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ASSESSMENT OF UTILISATION OF SOIL MANAGEMENT PRACTICES AMONG ARABLE CROP FARMERS IN OGUN STATE: IMPLICATION FOR SUSTAINABLE AGRICULTURE IN NIGERIA

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Abstract

The study assessed utilization of soil management practices among arable crop farmers in Ogun State. Specifically, it described the socio-economic characteristics of arable crop farmers; identified the soil management practices (SMPs) prevailing in the study area; determined the crop yield and respondents' level of utilization and identified problems associated with their utilization. A multi-stage sampling procedure was used to select 110 farmers from selected six functional fadama sites in Ogun State. Results showed that majority (92.7% and 79.1 %) of the respondents were male and married respectively with mean age of 37.5 years. Zero tillage, mulching, ridging and cover cropping were the major SMPs identified by the respondents. Among SPMs identified, mulching (mean = 2.76), ridging (mean = 2.41), fertilizer application (mean = 2.26), zero tillage (mean = 2.25) and cover cropping (mean 2.25) were the mainly utilized while majority (69.1%) utilised SMPs at moderate level. Further results showed that inadequate supply of fertilizer (mean = 1.78) and high cost labour (mean = 1.69) were identified as the major constraints to usage of the sustainable soil management practices. Age (r = 0.20); farming experience (r= 0.451) and crop yield (r = 0.223) had significantly relationship with the respondents' utilisation of SMPs. The study concluded that the level of use of soil management practices had direct effect on yield of crops and sustainability of soil used in Ogun state, Nigeria.

Key words**:** *sustainability, yield, soil management practices, arable crops*

INTRODUCTION

Good soil management is a key to sustainable farming practices. Generally, there is close link between good and profitable farming; improving/maintaining soil fertility and good environmental management. [13] opined that what a farmer can achieve is highly dependent on good soil management and climate of the area. It is clear that good soil management can drastically reduce the value of land for agriculture and lead to environmental problems which invariably results into soil degradation and this is termed unsustainable use of land. It has ascertained that about 2,145 million hectares out of 2,900 million hectares total land area in Africa, 72% are problem soils with different production constraints (soil acidity, steeply sloping soils, low fertility, shallow and stony soils, saline and poorly drained soils [10]. This shows that the level of sustainability of land management practices in Africa. Sustainable land management has been defined as the use of appropriate soil management practices that enables land users to maximize the economic and social benefits from the land while maintaining or enhancing the ecological support functions of the land resources [10].
Human activities have either direct or indirect effects on the sustainability of natural resources like land, thereby threatening its continuous productivity. This consequently, affects agricultural production. Also, ever increasing population in the developing countries which result in continually rising of demand for agricultural produce is contributing to the intensification of land use and adoption of technologies that would enhance constant

supply of agricultural produce. Attempt by man to meet his food, wood and other resources requirements have destroyed the biodiversity and in order to expand agriculture and forestry, over cropping of some crops has resulted more often, to adoption of appropriate technologies and farm practices which further worsen sustainable land use among farmers. Loss of biodiversity, climate change and land degradation due to population pressure in developing countries, poverty and poor performance of extensive agriculture are such factors that make farmers to have problems in sustainable production activities [19]. Soil is therefore managed in order to conserves agricultural land, biodiversity and food security for the country. Sustaining soil fertility and food security cannot be separated. In addition, it is sometimes noted that some farmers have no or little knowledge about soil management, hence they abandon certain farmland when found unproductive due to some factors which can be controlled provided they are well equipped with knowledge on soil fertility. [13] opined that if some of the currently used soil management practices are continued, groundwater and food contamination will increase and jeopardize the sustainability of the current land use systems

Sustaining soil fertility has become a major issue for agricultural research and development in rural areas of Africa [22]. Sustaining soil fertility is an essential component in achieving food and livelihood security for the present and future generations [11]. In the past, most research efforts focused on trials to determine the appropriate amount and type of fertilizer needed to obtain the best yields for particular soil types and specific agro-ecological locations. This approach emphasized the use of external inputs and expensive technologies, and often disregarded farmers' knowledge and the resources at their disposal. Since then, research has gradually shifted towards an approach based on Integrated Soil Fertility Management (ISFM), which combines various existing soil fertility management techniques with external inputs. This combination is based on a thorough scientific understanding of the underlying biological processes of ISFM and aims to promote options that make the best of locally available inputs, and that are tailored to suit local agro-ecological conditions, and farmers' resources and interests.

