



## RESEARCH ARTICLE

## SOIL FERTILITY MANAGEMENT TECHNIQUES AMONG ARABLE CROP FARMERS IN SOUTHWEST, NIGERIA

Janet Ojediran\*, Kehinde Ogunleye, Rasheed Adeola

Department of Agricultural Extension and Rural Development, Ladoke Akintola University of Technology, Ogbomosho, Nigeria.

\*Corresponding Author Email: [jtojediran@lautech.edu.ng](mailto:jtojediran@lautech.edu.ng)

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## ARTICLE DETAILS

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## ABSTRACT

Soil fertility management techniques (SFMT) among arable crop farmers in southwest, Nigeria was examined. Multiphase techniques were employed in selecting three hundred and fifty (350) arable crop farmers. Data were harvested using a structured interview schedule and analysis was done using descriptive statistics and Person-Product-Moment-Correlation (PPMC). Results indicated that the farmers were majorly married males, mostly aged 50 years using an average of 2.3 ha, cropping mainly cassava (90.0%), maize (82.6%), and yam (70.9%). The respondents used cultural methods, synthetic fertilizers, and organic manure in that order as SFMT. The level of utilization of SFMT was predominantly cultural methods of ridging across the slope with a weighted mean score (WMS) of 2.72, mulching (WMS=2.60), and rotational cropping (WMS=2.26); synthetic fertilizers: NPK (WMS=1.99) and urea (WMS=1.96); organic manure: poultry manure (WMS=0.95) and animal dung (WMS=0.67). PPMC analysis showed that age ( $r=0.22^*$ ) and farm size ( $r=0.16^*$ ) were significantly related to the utilization of SFMT. In conclusion, the respondents were small-scale farmers who utilized majorly cultural methods of SFMT and were mainly influenced by crop type as a function of age and farm size.

## KEYWORDS

Crops, Cultivation, Cultural Practices, Socio-Economic, Fertilizer

## 1. INTRODUCTION

Soil fertility is the essential capability of the soil to provide enough nutrients to crops in sufficient quantity and proportions. Similarly, it's the potential soil status to produce crops of economic value through maintenance of soil health without deterioration, and it determines the magnitude of yields (Gicheru, 2012). Soil management influences fertility, thus managing fertility for maximum productivity from the land becomes imperative. Soil fertility management methods target long-term use with a thought of the future. Soil fertility management combines methods or practices of land use safeguarding soil against depleting nutrient or deterioration by ecological or human-induced factors (Oladipo et al., 2017). Moreover, removal of crops without returning the residues like stalk or burning away of organic matter reduces soil nutrients, causing low yields and thus food insecurity (Yirga and Hassan, 2014).

Land frontiers for farming are reducing globally, due to urban expansion, construction, environmental degradation and other land uses. FAO, attested to the fact that inappropriate ways of tillage was also responsible for degradation across Africa (FAO, 2013). Managing the available land is imperative for crop production. Farmers had ways of conserving soil fertility but this differs across locations (Ojediran and Adeola, 2022). A group researchers corroborated that soil is managed to protect agricultural land, biodiversity, and food security (Adeyemo et al., 2017). Therefore, preserving soil nutrients and food security are inseparable. Arable crops are also referred to as food crops. Food crops are also used as feed ingredients for livestock and as raw materials for industries (Ojediran et al., 2018; Ojediran et al., 2020b). They could be grains, root, and tubers (Adewumi et al., 2019). Major arable crops are maize, rice, wheat, sorghum, cowpea, and peas. Others include cassava, yam and potato and so on.

This study, therefore, investigates the SFMT among crop farmers in rural parts of Southwestern, Nigeria.

The objectives were to:

- examine the socioeconomics of the respondents;
- determine the arable crops cultivated by the farmers;
- determine the various SFMT used by the respondents as soil improvement strategies.
- identify the level of utilization of SFMT;

## 1.1 Hypothesis

The hypothesis of this study in null form:

H<sub>01</sub>: No significant relationships between the selected respondents' socioeconomic features and the utilization of SFMT.

## 2. MATERIALS AND METHODS

## 2.1 Respondents' Size

The respondents included arable crop farmers in the Southwestern zone of Nigeria who were selected using multistage sampling techniques. Stage one: the selection of fifty percent of Southwestern states of Nigeria which gave a total number of three states which comprises Ondo, Oyo and Osun States out of 6 states due owing to the prevalence of arable crop farmers in the area. Ondo, Oyo and Osun State had 3, 4 and 3 agricultural zones respectively with an average of 6, 17 and 15 extension block in each state's Agricultural Development Project (ADEP) zones respectively. Moreover, random selection of two extension blocks from fifty percent of the ADEP

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zones were made. In Ondo state Ileoluji/Okeigbo and Akure were selected from Ondo Agricultural zone while Owo was selected for Owo Agricultural Zone.

