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Research Article

Soil maintenance practices for improving arable crop production in Anambra east local government area, Anambra state, Nigeria

Emmanuel Akintunde Oketoobo, Nkereuwem Jonah Umoren, Ifechi Favour Okeke

Department of Agricultural and Vocational Education, College of Education, Michael Okpara University of Agriculture, Umudike

Abstract: The study determined soil maintenance practices for improving arable crop production in Anambra East Local Government Area, Anambra State, Nigeria. The sample of the study was 144 drawn using simple random sampling technique, with structured questionnaire as the instrument. Mean and standard deviation was used to analysed the data while the hypotheses were tested using t-test statistic at 0.05 level of significance. The findings of the study revealed different soil maintenance practices used by arable crop farmers such as: crop rotation (3.42), erosion prevention (3.37), bush fallowing (3.34), compost manure (3.27), integrated soil fertility management (3.14) and inorganic fertilizers (3.56). The benefits of soil maintenance practices include: soil fertility improvement (3.49), reduction in nutrient depletion (3.42) and soil degradation prevention (3.34). Moreover, all the hypotheses tested revealed that there is no significant difference between the mean responses of extension agents and arable crop farmers. The farmers used diverse soil maintenance practices due to their benefits. Also, the used of soil maintenance practices by farmers were affected by illiteracy, limited farmlands and financial challenges. It is recommended that there is need for awareness campaign to educate the farmers on different soil maintenance practices for improving arable crop production for food security.

Keywords: Soil, maintenance practices, arable crop, farmers, food security,

1. Introduction

Soil can be described as the unconsolidated upper part of the earth's crust that serves as a natural medium for the growth of crops (Abhulimen et al., 2021). Soil provides mechanical support to the plants, space for root growth and development as well as environmentally conducive for the respiration of living organisms. It also serves as a reservoir of nutrients and water for plants growth. Soil plays pivotal roles in the agricultural production system. As a medium that physically supports crops and animal growth, the sustainability of crop productivity also depends on the quality of soil. Though a fixed asset, soil is primarily essential to guarantee food security, industrial crop production and improved household financial status. In the tropics, Nigeria inclusive, soil fertility deterioration is a common form of degradation, which is increasingly threatening the sustainable agricultural production of smallholder farmers whose livelihoods partly or wholly depend on soil (Belachew et al., 2020).

Soil is an asset essential for the survival of all living things that man directly or indirectly depend on for existence. Soil undoubtedly plays pivotal roles in the agricultural production systems. It is the natural body of loose unconsolidated materials which constitutes a layer of several meters deep on the earth surface. Soil resources are finite, fragile and susceptible to degradation owing to poor soil management and vulnerable to unforeseen climate changes (Abhulimen et al., 2021). This implies soil required adequate maintenance for enhancing effective use and improving crop production.

Soil maintenance practices are essential for improving arable crop production. They are important steps to increase productivity and sustainability in agriculture, and meeting basic human needs particularly food (Tsado et al., 2021). A continuous growing pressure

* Corresponding author:
Email: oketooboea@gmail.com

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to increase food, fibre and fuel production to meet worldwide demand and to achieve zero hunger has put severe pressure on soil resources. The continued use of degraded land for agricultural production requires ever-increasing management interventions to enable high yielding food production (Mosier et al., 2021). There is a need to maintain the soil since plant growth and all agricultural and other related primary production activities are dependent on the soil. As stated by (Ahuchaogu et al., 2022), soil erosion, soil toxicity, soil pollution and depletion of soil nutrients resulting from agricultural and non-agricultural practices cause soil degradation. Agbede, (2017) pointed out the importance of adopting sustainable soil maintenance practices in the study area due to its unique climatic and geographical conditions. The region experiences a tropical climate with distinct wet and dry seasons, influencing soil properties and crop growth patterns. Frequent flooding during the rainy season poses challenges to soil health, including erosion and nutrient leaching. Conversely, the dry season can lead to soil compaction and reduced microbial activities affecting soil structure and fertility.

