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LEVEL OF SOIL FERTILITY MANAGEMENT PRACTICES AMONG ARABLE CROP FARMERS IN ONDO STATE, NIGERIA

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ABSTRACT
The study assessed the level of soil fertility management practices (SFMP) among arable crop farmers in Ondo State, Nigeria. Multistage sampling process was used in selecting 95 arable crop farmers Data were collected using a well-structured interview schedule and analysed using descriptive statistics and Person Product Moment Correlation (PPMC). Results showed that respondents' average age was 47 years, mostly males (81%), married (85%) with an average farm size of 1.7ha who cultivated mainly yam (86.3%) cassava (82.1%) and maize (52.6%). The respondents had array of SFMPs predominantly cultural methods, inorganic fertilizers and organic manure in that order. The level of utilization was predominantly cultural methods of ridging across the slope with a weighted mean score (WMS) of 2.70 and mulching (WMS=2.50); inorganic fertilizers: urea (WMS=1.64) and NPK (WMS=1.45) and organic manure: poultry manure (WMS=0.84) and animal dung (WMS=0.77). The major source of information regarding SFMP was radio (85.3%), market-place (83.2%), and fellow farmers (80.0%). PPMC analysis showed that farm size (p=0.00), was significantly related to the level of SFMP. Conclusively, farm size influences the level of SFMP. It is therefore recommended that farmers should be enlightened to utilize relevant farming system techniques to improve on production of arable crops.

KEY WORDS
Arable crop farmers, soil fertility management, socio-economic, information.

Low and declining soil fertility due to net nutrient extraction by crops is responsible for low agricultural productivity and food insecurity (Yirga and Hassan, 2014). Crop output remains stagnant at low ebbs aggravating food insecureness and poverty (Khan *et al*., 2014). Geremew (2016), indicated that among others, the breakdown of traditional soil nutrient management practices due to increasing pressures on agricultural land prompted by the need to feed the increasing population in the face of shrinking land frontier is responsible for depleting nutrients in sub-Saharan Africa. For agricultural production to keep pace with the growing global population, the use of SFMPs will continue.

The number of smallholder farmers using fertilizers in Africa is oft beneath 10%, corresponding to the wealthy family in the community (Misiko *et al*., 2011). Poor SFMPs are major reasons why there is a static or declined food production among farmers of sub-Saharan especially the smallholder farmers in Africa including Nigeria (Daudu *et al*., 2019). Also, Di Falco and Zoupanidou (2017) established that improvements in soil fertility to a level that boosts food security in Africa will require substantial increases in fertilizer use. Chianu and Mairura (2012) observed that most farms fail to make sufficient soil fertility replenishment investments, leading to declining soil fertility, little return to cropping investment, shrank food security and exorbitant food costs.

One of the intense threats to the sustainability of agricultural crop production in Nigeria is declining productivity as a result of the loss of soil fertility. Soils in Nigeria suffer deficiency and this is common to the soils in the tropics with a low percentage of organic matter and nitrogen (Oladipo *et al.,* 2017). There are different ways in which farmers do land tillage including selective tree felling, controlled bush burning, manual tillage, diverse cropping and harvesting techniques and appropriate and inappropriate fertilizers application (FAO, 2013).

Overuse of soils causes acidification, salinization or other chemical soil contamination resulting from mismanagement of soil with inappropriate management practices.

Part of the major author of soil degradation identified in different parts of Africa (FAO, 2013) is the use of unsuitable ways of soil preparation and tillage. The soil in natural manner renew itself when used properly. In an attempt to maintain optimum crop productivity, farmers are therefore encouraged to adopt different production technologies that would conserve the soil in which fertilizer is mainly used to conserve soil fertility (Druilhe and Barreiro-Hurle, 2021). Concerning fertilizer use, Onwudike *et al*. (2016) suggested the adoption of many strategies which aimed at improving soil productivity and crop yield. Also, Adeyemo *et al.* (2017) corroborated that soil is managed to protect agricultural land, biodiversity, and food security. Therefore, preserving soil nutrients and food security are inseparable.

Production of arable crops remains an important part of all farming enterprise in Nigeria agricultural sub-section with diverse arable crops like include cassava, yam, maize, rice, sorghum, millet, cowpea, soybean, groundnut, potatoes, cocoyam, tomato, pepper, okro among others. These crops can be classified as cereals, legumes, root and tuber crops, and horticultural crops. They differ in soil and nutrient requirements (Adewumi *et al*., 2019). This study therefore, investigates the level of SFMP amongst the respondents in Ondo State.