In Oyo state, Oriire and Ogo-Oluwa were selected from the Ogbomoso Agricultural zone, while Atiba and Afijio were selected from Oyo Agricultural Zone. In Osun state, Oriade, Obokun and Irewole were selected from Ife/Ijesa while Iwo and Ola-Oluwa were selected in Iwo Agricultural Zone. Stage four employed the random selection of three extension cells from each of the randomly selected extension blocks. Furthermore, 30% of the respondents were randomly chosen in each picked extension cells across the selected blocks. The total number of respondents selected in Ondo State was ninety-five (95), Oyo State was ninety-five (95) and Osun State was one hundred and sixty (160). Hence, a total of three hundred and fifty (350) respondents were sampled for this research work in the study area.

## 2.2 Data Analysis

The data obtained were analyzed using descriptive (frequency count, percentages, mean, standard and weighted mean score) and inferential statistics (PPMC, to test the hypothesis).

## 3. RESULTS AND DISCUSSION

### 3.1 Respondents' Socioeconomics

#### 3.1.1 Age of the Respondents

Result presented in Figure 1 showed that 35.4% of the respondents were between the ages of 41 - 50 years, 33.4% were 51 - 60 years, 14.9% were above 60 years, 8.3% were between 31 - 40 years, 6.9% were between 21 - 30 years while 1.1% were less or equal to 20 years. Respondents' average age in Southwestern, Nigeria was 50 years. This showed that most of the respondents were active with more strength to do energy-consuming undertakings. This gives credence to who reported that the mean age of farmers in southwestern Nigeria was 49 years unlike the report of that averagely US and Japanese farmers were 58 and 67 years respectively (Adeola et al., 2014; John, 2012; Mahapatra, 2019; Zuluf, 2020). A group researchers argued that age significantly influences perception and farmers' knowledge (Ng'ombe et al., 2014).

#### 3.1.2 Sex of the Respondents

The distribution of respondents' sex (Figure 1) revealed that male respondents from were 73.4% while the female respondents were 26.6%. This study revealed that male farmers dominate arable crop farming, and this could be linked to the energy-demanding activities involved. Some researchers found that men are more involved in arable crop production farming than women and observed that the dominance of males in farming could be a reflection of traditional restrictions placed on women which limit their ownership right to land and input resources (Amanze et al., 2012; Orifah et al., 2018).

#### 3.1.3 Marital Status of the Respondents

Figure 1 shows the distribution of the respondents' marital status. It revealed that 7.4% were single, 84.6% were married, 2.6% were divorced and 5.4% were widowed. This result showed that more than 80% of the respondents were married. Some researchers explained that there is cultural inclination on married people with the responsibilities of meeting the well-being of their families and their views been respected within the rural communities (Ahmed et al., 2016; Adeola et al., 2017). Also, some researchers suggested that marriage makes people to personally engage in rewarding activities such as cropping for domestic use and cash needs (Daudu et al., 2019; Ogunsumi, 2010).

#### 3.1.4 Farm Size of the Respondents'

Figure 1 also showed the respondents' farm size. The distribution of the arable crop farmers showed that about 33% had a farm size between 0.1-1 ha, 29.1% had between 1.1-2.0 ha, 22.6% had between 2.1-3.0 ha, 9.6% had 3.1-4.0 ha, 1.7% had 4.1-5.0 ha, 4% had more than 5 ha. The average farm size cultivated by farmers from Southwestern, Nigeria for arable crop farming was 2.3 ha.

This result showed that arable crop farmers in Southwestern Nigeria were small-scale farmers, and this could lead to more intensive and efficient use of land resources revealed that small landowners' farmers in rural Tanzania were most likely to use intercropping, synthetic fertilizer and tillage as management practices (Kassie et al., 2015). Arable crop farmers from Ondo had the least farm size which could be attributed to their interest in cash crop production (Olaniyi and Ogunkunle, 2018).