The present soil fertility management practices at the farm level are not sustainable. However, there are possibilities to improve farmers' soil fertility management practices, for instance, it is necessary to recommend soil and/or plant testing to adjust fertilizer and/or manure application rates to crops to reduce excessive nutrient input, and to adopt appropriate decision support systems for efficient and sustainable management of production resources. Many development projects and policies have collapsed because of the failure to understand local knowledge and how this influences the way farmers manage natural resources [20]. Less attention has been paid to studying and understanding how soil fertility is perceived and managed at farm level, and how various physical, economic and socio-cultural factors interact. Hence, the need to study the current soil management practices crop farmers in Ogun State. The study thus, assessed the level of utilization of sustainable soil management practices among arable crop farmers in Ogun State, Nigeria.

Objectives of the study

The main objective of the study was to assess the soil management practices used by vegetable farmers in Yewa North Local Government Area (LGA) of Ogun State. The specific objectives were to

(1)describe socio-economic characteristics of respondents;

(2)identify soil management practices prevailing in study area;

(3)determine the crop yield and level of utilisation of soil management practices; and

(4)identify constraints associated with utilization of soil management practices in the study area.

Hypotheses of the study

The hypotheses were set in null form.

$H0_1$: There is no significant relationship between utilization of soil management practices and socio-economic characteristics of the respondents.

$H0_2$: There is no significant relationship between utilization of soil management practices and crop yield of the respondents

Theoretical framework

The study was based on sustainability theory by Scoones [21]. The theory assumed that sustainability could either be strong or weak. A 'strong sustainability' prioritised the preservation of ecosystem while a 'weak sustainability' disregards specific obligations to sustain any particular good practices. In terms of farmland, for example, a strong view might argue for protection, even if it requires foregoing development that would increase opportunities for future generations.

A weak view would take into account the various immediate benefits of soil management practices without making attempt to measure the future value of those benefits against the values created by development.

Development in this regard is mainly in economic gain (profit).

The two views loosely correspond to ecocentric (ecologically centered) and anthropocentric (human-centered) positions in environmental ethics, but not perfectly.

The ecocentric view requires that moral decisions take into account the good of ecological integrity for its own sake, as opposed to exclusively considering human interests.

In this case, farmers productivity may be paramount to them. But a strong sustainability view could be held from an anthropocentric perspective by arguing that human systems depend on rich biodiversity or that human dignity requires access to these natural resources like soil.

However, a weak view would not necessarily approve the expiration of natural resources, even with the prospect of lucrative profit. Thus, sustainability theory becomes very important to this study as it reveals that sustainable soil management practices are based on farmers decisions and farmers decisions are primarily based on the economic gain they intend to have from their farmland.

MATERIALS AND METHODS

The study area

The study was carried out in Yewa North LGA in the West of Ogun State, Nigeria, bordering the Republic of Benin. Its headquarters is Ayetoro town at longitude 7°14'00"N and latitude 3° 02'00" E in the north-east of the Area. It has an area of 2,087km^2 and a population of 181,826 [15].The climate is sub-humid tropical with an average annual rainfall of 1,909.30 mm. It is located in the Derived savanna agro ecological zone. Ayetoro lies between 90 and 120 metres above sea-level. The entire surface is made up of an undulating surface drained mainly by Rori and Ayinbo Rivers. The landform is that of eroded pediment plain with well-incised valleys forming a trellis pattern. The major occupation among the inhabitants of the area is farming particularly arable crop farming.

Sampling procedure and sample size

Two stage sampling techniques were adopted for the selection of respondents. Yewa LGA comprises of ten (10) Fadama sites where vegetables are primarily grown. However, only six of these sites were functional. Purposively, the six (6) functional sites were selected. The total number of registered vegetable farmers in each of the sites was 90, 70, 110, 190, 40 and 50 respectively. Proportionate sampling procedure was used to select 20% of the vegetable farmers in each of the functional Fadama sites to get 18, 14, 22, 38, 8 and 10, thus a total of 110 farmers were sampled for the study. Quantitative data were collected using well-structured and validated interview schedule. The data were summarized using descriptive statistics such as frequency count, percentages, mean and standard deviation, while Chi-Square and Correlation analyses were inferential statistics were used in the study to draw inferences on the hypotheses.