Agricultural practices such as soil and water conservation appear to be a step in the right direction to meet global food demands in a more environmental and sustainable manner (Fontes, 2020). Without soil and water conservation regulation, the cost of remediating soil degradation would increase, productivity would continue to decline and thereafter, it would continue to lower agricultural export revenue and increase food insecurity (Alhasan & Abu, 2022). Therefore, there is need to augment the soil back through effective utilization of soil maintenance practices. Studies have explored and recommended conservation measures which can enhance soil fertility and increase crop yield sustaining in the wake of climate change (Darkwash et al., 2019).

Soil maintenance practices involve the application of practices that are economically viable, socially acceptable, environmentally friendly and technically appropriate for planting of arable crops which in turn reduces soil erosion, increases soil fertility, increase soil organic matter and improve agricultural productivity (Alhasan & Abu, 2022). Soil maintenance practices such as crop rotation, conservation tillage, use of organic amendments, mulching, cover cropping, inter-cropping precision agriculture, integrated pest management practices, strip cropping, contour farming, and soil testing, nutrient management, terracing and agroforestry are important in production of arable crops (Ahuchaogu et al., 2022,).

Arable crops are herbaceous plants produced under a more or less intensive cultivation. Arab crops such as wheat and barley require good soil to quality and a favourable climate to grow and land amendable to the use of ploughing and harvesting machinery. Arable crops include, sorghum millet, cowpea, groundnut, cassava, maize, yam, vegetable like fluted pumpkin among others cultivated by the farmers (Ahuchaogu et al., 2022).

However, the use of different soil maintenance practices provides many benefits such as increases the sustainability of farming and reduces soil erosion, increase food production to meet the need of growing population, enhance soil resources management to meet up with the food demand in the country and for improving arable crop production using practices such as crop rotation, organic amendments, conservation tillage, cover cropping, soil testing, integrated pest management, agroforestry, mulching, contour farming and others (Adeyemo et al., 2017). These practices not only improve yields but also contribute too long-term soil sustainability and environmental protection (Adeyemo et al*.,* 2017).

Unfortunately, improving arable crop production by the farmers seems to be affected by some factors which impede adoption of different soil maintenance practices for enhancing arable crop production. These factors in view of Elenwa & Emodi (2019) faced by the farmers may include illiteracy of some farmers on diverse soil maintenance technique, high cost of input and inadequate technical know-how of the farmers on the adoption of soil maintenance practices as well as limited agricultural land among others. Thus, to address the constraints to the farmers adequate soil maintenance practices appropriate measures are required. These measures are those mechanisms that will enhance farmers capacity to ensure that divers soil maintenance practices are adopted by the farmers. It is therefore on this background the study sought to examine soil maintenance practices for improving arable crop production in Anambra East L.G.A, Anambra State.

Soil maintenance practices are important agricultural operation or strategies for prevention of soil being eroded from the earth's surface or becoming chemically altered by over use. However, good soil maintenance practices promote minimum disturbance of the soil by tillage, balance application of chemical inputs for improvement of soil quality and healthy crop production for enhancing high yield of arable crops. Despite of the fact that good soil maintenance practices

may help to enhance crop production many farmers in Anambra East seems to adopt some other practices that pose serious threat to the environmental sustainability which in turn retard optimum arable crop yield and productivity. Some of the practices used by farmers in the rural communities include: continuous bush burning, continuous cropping, deforestation, lack of erosion prevention and control among others. These practices seem to causes serous environmental threat leading to climate change and soil degradation. Some of these practices are the major contributors to crop failures, low yield and low agricultural outputs leading to shortfall of food supply and food insecurity.

Therefore, enhancing crop production requires adequate adoption of good soil maintenance practices that will provide conducive environment to enable the farmers to produce enough food for the survival of the people since a hungry nation is an angry nation therefore without adequate food production the individual will be starving and the average life span of an individual maybe shortened. It is therefore expedient to examine with empirical evidence the soil maintenance practices for improving arable crop production in Anambra East L.G.A, Anambra State. The major objective of the study was to investigate soil maintenance practices for improving arable crop production in Anambra East L.G.A, Anambra State. Specifically, the study sought to: identify the different soil maintenance practices that can enhance arable crop production; examine the benefits of soil maintenance practices in arable crop production; and determine the factors affecting the use of soil maintenance practices for improving arable crop production.