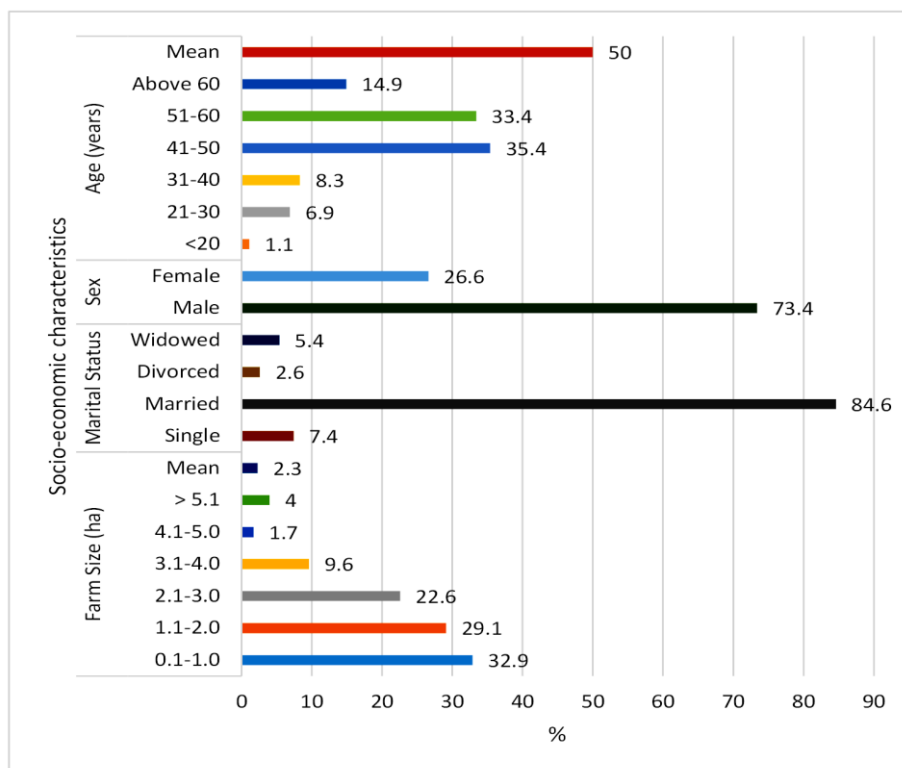


Figure 1: Socioeconomic characteristics of the respondents (Source: Field Survey, 2021)

### 3.2 Arable Crops Cultivated by the Respondents

The distribution of arable crops cultivated by the respondents is shown in Figure 2. The respondents planted Cassava (90.0%), Maize (82.6%), Yam (70.9%), cowpea (38.6%), Okro (20.9%), Pepper (21.1%) Potatoes (19.4%), Cocoyam (20.9%), Pigeon pea (10.6%), Melon (8.6%), Tomatoes

(11.1%) and Guinea corn (2.9%). This revealed that arable farmers in the region plant mostly cassava, maize, yam and cowpea. However, the major arable crops cultivated in Oyo, Osun and Ondo States were maize and cassava. This is in line with the work of Adeola and Adetumbi that most farmers in southwest, Nigeria cultivated maize and cassava (Adeola and Adetumbi, 2015).