Measurement of variables

The dependent variable for the study was conceptualised as utilization of soil management practice. It was measured by calculating total utilisation score of each respondent from ten soil management practices utilized. The reaction was against a 4-point Likert type scale of utilisation ranging from Always utilized (3 points), Occasionally utilized (2 points), Rarely utilised (1 point), and Never utilised (0 point) as used by [3]. The

maximum score for each respondent was 30 while the minimum score for each respondent was zero. The total score per respondent was further classified into three categories as follows: low, moderate and high level of adoption using mean of total adoption score plus/minus standard deviation. Crop yield was measured by asking the respondent to rate their crop yield in the last three years of using SMPs. The reaction was against 4-point Likert-like scale ranging from very high (4 points), high (3 points) average (2 points) and low (1 point).

RESULTS AND DISCUSSIONS

Socio-economic characteristics of respondents

Results in Table 1 show majority (92.7%) of the respondents were male with very (7.3%) female. The findings showed that male dominate arable crop production in the study area. This is expected because traditionally farming work is known to be male gender specific due to drudgery and risk involved in it. Also, the study revealed that about two-third (61.2%) were within the age bracket of 20-40 years with the mean age of 37.5 years. This implies that majority of the respondents were in their active and productive age during which they could withstand the rigour required for farming operations. This result is in line with the findings of [16]; [12] who both asserted that people in their active ages tend to perform their tasks effectively and efficiently as they painstakingly endure the stress and rigours of exerting and fatigue laden assignments. The ecological implication is that the respondents had potential to adopt and utilise new methods of soil management practices which are sustainable as they were expected to be less risk averted. Moreso, majority (79.1%) were married. This implies that married people were more involved in arable crop production. This could be due to the fact that this category of people have more responsibilties than the unmarried, so the need to involve in income generating activities becomes necessary so as to meet up with the challenges of meeting the family responsibilities. In addition, majority (52.7%) were Muslims, 40.9 percent were Christians and only very few (6.4%) were traditional worshipers. This implies that Christianity and Islam were the dominant religions in the study area. About (59.1%) had farming experience of 11-15 years with the mean farming experience of 12.5 years. This means that majority of the respondents were experienced farmers and this could influence their utilization of sustainable soil management practices.

Table 1. Distribution of respondent by some selected socio-economic characteristics of respondents (n = 110)

Variable	Frequency	Percentage mean
Age (years)		
20-30	31	28.3 37.5
31-40	36	32.9
41-50	24	20.8
51-60	7	4.5
Sex		
Male	102	92.7
Female	8	7.3
Marital status		
Single	13	11.8
Married	84	79.1
Divorced	10	9.1
Religion		
Christianity	45	40.9
Islam	58	52.7
Traditionalist	7	6.4
Years of farming experience		
1 – 5	6	5.5
6 – 10	19	17.3 12.5
11 – 15	65	59.1
Above 15	20	18.1
Other occupation aside farming		
None	74	67.3
Civil service	18	16.4
Trading	10	9.1
Student	1	0.9
Monthly income		
₦ 2,000 – ₦ 10,000	20	18.2
₦ 10,100 - ₦20,000	35	31.8 ₦ 8,536.26
₦20,100 - ₦30,000	40	36.4
Above ₦30,000	15	13.6

Source: Field survey, 2015

Furthermore, majority (71.8%) of the respondents had attained one form of formal education or the other while about 28.2 percent had no formal education. This implies that majority of them were literate which could assist them to be more enlightened in utilization of innovations than illiterates. This result however, is in tandem with the findings of [12]; [6] who submitted that education and training improves the skill, attitude and knowledge of an individual thus sharpening their ability to comprehend and apply innovations with ease. Therefore, since majority of the respondents were educated, 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. In addition, 67.3 percent had farming as their sole occupation while few (16.4%) were civil servants who also engaged in farming. The findings were in consonant with [4] assertions that farming is the major occupation among the people of Ogun State. About 37 percent had monthly income range of ₦ 20,100 – ₦ 30,000 with the mean monthly income of ₦ 18,536.26. This implies that majority of the respondents' income were within the range of national minimum wage which show that there is need for them to intensify efforts in utilizing more SMPs which could translate into increment crop yield and better income.

Type of soil management practices utilized by the respondents

Results in Table 2 show that zero tillage (97.3%), mulching (95.2%), ridging (92.7%), cover cropping (87.3%), crop rotation (77.3%), fertilizer application (73.7%) and bush fallowing (50%) were identified as the prevailing SMPs in the study area. On the other hand, SMPs like the use of green manures (40%), animal manures (15.5%) and compost (8.2%) were not popular in the study area. This result is line with the report of [18] who identified ridging, crop rotation, mulching, cover cropping and fertilizer application as the sustainable soil management practices in their studies but contrary to the reports of [2]; [1] which established compost, animal droppings and mixed cropping as the major sustainable soil management practised among the farmers studied.