The objectives of the study were to:

- Examine the socio-economic characteristics of the respondentss;
- Identify the arable crops cultivated by the respondents
- Identify the various types of SFMPs used by the respondents as soil improvement strategies;
- Identify the level of utilization of SFMPs;
- Identify the various sources of agricultural information on SFMPs.

The hypothesis of the study was stated in a null form:

- Ho_1: There is no significant relationship between the selected socioeconomic features of the respondents and the level of utilization of SFMPs.

MATERIALS AND METHODS OF THE RESEARCH

The population of this study included all arable crop farmers in Ondo state in southwest of Nigeria. However, multistage sampling procedures were used in selecting the arable crops farmers across Ondo state. Ondo State Agricultural Development Projects (ODASADEP) comprised three Agricultural Zones (Owo/Akure, Ondo and Idanre/Owena) with extension blocks each. A random selection of two (2) extension blocks from each of the selected agricultural zones was done. Hence, Ileoluji/Oke-igbo and Odigbo extension blocks were selected from Ondo agricultural zone while Owo and Akure extension blocks were selected from Owo/Akure Agricultural Zone. The next stage involved another random selection: three (3) extension cells from each of the selected extension blocks. The extension cells were selected due to the dominance of arable crop farmers and their involvement in arable crop farming. Furthermore, 30% of the respondents were randomly selected in each of the extension cells across the selected extension blocks that were used for this research work. The total number of respondents selected in Ondo State was ninety-five (95). Questionnaires and interviews were scheduled to get information from the farmers.

The data for this study were analyzed by using descriptive and inferential statistics. The descriptive statistics include frequency count, percentages, mean, standard and weighted mean score while the inferential statistics employed Pearson Product Moment Correlation (PPMC) was used to test the hypotheses.

RESULTS AND DISCUSSION

The results in Figure 1 showed that 38.4% of the farmers were between the ages of 41 and 50 years, 32.3% were 51 and 60 years, 21.1% were above 60 years, 6.1% were between 31 and 40 years, 1.0% were between 21 and 30 years while 1.1% were less or

equals to 20 years of age. The mean age of the farmers was 47 years, which implies that the majority of the farmers from Ondo state were between the ages of 41 and 50 years and it shows that they are active and agile in arable crop production. This is similar to the report of Adeola *et al.* (2014) who found that the average age of arable farmers in Ondo State was 49 years. This is also similar to the report of Igbalajobi *et al*. (2013) where farmers in the state had an average age of 51 years. However, Igbalajobi *et al.* (2013) noted that Nigerian arable crop farmers were ageing. This conforms to the report of John (2012) and Mahapatra (2019) that the average age of an Indian farmer was 50.1 years unlike that of a US farmer which was 58 years (Zuluf, 2020).

