by Arifin and Nirawal [1].

The results in Table 1 also reveal the years of farming experience among farmers. 70.8% of the respondents had 1 to 20 years of farming experience, while 27.5% had 21 to 40 years. Only 0.8% had 41 to 60 years, and another 0.8% had 61 to 80 years of farming experience. The average farming experience was 18.7 years, indicating that most farmers had significant experience in arable crop production.

Regarding the educational level, Table 1 shows that 9.2% of the respondents had no formal education, 16.7% had primary education, 35.8% had secondary education, 21.7% had OND, 15.8% had HND/BSc, and 0.8% had a postgraduate degree. These findings support Nwaobiala's [16] research, which suggests that farmers' level of education enhances their acceptance of innovation.

Regarding marital status, Table 1 indicates that 8.3% of the respondents were single, 88.3% were married, 0.8% were divorced, and 2.5% were widowed. This suggests that the majority of respondents were married.

Examining the primary occupation of farmers, Table 1 reveals that 83.3% had farming as their primary occupation,

11.7% had paid employment, and 5% were pensioners.

Table 1 also indicated that 35% of the respondents had 0-2 children, 40% had 3-5 children, and 25% had 6-9 children. The average number of 4 children were represented in each family.

Table 1. Socio-economic characteristics of the respondents (n = 120).

Category	Category	Category	Category
Farmers' Age			
25-34 Years	15	12.5	45.7 Years
35-44 Years	41	34.2	
45-54 Years	37	30.8	
55-64 Years	21	17.5	
65-74 Years	6	5.0	
Sex of Farmers			
Male	88	73.3	19.2
Female	32	26.7	
Religion of Farmers			
Christianity	86	71.7	19.2
Muslim		23	
Traditional	11	9.2	
Farmers' Farm Size			
1-10	118	98.3	3.7 Hectares
11-20	1	0.8	
21-30	1	0.8	
Years of Farming			
1-20 Years	85	70.8	18.7 Years
21-40 Years	33	27.5	
41-60 Years	1	0.8	
61-80 Year	1	0.8	
Famers' Educational level			
No Formal Education	11	9.2	18.7 Years
Primary	20	16.7	
Secondary	43	35.8	
OND	26	21.7	
HND/BSC	1	15.8	
Postgraduate	1	0.8	
Farmers' Marital Status			
Single	10	8.3	

Category	Category	Category	Category
Married	106	88.3	
Divorced	1	0.8	
Widowed	3	2.5	
Farmers' Primary Occupation			
Farming	100	83.3	
Paid Employment		14	11.7
Pensioner	6	5.0	
Number of Farmers' Children			
0-2 Children	42	35.0	
3-5 Children	48	40.0	4 Children
6-9 Children	30	25.0	

Source: Field survey, 2020.

3.2. Soil Fertility Management Practices Carried out by Farmers

Table 2 presents an analysis of the distribution of soil fertility management practices implemented by farmers. The

results reveal that the practice adopted by 82.5% of the farmers was crop rotation, ranking it as the 1st and most prevalent technique, 80% of the farmers practiced alley cropping ranked 2nd, 57.5% of the farmers applied agro-minerals to their farms is ranked 3rd, 50% of the farmers practiced cover cropping is ranked 4th, 36.7% of the famers practiced bush fallowing is ranked 5th, 30.8% of the farmers practiced mulching is ranked 6th, 28.3% of the farmers applied inorganic fertilizers to their farms is ranked 7th, 15% of the farmers practiced tillage is ranked 8th, 15% of farmers practiced the use of grain legumes is ranked 8th, 2.5% of the farmers practiced the use of improved germplasm is ranked 9th. The data implies that most of the arable crop farmers predominantly practice crop rotation as a soil fertility management strategy aimed at enhancing crop production and productivity.

Alley cropping and crop rotation are adopted by a majority of farmers because they understand how important it is to use chemical pesticides and fertilizers to lessen erosion and promote biodiversity. Fewer farmers use grain legumes, which have advantages in terms of controlling weeds and pests. Wheat in corn-soybean rotation supports Carrara et al.'s [3] finding that soil inoculated with *Rhizopagus Irregularis* (fungus gotten from the roots of legumes) at planting increases soil nutrients and nutrient uptake by plants. Crop rotation with grain legumes and wheat can improve soil quality and productivity.