The following research questions guided the study;

i. What are the different soil maintenance practices for enhancing arable crop production?
ii. What are the benefits of soil maintenance practices in arable crop production?
iii. What are the factors affecting the use of soil maintenance practices for improving arable crop production?

The following null hypotheses were formulated and tested at 0.05 level of significance:

$H0_1$: There is no significant difference between the mean responses of extension agents and arable crop farmers on different soil maintenance practice that can enhance arable crop production.

$H0_2$: There is no significant difference between the mean responses of extension agents and arable crop farmers on the benefits of soil maintenance practices in arable crop production.

$H0_3$: There is no significance difference between the mean responses of extension agent and arable crop farmers on the factors affecting the use of soil maintenance practices for improv ing arable crop production.

2. Materials and Methods

The study was carried out in Anambra East Local Government Area of Anambra State. Anambra East is one of the twenty-one Local Government Areas of Anambra State with the headquarters in the town of Otuocha. Anambra East is bound on the north by Ayem Elum Local Government Area, on the east by Oyi, on the south by Onitsha north and on west by Anambra west Local Government Area. The area is located between latitudes 6^0 15' N to 6^0 46' N and longitude ^{0} 48' E to 6^0 50'E with the land mass of 616.4 km^2. According to National Population Commission (NPC) (2006), Anambra Eat has a population of 659, 380 people. Agriculture is a major economic activity in Anambra East. The study adopted descriptive survey research design. Descriptive survey design according to Nkwocha and Akanwa (2017), is the type of research design that describes what exists or the present status of existence or absence of what is being investigated in which a group of people or items is studied by collecting data through questionnaire. The population of the study is 230 comprising 214 arable crop farmers and 16 extension agents in Anambra East Local Government Area of Anambra State. The sample size of the study was 144 comprising 131 farmers and 13 extension agents in Anambra East Local Government Area. The sample size was derived using sampling formula of (Holmes, 1983). The samplings technique adopted was simple random sampling technique to enable the researcher selected the farmers who are into crop production. The instrument for data collection was structured questionnaire developed titled by the researcher titled; "Soil Maintenance Practices for Improving Arable Crop Production Questionnaire (SFMPIACPQ)". The drafted copy of the questionnaire was presented to three experts, two experts, in Agricultural Education in the Department of Agricultural and Vocational Education and one expert in Measurement and Evaluation unit of Science Education Department, all from Michael Okpara University of Agriculture, Umudike. Cronbach Alpha statistic was used to determine the reliability coefficient of the instrument which yielded 0.82, 0.78 and 0.75 for each cluster and overall reliability coefficient index of 0.78 considered reliable for the study. A total of 144 copies of questionnaire were administered using direct

delivery and retrieval method and 132 copies were retrieved which include 119 farmers and 13 extension agents representing appropriately 92% return rate. Data collected were analysed using mean and standard deviation to answer the research questions and t-test statistic was used to test the hypotheses at 0.05 level of significance. Thus, the mean scores of 2.50 and above were considered as agreed while the mean scores below 2.50 were considered as disagreed. The standard deviation was used to ascertain the homogeneity of the respondents' response to the items in the instrument.

3. Results and discussion

Research Question 1: What are the different soil maintenance practices for enhancing arable crop production? The data that answered research question 1 is presented in Table 1

Table 1: Mean and standard deviation of the respondents' responses on the different soil maintenance practices that can enhance arable crop production

S/n	Item statement	$\bar{X}$	SD	Remarks
1.	Use of crop rotation practices	3.42	0.81	Agreed
2.	Erosion prevention and control	3.37	0.86	Agreed
3.	Cover cropping	3.33	0.87	Agreed
4.	Adoption of bush fallowing technique	3.34	0.81	Agreed
5.	Minimum bush burning practice	3.50	0.88	Agreed
6.	Use of compost manure to maintain the fertility of the soil	3.27	1.10	Agreed
7.	Adoption of mulching to maintain the moisture of the soil	3.25	1.09	Agreed
8.	Use of integrated soil fertility management	3.14	1.00	Agreed
9.	Inorganic fertilizers application	3.56	0.76	Agreed
	Cluster mean	3.35	0.91	Agreed

Key: $\bar{X}$ = mean, SD= Standard deviation, n=132

From the data in Table 1 above, the mean responses of the respondents range from 3.14-3.56 which are all above the cut-off point of 2.50. This implies that the 9 items are the different soil maintenance practices for enhancing arable crop production. Also, the standard deviation of all the items ranges from 0.76 - 1.10 which shows that the responses of the respondents are close to one another in their responses and that they were not far from the mean. This implies that crop rotation, erosion prevention and control, cover cropping, bush fallowing, minimum bush burning, compost manure, mulching, integrated soil fertility management and inorganic fertilizers are the different soil maintenance practices for enhancing arable crop production.