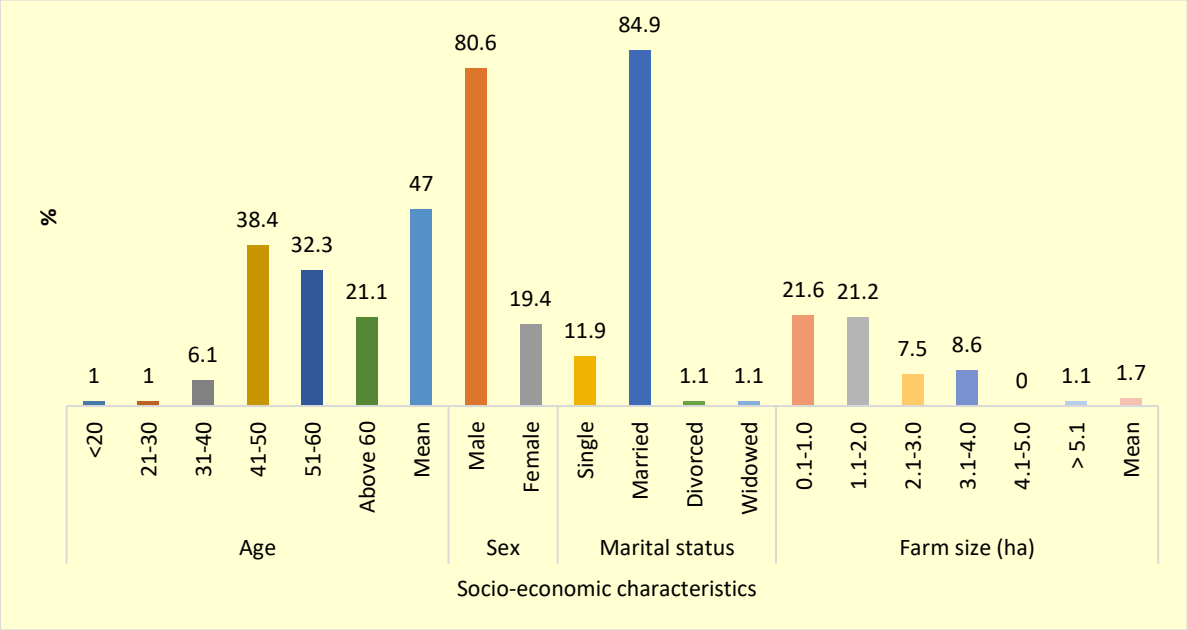

Figure 1 – Socio-economic characteristics of Arable crop farmers

81% of the respondents were male while the female respondents from were 19%. This study revealed that there was dominance of the male farmers in the selected state and this could be attributed to the energy-demanding activities involved. Amanze *et al.* (2012) and Ojediran *et al*. (2020a, b) found that men were more in crop production than women and Orifah *et al*. (2018) also 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 in the study areas.

The result revealed that 12% were single, 81% were married, 1% were divorced and 1% were widowed. This result showed that more than 80% of the respondents were married. Ahmed *et al*. (2016) explained that there are cultural inclinations on married people with the responsibility of providing for the wellbeing of their household and their views are respected within the rural communities (Adeola *et al*., 2017). Also, Daudu *et al*. (2019) and Ojediran *et al*. (2020b) suggested that marriage commits individuals to directly engage in productive activities such as farming to raise enough crop production for domestic use and sale to meet other cash needs and it denotes that the household members were needed in most agricultural operations (Ogunsumi, 2010).

The distribution of farmers showed that 21.6% had a farm size between 0.1-1(ha), 21.2% had between 1.1-2.0 ha, 7.5% had between 2.1-3.0 ha, 8.6% had 3.1-4.0 ha, while 1.1% had more than 5 ha and the average farm size was 1.7. This shows that majority of the arable crop farmers had a farm size between 1.1-2.0 ha. Adeola *et al*. (2017) also established that the average farm size used for cassava cropping in Oyo State was 2 hectares. Arable crop farmers from Ondo state had low farm size which could be attributed to their interest in cash crops production (Ogunkunle and Olaniyi, 2018).

The distribution of arable crops grown by the respondents is shown in Figure 2. In Ondo state, 86.3% of the farmers cultivated yam, about 82.1% cropped cassava, maize (52.6%), cowpea (40.0%), pepper (33.7%), cocoyam (31.6%), okro (25.3%), potatoes (20.0%), Tomatoes (3.2%), Guinea corn (10.5%) and Pigeon pea (1.1%). Many of the farmers cultivated yam and cassava. Arifalo and Mafimisebi, (2011) also indicated that cassava, yam and maize as important food crops cultivated in Oyo State. This in line with the work of Adeola and Adetumbi (2015) that majority of the farmers in southwestern Nigeria cultivated mainly maize and cassava.