Table 2. Soil fertility management practices among farmers (n = 120).

Soil fertility management practices	Yes F (%)	No F (%)	Rank
Crop rotation	99(82.5)	21(17.5)	1
Alley cropping	96(80.0)	24(20.0)	2
Application of agro-minerals	69(57.5)	51(42.5)	3
Cover cropping	60(50.0)	60(50.0)	4
Bush fallowing	44(36.7)	76(63.3)	5
Mulching	37(30.8)	83(69.2)	6
Application of inorganic fertilizers	34(28.3)	86(71.7)	7
Tillage	18(15.0)	102(85.0)	8
The use of grain legumes	18(15.0)	102(85.0)	8
Use of improved germplasm	3(2.5)	117(97.5)	9

Source: Field survey, 2020.

3.3. Sources of Information on Soil Fertility Management

Outcomes in Table 3 show the distribution of sources of infor-

mation. Findings show that 71.7% of farmers received information through radio ranked 1st, 60.8% of farmers received from family and friends ranked 2nd, 33.3% of farmers received information through newspaper ranked 3rd, 28.3% of farmers received information through television ranked 4th, 13.3% of farmers re-

ceived information through extension workers ranked 5th, 13.3% of farmers received information through conferences ranked 5th, 12.5% of farmers received information through books ranked 6th, 10.0% of farmers received information through phones ranked 7th, 10.0% of farmers received information through posters ranked 7th, 8.3% of farmers received through social media ranked 6th, 7.5% of farmers received information through internet and ranked 9th. This corroborates the findings of Khan et al. [10], which indicate that one of the quickest ways to spread technology is through the use of the media, which can inform farmers about the newest advancements available.

Table 3. Sources of information on soil fertility management (n = 120).

Sources of information	Yes f (%)	No f (%)	Rank
Radio	86(71.7)	34(28.3)	1
Family and friends	73(60.8)	47(39.2)	2
Newspaper	40(33.3)	80(66.7)	3
Television	34(28.3)	86(71.7)	4
Extension workers	16(13.3)	104(86.7)	5
Conferences	16(13.3)	104(86.7)	5
Books	15(12.5)	105(87.5)	6
Phones	12(10.0)	108(90.0)	7

Sources of information	Yes f (%)	No f (%)	Rank
Poster	12(10.0)	108(90.0)	7
Social media	10(8.3)	110(91.7)	8
Internet	9(7.5)	111(92.5)	9

Source: Field survey, 2020.

3.4. Benefits of Soil Fertility Management

Table 4 shows that arable crop farmers benefit from soil fertility management as follows; improvement in crop yield ($\bar{x} = 1.51$) ranks 1st, increase in income due to increased crop yield ($\bar{x} = 1.73$) ranks 2nd, increase in marketable surplus ($\bar{x} = 1.78$) ranks 3rd. This implies that continuous practice of soil fertility management could be because of improvement in crop yield, increase in income due to increased crop yield and increase in marketable surplus.

The results also show improvement in soil water level ($\bar{x} = 1.79$) ranks 4th, improvement in household nutrition ($\bar{x} = 1.83$) ranks 5th, increase in household food security ($\bar{x} = 1.84$) ranks 6th, increased percentage of crop germination on farm ($\bar{x} = 1.96$) ranks 7th, little effect of weed, pest and diseases on farm ($\bar{x} = 2.11$) ranks 8th, reduced surface water runoff on farm ($\bar{x} = 2.23$) ranks 9th, improved reduction in cost of fertilizing crops ($\bar{x} = 2.80$) ranks 10th.

Table 4. Benefits of soil fertility management to farmers (n=120).