Hypothesis 1: There is no significant difference between the mean responses of extension agents and arable crop farmers on different soil maintenance practice that can enhance arable crop production.

The data in Table 2 shows that the p-value of all the 9 items range from 0.10 to 0.96 which are all greater than 0.05 alpha level of significant. Therefore, there is no significant difference between the mean responses of extension agents and arable crop farmers on different soil maintenance practice that can enhance arable crop production. The hypothesis of no significant difference between the mean responses of extension agents and arable crop farmers on different soil maintenance practice that can enhance arable crop production was upheld on those items. This implies that extension agents and arable crop farmers were on the same opinion.

Research Question 2: What are the benefits of soil maintenance practices in arable crop production? The data that answered research question 2 is presented in Table 3.

From the data in Table 3, the mean responses of the respondents range from 3.22-3.49 which are all above the cut-off point of 2.50. This implies that the 8 items are the benefits of soil maintenance practices in arable crop production. Also, the standard deviation of all the items ranges from 0.74 - 1.04 which shows that the responses of the respondents are close to one another in their responses and that they were not far from the mean. This implies that the benefits of soil maintenance practices in arable crop production include: improve the fertility, reduction of soil nutrient depletion, prevention of soil degradation, promotion of soil microbes among others.

Hypothesis 2: There is no significant difference between the mean responses of extension agents and arable crop farmers on the benefits of soil maintenance practices in arable crop production

The data in Table 4 shows that the p-value of all the 8 items range from 0.16 to 0.99 which are all greater than 0.05 alpha level of significant. Therefore, there is no significant difference between the mean responses of extension agents and arable crop farmers on the benefits of soil maintenance practices in arable crop production. The hypothesis of no significant difference between the mean responses of extension agents and arable crop

Table 2: t-test analysis of the mean responses of extension agents and arable crop farmers on different soil maintenance practice that can enhance arable crop production

S/n	Item statement	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	P-value	Remarks
1.	Use of crop rotation practices	3.46	0.77	3.38	0.86	0.72	NS
2.	Erosion prevention and control	3.38	0.76	3.37	0.97	0.26	NS
3.	Cover cropping	3.30	0.85	3.36	0.89	0.96	NS
4.	Adoption of bush fallowing technique	3.38	0.65	3.31	0.97	0.10	NS
5.	Minimum bush burning practice	3.53	0.96	3.47	0.80	0.79	NS
6.	Use of compost manure to maintain the fertility of the soil	3.30	1.18	3.25	1.02	0.49	NS
7.	Adoption of mulching to maintain the moisture of the soil	3.23	1.16	3.28	1.02	0.65	NS
8.	Use of integrated soil fertility management	3.15	0.98	3.13	1.02	0.79	NS
9.	Inorganic fertilizers application	3.61	0.76	3.52	0.77	0.68	NS

KEY: $\bar{X}_1$= mean of extension agent, $\bar{X}_2$= mean of farmers, SD_1= Standard deviation of extension agent, SD_2= Standard deviation of farmers.

Table 3: Mean and standard deviation of the respondents' responses on the benefits of soil maintenance practices in arable crop production

S/n	Item statement	$\bar{X}$	SD	Remarks
	Soil maintenance practices:			
1.	Helps to improve the fertility of the soil for enhancing crop productivity	3.49	0.74	Agreed
2.	Reduces the level of soil nutrient depletion in crop production	3.41	0.77	Agreed
3.	Helps to prevent soil degradation	3.34	0.86	Agreed
4.	Helps to promote soil microbes	3.42	0.68	Agreed
5.	Prevents loss of the top soil layer	3.29	1.03	Agreed
6.	Enhances high crop yields	3.25	1.04	Agreed
7.	Increases the income of the farmers through the yields of the crop	3.28	1.03	Agreed
8.	Facilitates sustainability of arable crop production	3.22	1.03	Agreed
	Cluster mean	3.34	0.89	Agreed