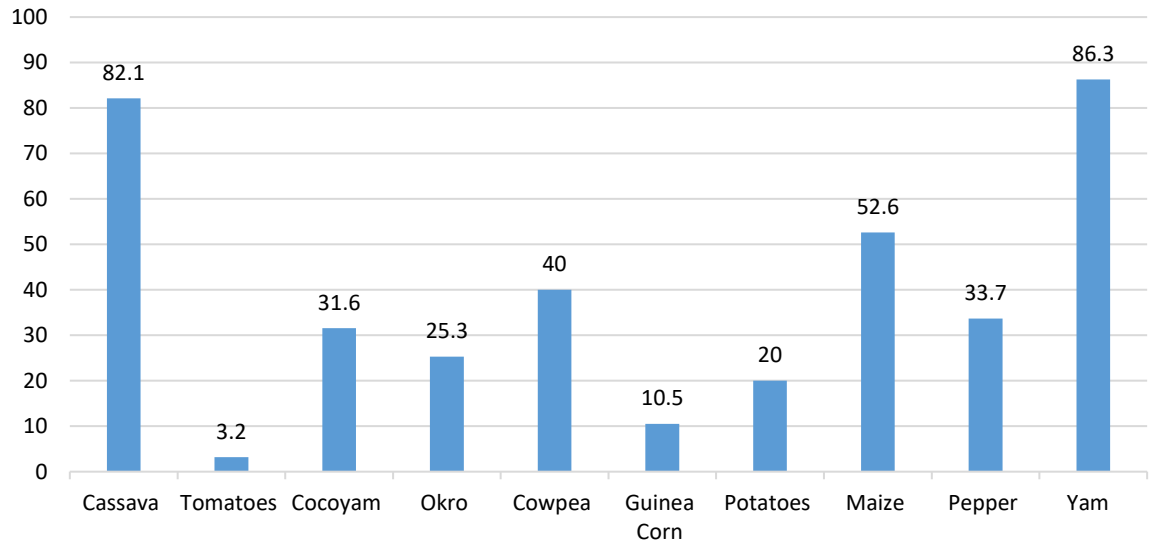

Figure 2: Arable crops grown by the respondents *Multiple Responses Recorded
(Source: Field Survey, 2021)

Figure 3 shows the types of SFMPs employed by the farmers. The result revealed for organic manure, 47.3% used animal dung, 50.5% used poultry manure, 4.3% of the farmers reported the use of compost while green manure was used by 3.2%. This implies that the most used organic soil management practice in Ondo State was poultry manure followed by dung. This conforms to the report of Orifah *et al*. (2018) which posited that farmyard manure is the prominent organic manure used by arable farmers in southwestern, Nigeria. 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 findings Adeniran *et al*. (2017) who concluded that poultry manure and dung are the most common organic manure used among maize farmers in Ido, Oyo State.

On the use of inorganic fertilizers: 74.2% of the respondents revealed that they used NPK, while 75.3% used urea fertilizer, while 1.1% showed that they had used muriate of potash. This could be deduced from the result showing the various arable crops cultivated were yam, cassava and maize. Also, the main inorganic fertilizer applied to maize was NPK and urea as the major grain crop. Farmers do not usually use fertilizer for root and tubers in this zone. Bwambale (2015), posited that crop type planted can influence the type of inorganic fertilizer to be applied. This may have been because arable crop farmers were targeted.

The result revealed that NPK and urea were the major inorganic fertilizers used by arable farmers. Bwambale (2015) noted that mostly used animal manure was from cattle, swine and poultry while the inorganic fertilizers were diammonium phosphate, NPK, Urea and Calcium Ammonium Nitrate (CAN).

The results for cultural practices among these farmers revealed that 94.7% used mulching as a form of SMP while ridging across the slope was used by about 93.7%. Those that admitted to using cover crops were 91.6%, rotational cropping was used by 87.4% while bush fallowing was used by 46.3%.

Mugwe *et al*. (2007) reported that small-scale farmers in Kenya were ready to adopt new SFMP only if they perceived soil fertility to be a problem. As such, farmers become motivated to seek alternative ways to avert current problems based on various perceived constraints, which includes the characteristics of technologies available to them. Consistent with this notion, farmers that have a strong sense of the causes and consequences of soil degradation within their areas have been influenced to adopt innovations in soil fertility management practices. Similar to the observation of this study, Bwambale (2015) reported that farmers in Uganda had adopted various integrated SFMP, which reflect four categories: animal manure, inorganic fertilizers, traditional practices and foliar sprays.