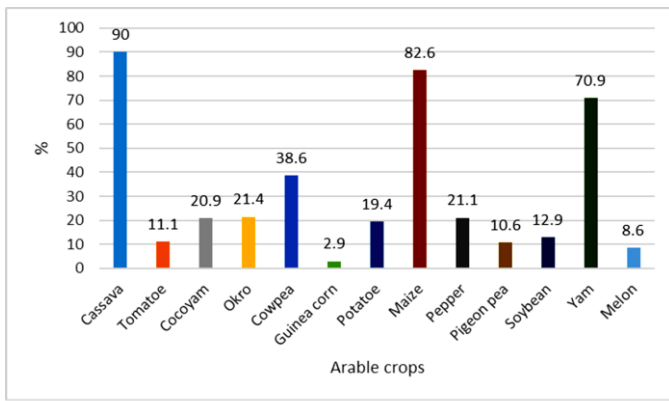


Figure 2: Arable crops cultivated by the respondents

\*Multiple Responses Recorded

Source: Field Survey, 2021

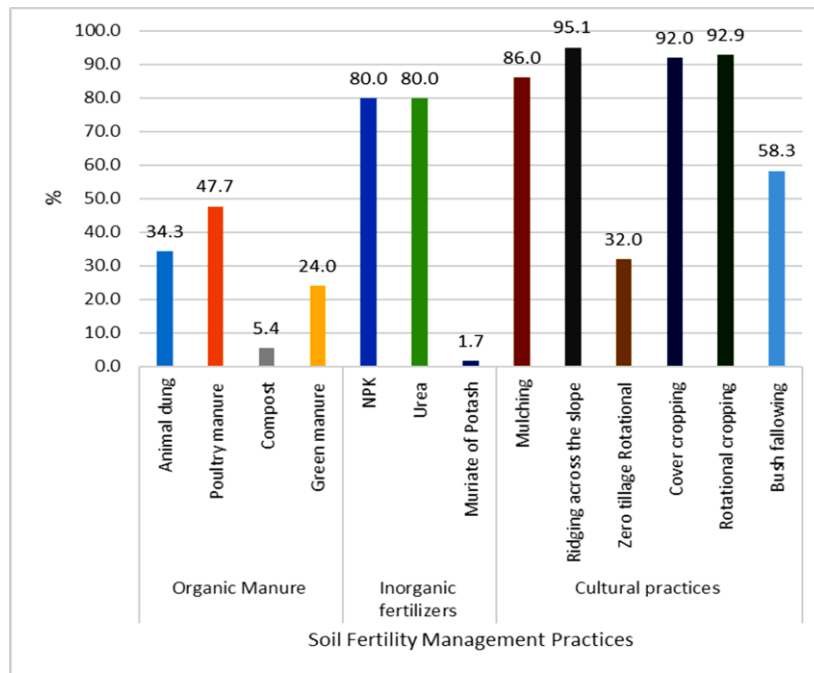


Figure 3: Types of soil fertility management techniques employed

\*Multiple Responses Recorded

Source: Field Survey, 2021

The results for cultural practices revealed that 83% used mulching as a form of soil management practice while, ridging across the slope was used by 95.1%. Those that admitted using cover crops were 92%, rotational cropping was used by about 93% while bush fallowing was used by 58.3%. A group researchers reported that the perception that soil infertility or reduced fertility when viewed as a problem made small-scale farmers to adopt novel and sustainable management practices in Kenya (Mugwe et al., 2007). In like manner, there would be motivation for farmers to look out for alternatives to overcome the challenges owing to diverse perceived constraints, which includes the features of technologies at hand. Similar to the observation of this result, Bwambale reported that farmers in central Uganda have adopted various integrated SFMT, which reflected four types: livestock manure, synthetic fertilizer, cultural methods and leaf sprays (Bwambale, 2015).

As a whole, conventional tillage and mulching, the use of NPK and urea fertilizers, use of poultry and animal manures were the pairs of fertility management practices prominently employed in this study area which could be because of the low cost of handling and easy access to such practices. This does not follow the trend observed by Bwambale which reported that farmers commonly use traditional practices, organic manure, foliar fertilizers and inorganic fertilizers as SFMP (Bwambale, 2015). However, arable farmers in Jigawa, were favourably disposed to inorganic fertilizer and traditional practice of conventional tillage and organic farmyard manure (Odhiambo and Nematodzi, 2007; Orifah et al., 2018). This reflects that geographical zone could influence predominant arable crop type produced and as such SFMP utilized.

### 3.3 Types of Soil Fertility Management Techniques Employed by the Farmers

Figure 3 shows the types of SFMT employed by the farmers. About 34.3% reported using animal manure and 47.7% used poultry manure, 5.4% of the farmers used compost while green manure was used by 24%. As observed in this study, the most organic manure used by the respondents was in the order: poultry manure, cattle dung, green manure and compost. This corroborates the results of that poultry manure and cattle dung are the most common organic manure used among maize farmers in Ido, Oyo State. About 80% of the respondents revealed that they use NPK and 80% had used urea fertilizer while 1.7% showed that they had used muriate of potash and none of the respondents showed that they have used calcium ammonium nitrate and diammonium phosphate (Adeniran et al., 2017). The results showed that NPK and urea were the major inorganic fertilizers used by arable farmers. Bwambale noted that commonly used livestock manure were from cattle, swine and birds while the synthetic fertilizers were NPK, Urea and Calcium Ammonium Nitrate (Bwambale, 2015).

### 3.4 Level of Utilisation of SFMT Employed by the Farmers

Table 1 shows the level of utilization of SFMT employed by the respondents in the pooled States. The result was ranked in chronological order with cultural methods of ridging across the slope ranked first (WMS=2.72), mulching ranked second (WMS=2.60), rotational cropping ranked third (WMS=2.26), cover cropping ranked fourth (WMS=2.04), the use of NPK ranked 5th (WMS=1.99) and urea ranked sixth (WMS=1.96). The use of bush fallowing ranked seventh (WMS=1.23), poultry manure is ranked eighth (WMS=0.95), animal dung ninth (WMS=0.67), green manure was ranked tenth (WMS=0.57), zero tillage rotational ranked was eleventh (WMS=0.41), compost was ranked twelfth (WMS=0.22) muriate of potash ranked thirteenth (WMS=0.11) while the use of Calcium Ammonium Nitrate and Diammonium Phosphate were ranked least (WMS=0.00).