Key: $\bar{X}$ = mean, SD= Standard deviation, n=132

Table 4: t-test analysis of the mean responses of extension agents and arable crop farmers on the benefits of soil maintenance practices in arable crop production

S/n	Item statement	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	P-value	Remarks
	Soil maintenance practices:						
1.	Helps to improve the fertility of the soil for enhancing crop productivity	3.53	0.66	3.45	0.82	0.44	NS
2.	Reduces the level of soil nutrient depletion in crop production	3.46	0.66	3.36	0.89	0.20	NS
3.	Helps to prevent soil degradation	3.38	0.76	3.31	0.97	0.37	NS
4.	Helps to promote soil microbes	3.46	0.51	3.38	0.86	0.16	NS
5.	Prevents loss of the top soil layer	3.30	0.94	3.29	1.12	0.28	NS
6.	Enhances high crop yields	3.23	0.94	3.28	1.06	0.59	NS
7.	Increases the income of the farmers through the yields of the crop	3.30	1.03	3.27	1.03	0.99	NS
8.	Facilitates sustainability of arable crop production	3.23	0.92	3.21	1.14	0.27	NS

KEY: $\bar{X}_1$= mean of extension agent, $\bar{X}_2$= mean of farmers, SD_1= Standard deviation of extension agent, SD_2= Standard deviation of farmers.

Table 5: Mean and standard deviation of the respondents' responses on the factors affecting the use of soil maintenance practices for improving arable crop production

S/n	Item statement	$\bar{X}$	SD	Remarks
1.	Illiteracy of many rural farmers	3.28	0.91	Agreed
2.	Limited farmlands in terms of crop rotation	3.27	1.06	Agreed
3.	Financial challenges	3.34	0.84	Agreed
4.	Inadequate dissemination of extension information to farmers on sustainable soil maintenance practices	3.31	1.01	Agreed
5.	Inadequate access to agricultural inputs	3.24	0.91	Agreed
6.	Limited access to agricultural credit facilities	3.12	0.85	Agreed
	Cluster mean	3.24	0.93	Agreed

KEY: $\bar{X}$ = mean, S.D.= Standard deviation, n=132

farmers on the benefits of soil maintenance practices in arable crop production was upheld on those items. This implies that extension agents and arable crop farmers were on the same opinion.

Research Question 3: What are the factors affecting the use of soil maintenance practices for improving arable crop production? The data that answered research question 3 is presented in Table 5

From the data in Table 5, the mean responses of the respondents range from 3.12-3.34 which are all above the cut-off point of 2.50. This implies that the 6 items are the factors affecting the use of soil maintenance practices for improving arable crop production. Also, the standard deviation of all the items ranges from 0.84-1.01 which shows that the responses of the respondents are close to one another in their responses and that they were not far from the mean. The findings imply that the items were accepted as the factors affecting the use of soil maintenance practices for improving arable crop production.

Hypothesis 3: There is no significance difference between the mean responses of extension agent and arable crop farmers on the factors affecting the use of soil maintenance practices for improving arable crop production.

The data in Table 6 shows that the p-value of all the 6 items range from 0.10 to 0.66 which are all greater than 0.05 alpha level of significant. Therefore, there is no significance difference between the mean responses of extension agent and arable crop farmers on the factors affecting the use of soil maintenance practices for improving arable crop production. The hypothesis of no significance difference between the mean responses of extension agent and arable crop farmers on the factors affecting the use of soil maintenance practices for improving arable crop production was upheld on those items. This implies that extension agents and arable crop farmers were on the same opinion.