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

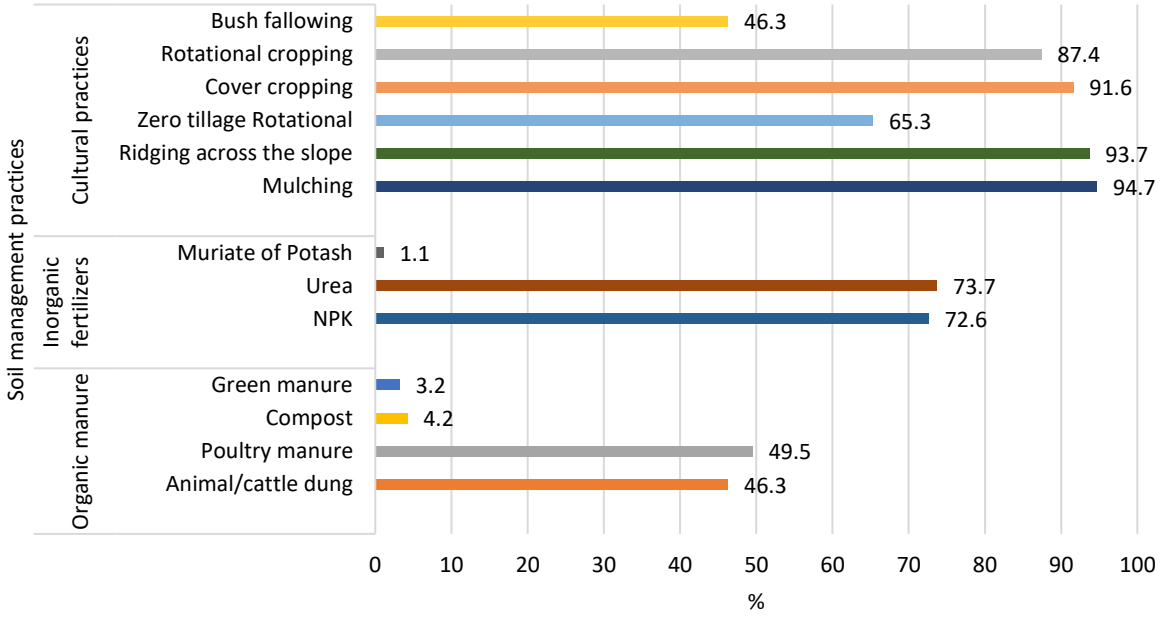

Figure 3 – Types of SFMPs employed. *Multiple Responses Recorded. Percentages are in parentheses (Source: Field Survey, 2021)

Table 1 shows the level of utilization of SFMPs employed by the respondents in Ondo state which are ranked chronologically. The cultural methods used by the farmers showed that ridging across the slope was ranked first (WMS=2.70), mulching was ranked second (WMS=2.50), cover cropping ranked third (WMS=1.78), urea ranked fourth (WMS=1.64), rotational cropping ranked fifth (WMS=1.59), the use of NPK ranked sixth (WMS=1.45), the use of bush fallowing ranked seventh (WMS=1.01), poultry manure was ranked eighth (WMS=0.84), animal dung ranked ninth (WMS=0.77), zero tillage rotational ranked tenth (WMS=0.71), then compost and green manure ranked eleventh (WMS=0.02). This result shows that farmers utilized ridging across the slope, mulching, and cover cropping. This result could be linked to the fact that the main arable crop cultivated in Ondo state was yam and cassava. This does not follow the trend observed by Bwambale (2015) which reported that farmers commonly use traditional practices, organic manure, foliar fertilizers and

inorganic fertilizers as SFMPs. It, therefore suggests that arable crop type and soil type may influence farmers' soil management practice.

Table 1 – Level of utilisation of SFMPs employed

Management Practices	Always	Occasionally	Rarely	Never	WMS	Rank
Organic Manure						
Animal/cattle dung	11(11.8)	6(6.5)	27(29.0)	46(52.7)	0.77	9th
Poultry manure	11(11.8)	9(9.7)	27(29.0)	46(49.5)	0.84	8th
Compost	--	--	2(2.2)	91(97.3)	0.02	11th
Green manure	--	--	2(2.2)	91(97.3)	0.02	11th
Inorganic fertilizers						
NPK	25(26.9)	16(17.2)	28(30.1)	24(25.8)	1.45	6th
Urea	34(36.6)	14(15.1)	22(23.7)	23(24.7)	1.64	4th
Cultural practices						
Mulching	57(61.3)	28(30.1)	5(5.4)	2(2.2)	2.50	2nd
Ridging across the slope	76(81.7)	8(8.6)	7(7.5)	2(2.2)	2.70	1st
Zero tillage Rotational	--	8(8.6)	50(53.8)	35(37.6)	0.71	10th
Cover cropping	32(34.4)	14(15.1)	41(44.1)	6(3.6)	1.78	3rd
Rotational cropping	21(22.6)	23(24.7)	39(41.9)	10(10.8)	1.59	5th
Bush fallowing	18(19.4)	14(15.1)	12(12.9)	49(52.7)	1.01	7th

*Note: WMS =Weighted Mean Score, Percentages are in parentheses. *Multiple Responses Recorded*
Source: Field Survey, 2021.