S/N	Benefits of soil fertility management	Strongly Agree F (%)	Agree F (%)	Undecided F (%)	Disagree F (%)	Strongly Disagree F (%)	Mean	Rank
1.	Improvement in crop yield	72(60)	40(33.3)	4(3.5)	3(2.5)	1(0.8)	11.5083	1
2.	Increase in income due to increased crop yield	56(46.7)	48(40.0)	10(8.3)	4(3.3)	2(1.7)	11.7333	2
3.	Increase in marketable surplus	65(54.2)	32(26.7)	11(9.2)	8(6.7)	4(3.3)	11.7833	3
4.	Improvement in soil water level	45(37.5)	59(49.2)	12(10.0)	4(3.3)	-----	11.7917	4
5.	Improvement in household nutrition	38(31.7)	70(58.3)	7(5.8)	4(3.3)	1(0.8)	11.8333	5
6.	Increase in household food security	36(30.0)	70(58.3)	12(10.0)	1(0.8)	1(0.8)	11.8417	6
7.	Increased percentage of crop germination on	36(30.0)	64(53.3)	11(9.2)	7(5.8)	2(1.7)	11.9583	7
8.	Little effect of weed, pest and diseases	52(43.3)	36(30.0)	8(6.7)	15(12.5)	9(7.5)	22.1083	8
9.	Reduced surface water runoff on farm	35(29.2)	48(40.0)	18(15.0)	13(10.8)	6(5.0)	22.2250	9
10.	Improved reduction in cost on fertilization	23(19.2)	18(15.0)	49(40.8)	20(16.7)	10(8.3)	22.8000	10

Source: Field survey, 2020.

3.5. Indigenous Soil Fertility Management Practices Among Arable Crop Farmers

Table 5 presents the findings regarding growers of arable crops implementing native methods for managing soil fertility. The results indicate that intercropping was practiced by 58.3% of the farmers, while 20.8% of them employed organic fertilizer application. 18.3% of the farmers utilized farm animal waste as a soil fertility management approach, and 17.5% engaged in planting trees in eroded areas. Additional practices included

crop residue management (16.7% of farmers), domestic waste application (14.2% of farmers), the use of compost-manure pits (12.5% of farmers), and stone buds utilization (0.8% of farmers). The results imply that intercropping is the predominant traditional soil management practice adopted by most arable crop farmers. Intercropping is widely recognized for its potential to enhance crop yields, thereby fulfilling the primary objective of farmers to secure food for their households and generate surplus income to meet other family needs [11].

Table 5. Indigenous soil fertility management practices among farmers (n = 120).

Indigenous soil fertility management practices	Yes f (%)	No f (%)	Rank
Intercropping	70(58.3)	50(41.7)	1
Application of organic fertilizer	25(20.8)	95(79.2)	2
Application of farm animal waste	22(18.3)	98(81.7)	3
Planting trees in eroded areas	21(17.5)	99(82.5)	4
Crop residue management	20(16.7)	100(83.3)	5
Application of domestic waste	17(14.2)	103(85.8)	6
Compost-manure pit	15(12.5)	105(87.5)	7
Use of stone buds	1(0.8)	119(99.2)	8

Source: Field survey, 2020.

4. Hypotheses Testing

Ho₁: There is no notable connection between some of the respondents' socio-economic factors and practices of soil fertility management.

Ho₂: There is no notable connection between the information sources and practices of soil fertility management.

4.1. Relationship Between the Socio-Economic Characteristics of Arable Crop Farmers and Soil Fertility Management

The results in Table 6 shows age with the correlation value of 0.176 ($p=0.055>0.05$) implies that as age increased, soil fertility management increased. Sex with the correlation value of -0.054 ($p=0.560>0.05$) and implies that as sex increased, soil fertility management decreased. Religion with a correlation value of -0.102 ($p=0.268>0.05$), which implies that as religion increased, soil fertility management decreased. Primary occupation with the correlation value of -0.163 ($p=0.075>0.05$), which implies that as the primary occupation increased, soil fertility management decreased. Years of farming with a correlation value of 0.227 ($p=0.002<0.05$),