Table 2. Distribution of respondents based on types of soil management practices prevailing in the study area. (n = 110)

*Soil management practices	Frequency	Percentage
Compost	9	8.2
Ridging	102	92.7
Fertilizer application	81	73.6
Zero tillage	107	97.3
Mulching	105	95.2
Use of animal manure	17	15.5
Planting of tree/green manure	44	40
Cover cropping	96	87.3
Rotational cropping	85	77.3
Bush fallowing	55	50

*Multiple responses
Source: Field survey, 2015

Crop yield of respondents

Analysis in Table 3 show rating of farmers' yield based on the utilization of SMPs in the last three copping seasons, almost half (38.2%) and above one-third (30.9%) of the respondents rated their yield obtained from their crops as high and very high respectively, while above one-quarter (28.2%) and very few (2.7%) agreed that their crop yield were average and low respectively.

This result implies that majority of the respondents agreed that the use of SMPs bring about increase in crops crop, this corroborates the findings of [7]; [23]; [9]; [5] which is claimed that the use of SMPs like mineral fertilizers, crop rotation, recycling of crop residues and organic manures increased farming productivity (crop yield).

Table 3. Distribution of respondents by rating their yield rating

Crop yield	Frequency	Percentage
Very high	34	30.9
High	42	38.2
Average	31	28.2
Low	3	2.7

Source: Field survey, 2015

Level of utilization of soil management practices

Results in Table 4 reveal that mulching (mean = 2.76) ranked highest among SMPs utilized by the respondents, followed by ridging (mean = 2.41), fertilizer application (mean = 2.26), zero tillage (mean = 2.25) and cover cropping (mean= 2.25). Others include rotational cropping (mean=1.65), bush fallowing (mean =1.62), compost (mean = 0.78), green manure (mean = 0.75) and use of animal manure (mean = 0.0.37). Comparing the grand mean score of utilisation (mean = 1.78) with the individual utilization mean scores, the results showed that SMPs like mulching, zero tillage, ridging, crop rotation and cover cropping were highly utilised by the respondents.

This may be due to the fact that these SMPs help to conserve soil water, control soil erosion and enrich soil nutrients by the decay of crop residue and leaves [17].

The use of zero tillage mitigates soil against the release of CO_2 and N_2O caused by intensive tillage and burning and also reduces destruction of soil structure [8]. On the other hand, compost, green manure bush fallowing and animal manures were least utitilised by the arable crop farmers.

The use of bush fallow ranked low probably because of greater dependency on the use of fertilizer and inadequacy of arable land for farmers. The result is in agreement with the finding of [8] that established that mulching, planting of cover crops, crop rotation and inorganic fertilizer were the most preferred and utilized soil conservative practices among arable crop farmers in Enugu State.

The result was also in consonace with the reports of [20]; [9] assertion that the use of green manure, compost and animal manure were the least used SMPs among farmers. This could be due to their irritating odour, tediousness of preparation, bulkiness and high cost of application.

Further analysis in Table 5 show more than two-third (69.1%) of the respondents were in the moderate level of utilisation of SMPs, while one-fifth (20%) and about (11%) had high and low levels of utilisation of SMPs respectively.

Table 4. Distribution of respondents by utilization of sustainable soil management practices (n=110)

*Soil management practices	Never Feq	Rarely Freq	Occasionally Freq	Always Freq	Ranked mean
Mulching	3	4	16	87	2.70
Ridging	1	31	0	78	2.41
Fertilizer application	2	4	67	37	2.26
Zero tillage	13	12	21	64	2.25
Cover cropping	7	16	29	58	2.25
Rotational cropping	14	13	36	47	2.05
Bush fallowing	39	5	25	41	1.62
Slashing and burying	51	43	5	11	0.78
Use of green manure	56	8	37	9	0.75
Use of animal manure	91	7	8	4	0.37

*Multiple responses, Grand mean score = 1.78,
Source: Field survey, 2015.

Table 5. Level of utilisation of soil management practices (n = 110)

Level of utilization	Utilization scores	Frequency	Percentage
Low	6 and below	12	10.9
Moderate	7 and 13	76	69.1
High	14 and above	22	20

Source: Field survey, 2015

This could be as a result of problems asssociated with their utiilisation such as inadequate supply of fertilizers and finance, hence it is recommended that government should supply fertilizers at subsidized rate to farmers and make loan avaialable for them.