Table 2 shows the agricultural information sources by the farmers. About 85.3%, of the farmers got their information through radio, 15.8% of the farmers selected the internet or social media group and about 18% received information through phone messages. Furthermore, 80% of the farmers, got agricultural information through friends or neighbours or fellow farmers while about 78% of the farmers got agricultural information through agro-fertilizer dealers. Extension agents played a role in agricultural information as indicated by 65.3% of the farmers. Moreover, 60% of the farmers from received information through newspapers or magazines. The farmer that got information through television were about 54%. Traditional rulers played a role in agricultural information transfer as about 76% of the farmers stated. Also, 83.2% of the farmer identified that they received agricultural information at the marketplace. About 60% of the farmers received agricultural information through the co-operative society. Lastly, 76.3% of the farmers got information through farmers' meetings.

Table 2 – Agricultural information sources by the respondents

Sources of Agricultural information	Frequency	Percentage
Radio	81	85.3
Internet / social media group	15	15.8
Phone messages	17	17.9
Friends/neighbors/fellow farmers	76	80.0
Agro/fertilizer dealers	74	77.9
Extension Agents	62	65.3
Newspapers/Magazines	57	60.0
Television	50	53.8
Traditional ruler	72	75.8
Market place	79	83.2
Cooperative society	57	60.0
Farmers' meeting	71	76.3

*Note: WMS =Weighted Mean Score. *Multiple Responses Recorded. Percentages are in parentheses.*
Source: Field Survey, 2021.

This study revealed that the farmers had an array of sources. Prominent (Over 70%) among them were radio, friends/neighbors /fellow farmers, market place, farmer meetings, co-operative society, agro-dealers. Mittal and Tripathi (2009), reported that the most common information wellspring of small farm productivity or household for getting informed was through other farmers and input dealers. This showed that 2-way interaction is important and

more acceptable than one-way modes of information like television and newspapers because radio programs allowed the calling in option. The wide coverage and mobile forms of radio may have influenced the respondents as a source of information. Bachav (2012) also proved that most farmers in India preferred to first have information from fellow farmers followed by other sources. This is similar to the report of Butt *et al.* (2017) who stated that the majority of farmer used cell phones to seek information for micro-credit disbursement, agricultural marketing and SFMPs.

Table 3 – Correlation between socio-economic characteristics and level of utilisation of SFMPs

Variable	r-value	p-value	remarks
Age	0.97	0.35	NS
Farm size	0.37**	0.00	S
Marital status	0.02	0.85	NS

*Note: NS=Not significant, S=Significant, **=Significant at 1% level.*

The result of the Pearson's product-moment correlation (PPMC) analysis showed that farm size (r=0.37**; p=0.00), was significantly related to the level of utilisation of SFMPs. This showed that farm size and the level of SFMPs used by the farmers were positively correlated, thus small farm size would need low level or easier SFMP. This may not be unconnected to the use of mostly cultural practices of making ridges and mulching as SFMPs by the respondents.

CONCLUSION

The average age of arable crop farmers from Ondo state was 47 years, mostly married males with mean farm size of 1.7ha cultivating mainly yam (86.3%) cassava (82.1%) and maize (52.6%). The respondents used cultural methods, inorganic fertilizers and organic manure in that order as SFMPs. The level of utilization of SFMP was predominantly cultural methods of ridging across the slope (WMS=2.70) and mulching (WMS=2.50); inorganic fertilizers: urea (WMS=1.64) and NPK (WMS=1.45) and organic manure: poultry manure (WMS=0.84) and animal dung (WMS=0.77). The major source of information regarding SFMPs was radio (85.3%), market place (83.2%) and fellow farmers (80.0%). PPMC analysis showed that farm size (p=0.00), was significantly related to the level of SFMPs. It can be concluded that farm size influences level of SFMPs. It could therefore be recommended that farmers should be enlightened to utilize relevant farming system techniques to improve on arable crop production.

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