implies that as the years of farming increased, soil fertility management increased. Marital status with the correlation value of -0.127 ($p=0.168>0.005$), implies that as marital status increased, soil fertility management decreased. Number of children with the correlation value of 0.075 ($p=0.414>0.05$), which implies that as number of children increased, soil fertility management increased. Agricultural practices with the correlation value of 0.160 ($p=0.081>0.05$), which implies that as agricultural practices increased, soil fertility management increased. Farm size with the correlation value of 0.130 ($p=0.156>0.05$), which implies that as farm size increased, soil fertility management increased. The analysis of socio-economic traits, including sex, religion, age, primary occupation, status of marriage, number of children, agricultural practices, and farm size, revealed no significant relationship with soil fertility management practices. However, a significant association was found between years of farming and methods for managing soil fertility that are consistent with the discoveries of Sofu et al. [20]. The study suggests that farmers engaged in on-farm activities received fertilizer loans, facilitating timely and appropriate application. These results underscore the importance of considering the duration of farming experience as a contributing factor to effective soil fertility management practices.

Table 6. PPMC Relationship between some of the socio-economic characteristics and soil fertility management practices (n = 120).

Variables	Pearson Correlation (r)	Probability (p) value	Decision
Age	0.176	0.055	NS
Sex	-0.054	0.560	NS
Religion	-0.102	0.268	NS
Primary occupation	-0.163	0.075	NS
Years of farming	0.227	0.002	S
Marital status	-0.127	0.168	NS
Number of children	0.075	0.414	NS
Farm size	0.130	0.156	NS

Source: Field survey, 2020.

*Significant <0.05 S= Significant, NS= Not Significant

4.2. The Relationship Between the Sources of Information and the Soil Fertility Management Practices

In Table 7, the analysis examines the relationship existing between different sources of information and the soil fertility management practices adopted by arable crop farmers. Sources of information ($\chi^2=0.313$; $p= 0.576>0.05$), this implies that sources of information have no significant re-

lationship with the soil fertility management practices carried out by the farmers. This suggests that raising awareness of the deteriorating quality of the soil is a major production barrier and that doing so could greatly improve farmers' livelihoods through education and awareness campaigns. This is consistent with the findings of Spurk et al. [22], which show that small-scale farmers are open to implementing new methods of managing soil fertility once they become aware of the issues.

Table 7. Chi-Square result of sources of information and the soil fertility management practices (n= 120).

Variable	χ^2	Df	p-value	Decision
Sources of information	0.313	1	0.576	NS

Source: Field survey, 2020.

*Significant <0.05 S= Significant, NS= Not Significant

5. Conclusions and Recommendations

The study has revealed that the arable crops in Ifedore Local Government, Ondo State are actively looking for ways to increase the productivity of their farms and their crop production. They are enthusiastic about using different informational resources and implementing agricultural practices that can significantly raise their income and crop yields. Findings from the research strongly suggest that most of these farmers have reaped substantial rewards from using soil fertility management techniques. This demonstrates how crucial it is to keep encouraging and supporting such methods in order to improve regional agriculture.

Considering the study's findings, the establishment of a localized agricultural extension program is a key recommendation for enhancing soil fertility management practices among farmers of arable crops in Ifedore Local Government, Ondo State. This program should concentrate on giving farmers specialized advice, education, and tools for managing soil fertility. It can effectively address their unique needs and challenges by providing targeted support and information to farmers in the local setting, which will increase the execution and adoption of sustainable soil fertility management practices.

Abbreviations

FAO Food and Agricultural Organization

PPMC Pearson Product Moment Correlation
 BSc Bachelor of Science
 HND Higher National Diploma
 OND Ordinary National Diploma

Author Contributions

Owolabi Kehinde Elijah: Conceptualization, Funding acquisition, Methodology, Resources, Supervision, Visualization

Omorinkoba Aduragbemi: Data curation, Methodology, Software, Validation, Writing – original draft

Makanjuola Oluwaseun Joshua: Formal Analysis, Investigation, Resources, Software, Visualization, Writing – original draft, Writing – review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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Research Fields

Owolabi Kehinde Elijah: Land and Environmental Management, Ecological Restoration, Rural Economics, Project Management, Community Development

Omorinkoba Aduragbemi: Agricultural Extension, Rural Sociology

Makanjuola Oluwaseun Joshua: Extension Education, Rural Development, Land and Water Management, Environmental Sustainability, Agricultural Communication