Table 6 shows that inadequate supply of fertilizers (mean = 1.78) ranked highest among

the problems associated with utilization of SMPs, followed by high cost/non-availability of labour (mean = 1.69) inadequate finance (mean= 1.68), high cost of soil management practices (mean=1.22), poor knowledge of utilization (mean=1.15), transportation problems (mean = 1.10) and inadequate availability land (mean = 0.69). Comparing the grand mean score of constraint (mean=1.33) with the individual mean scores of constraints, the major problems faced by the respondents in the utilization of SMPs were inadequate supply of fertilizers, high cost and non-availability of labour and inadequate finance. This result gives credence to the finding of [14] who reported inadequate supply of fertilizer, non-availability of labour and inadequate finance as the highest ranking among the constraints faced by farmers utilizing sustainable land management practices in Kwara State.

Table 6. Distribution of respondents by problems associated with utilization of SMP (n = 110)

*Problem	Major problem Frequency	Minor problem Frequency	Not a problem Frequency	Ranked mean
Inadequate supply of fertilizer	90	16	4	1.78
High cost/ non availability of labour	86	14	10	1.69
Inadequate finance	86	13	11	1.68
High cost of soil magt practices	37	61	12	1.22
Poor knowledge of utilization	29	68	13	1.15
Transportation problem	53	15	42	1.10
Inadequate availability of land	14	48	48	0.69

* multiple responses, Grand mean= 1.33
Source: Field survey, 2015**.**

Results in Table 7 show that sex (χ^2=58.682), religion affiliation (χ^2=7.775), level of education (χ^2=16.459) and marital status (χ^2=4.281) had significant association with utilisation of SMPs among farmers at 0.01 level of significance in the study area.

The implication is that these significant socio-economic characteristics of farmers would affect their usage of sustainable soil management practices.

Results in Table 7 reveal that at 0.01 level of significance, respondents' age (r = 0.280) and years of farming experience (r = 0.451) had positive and significant relationship with utilization of soil management practices. Thus, increase in respondents' years of farming experience and age would increase their utilization of SMPs.

This finding is similar to the findings of [2] which established that years of farming experience had positive and significant relationship with choice of soil management practices.

Table 7. Chi-square showing association between respondents' socio-economic characteristics and utilization of sustainable soil management practices

Variables	χ^2	D.F	p-value
Sex	58.682*	1	0.016
Religion affiliation	7.775*	2	0.025
Educational level	16.459*	4	0.030
Marital status	4.281*	2	0.040

*significant at 0.01, * significant at 0.05, D.F = degree of freedom
Source: Field Survey, 2015.

Table 8. Chi-square showing relationship between respondents' socio-economic characteristics and utilization of sustainable soil management practices

Variables	Correlation coefficient (r)	p-value
Age	0.280	0.010
Farming experience	0.451	0.009
Monthly income	0.123	0.122

Source: Field survey, 2015

Results in Table 9 show that there was a positive and significant relationship between crop yield (r = 0.223; $p \leq 0.05$) and farmers' utilisation of sustainable soil management practices. The implication of this is that the higher the use of sustainable soil management practices among farmers the higher the crop yield. The results corroborates the findings of [7]; [9]; [5] assertions' that farmers use fertilizers which is one of the major SMPs to boost soil productivity with the aim of increasing arable crop production.

Table 9. Results of correlation analysis showing the relationship between crop yield and farmers' utilization of sustainable soil management practices

Variable	Correlation coefficient (r)	p-value
Yield	0.223*	0.030

*significant at 0.05 level of significance.
Source: Field survey, 2015.

CONCLUSIONS

Based on the findings of this study, mulching, ridging, fertilizer application, zero tillage and cover cropping were the major sustainable soil management practices utilized by the respondents and at moderate level. Inadequate supply of fertilizer and non-availability/high cost of labour were identified as the major constraints to effective usage of SMPs. This has implications on agricultural development in a country like Nigeria where land constitutes a major constraint to farming. Utilisation of sustainable SMPs among farmers would not only enhance productivity but also improve soil fertility. It is recommended that government and relevant agencies should be involved in promoting adoption and utilization of sustainable soil management practices through adequate training. Also, both organic and inorganic fertilizer as well as other farm inputs should be made available to farmers at subsidized affordable for farmers. This would enhance utilization of SMPs, higher productivity and environmental sustainability among farmers.

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