This study revealed that arable crop farmers from the Southwestern States of Nigeria had an array of Soil fertility Management Techniques predominantly cultural methods followed by inorganic fertilizers and organic manure. This order is unlike the report of Bwambale who identified that central Uganda farmers used cultural practices, then organic manure and also, inorganic fertilizer (Bwambale, 2015). Some researchers observed that cultural management practices like crop rotation, planting of cover crops, mulching and ridging across the slope help in water conservation, control erosion and improvement of soil organic matter through decomposed leaves and crop residues (Olaitan and Omomia, 2006; Orifah et al., 2018). Bwambale observed that

intercropping, crop rotation, mulching and fallowing were the most common traditional soil management system in central Uganda while commonly used livestock manure are from cattle, swine and birds then synthetic fertilizer were NPK, urea and calcium ammonium nitrate (Bwambale, 2015).

However, NPK and urea fertilizers might have come before other inorganic fertilizers in this study because they were most commonly available unlike diammonium phosphate and calcium ammonium nitrate were not used

by arable crop farmers in the southwestern. Some researchers asserted that the use of animal manure and compost could be less utilized because of irritating odour, drudgery and bulkiness (Edeoghon et al., 2008; Schoomaker-Freudenberger, 1994). According to farmyard manure is the most prominent organic manure in Jigawa (Orifah et al., 2018). Although, some researchers concluded that poultry manure and cattle dung are the most common organic manure used among maize farmers in Ido (Adeniran et al., 2017). It, therefore, suggests that arable crop type and soil type may influence farmers' soil management practice.

**Table 1: Level of Utilization of SFMT Employed by the Farmers**

Management Practices	Always	Occasionally	Rarely	Never	WMS	Rank
<b>Organic Manure</b>						
Animal dung	44(12.6)	30(8.6)	46(12.1)	230(65.7)	0.67	9 <sup>th</sup>
Poultry manure	55(15.7)	55(15.7)	57(16.3)	183(52.3)	0.95	8 <sup>th</sup>
Compost	1(0.3)	8(2.3)	10(2.9)	331(94.5)	0.22	12 <sup>th</sup>
Green manure	47(13.4)	23(6.6)	13(3.7)	267(76.3)	0.57	10 <sup>th</sup>
<b>Inorganic fertilizers</b>						
NPK	183(52.3)	50(14.3)	47(13.4)	70(20.0)	1.99	5 <sup>th</sup>
Urea	165(47.1)	75(21.4)	40(11.4)	70(20.0)	1.96	6 <sup>th</sup>
Muriate of Potash	2(0.6)	4(1.1)	2(0.6)	342(97.7)	0.11	13 <sup>th</sup>
<b>Cultural practices</b>						
Mulching	253(72.3)	71(20.3)	8(2.3)	18(5.1)	2.60	2 <sup>nd</sup>
Ridging across the slope	296(84.6)	29(8.3)	9(2.3)	16(4.6)	2.72	1 <sup>st</sup>
Zero tillage Rotational	1(0.3)	33(9.4)	75(21.4)	241(68.9)	0.41	11 <sup>th</sup>
Cover cropping	200(51.1)	54(15.4)	68(19.4)	28(8.0)	2.04	4 <sup>th</sup>
Rotational cropping	199(56.9)	68(19.4)	57(16.3)	26(7.4)	2.26	3 <sup>rd</sup>
Bush fallowing	65(18.6)	65(18.6)	104(29.7)	150(42.9)	1.23	7 <sup>th</sup>

WMS =Weighted Mean Score

Percentages are in parentheses

\*Multiple Responses Recorded

Source: Field Survey, 2021

### 3.5 Correlation between Socio-Economic Characteristics and Level of Utilisation of SFMT

The results of the PPMC showed a significant correlation exist between age ( $r=0.22^*$ ;  $p=0.01$ ), farm size ( $r=0.16^*$ ;  $p=0.04$ ), and the level of utilisation of SFMT. It implied that the level of SFMT used by the respondents was determined by age and farm size. The null hypothesis was rejected like the report (Ojediran et al., 2020a).

Table 2: Correlation between Socio-Economic Characteristics and Level of Utilization of SFMT			
Variable	R-Value	P-Value	Remarks
Age	0.22**	0.01	S
Farm Size	0.11*	0.04	S

NS=Not significant

S=Significant

\*=Significant at 5% level

## 4. CONCLUSION

In conclusion, arable crop farmers in southwestern, Nigeria were mostly active small-scale farmers who utilized majorly cultural methods of SFMT and were mainly influenced by crop type as a function of age and farm size. Future studies could compare the SFMT prominently utilized in different regions of Nigeria or other places.

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