The results and discussion were done in accordance with the research questions and hypotheses that guided the study as follows: from the findings of the study on research question one, it was revealed that the different soil maintenance practices that can enhance arable crop production include: use of crop rotation practices, erosion prevention and control, cover cropping, adoption of bush fallowing technique, minimum bush burning practice, use of compost manure to maintain the fertility of the soil, use of mulching to maintain the moisture of the soil, use of integrated soil fertility management and inorganic fertilizers application. Also,

Table 6: t-test analysis of the mean responses of extension agent and arable crop farmers on the factors affecting the use of soil maintenance practices for improving arable crop production

S/n	Item statement	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	P-value	Remarks
1.	Helps to improve the fertility of the soil for enhancing crop productivity	3.30	0.85	3.27	0.98	0.66	NS
2.	Reduces the level of soil nutrient depletion in crop production	3.23	1.01	3.31	1.11	0.52	NS
3.	Helps to prevent soil degradation	3.38	0.76	3.30	0.93	0.39	NS
4.	Helps to promote soil microbes	3.30	0.94	3.32	1.08	0.30	NS
5.	Prevents loss of the top soil layer	3.30	0.85	3.19	0.98	0.66	NS
6.	Enhances high crop yields	3.15	0.68	3.10	1.03	0.10	NS

KEY: $\bar{X}_1$= mean of extension agent, $\bar{X}_2$= mean of farmers, SD_1= Standard deviation of extension agent, SD_2= Standard deviation of farmers

the corresponding hypothesis tested indicates that there is no significant difference between the mean responses of extension agents and arable crop farmers on different soil maintenance practice that can enhance arable crop production. The findings relate to the study of Tsado et al. (2021) who found that conservation practices adopted by farmers for enhancing crop production: were use of cover crop, mulching, crop rotation, strip cropping and multiple cropping. The findings also align with the study of Kalu (2023) that the soil conservation methods for enhancing crop production in secondary school farms include: use of green manure, use of cover crop such as nitrogen fixing legume, use of farmyard manure, slash and biomass, mixed farming, crop rotation, mulching of the crops, use of bush fallow system, use of shifting cultivation, use of compost manure, use of inorganic fertilizer.

It was revealed from the findings of research question two, that the benefits of soil maintenance practices in arable crop production include: helps to improve the fertility of the soil for enhanced crop productivity, reduces the level of soil nutrient depletion in crop production, helps to prevent soil degradation, helps to promote soil microbes, prevents loss of the top soil layer, enhances high crop yields, increases the income of the farmers through the sale of produce and facilitates sustainability of arable crop production. Also, the corresponding hypothesis tested revealed that there is no significant difference between the mean responses of extension agents and arable crop farmers on the benefits of soil maintenance practices in arable crop production. According to Tsado et al. (2021), perceived effects of soil conservation practices by the respondents were: increase in the organic matter and nutrient content of the soil, increasing the yield of crop and improved physical properties of soil. The findings also align with the study of Kalu (2023) that to a high extent soil management practices enhanced crop productions in secondary school farms.

The findings of research question three also revealed that the factors affecting the use of soil maintenance practices for improving arable crop production include: illiteracy of many rural farmers, limited farmlands in terms of crop rotation and financial challenges. Other factors are: inadequate dissemination of extension information to farmers on sustainable soil maintenance practices, inadequate access to agricultural inputs and limited access to agricultural credit facilities. Meanwhile, the corresponding hypothesis tested indicates that there is no significance difference between the mean responses of extension agent and arable crop farmers on the factors affecting the use of soil maintenance practices for improving arable crop production. The findings correspond to the study of Kalu (2023) that the constraints to the adoption of soil conservation practices for crop productions in secondary school farms include: inadequate farmland, high cost of organic fertilizer, and financial constraints among others. The findings also agreed with study of Nwaeze (2023) that factors such as: high cost of organic and inorganic fertilizers, Limited agricultural land for crop rotation or bush fallowing, poverty among farmers and inadequate government support to farmers hinder farmers' adoption of soil conservation practices for enhancing crop production

5. Conclusion and recommendations

The soil maintenance practices help to improve the fertility of the soil for enhancing crop productivity. It reduces the level of soil nutrient depletion in crop production, helps to prevents soil degradation, helps to promote soil microbes, prevents loss of the top soil layer, enhances high crop yields, increases the income of the farmers through the yields of the crop and facilitates sustainability of arable crop production. Meanwhile, the factors affecting the use of soil maintenance practices for improving arable crop production include: illiteracy of many rural farmers, limited farmlands in terms of crop rotation, financial challenges, inadequate dissemination of extension information to farmers on sustainable soil maintenance practices, inadequate access to agricultural inputs and limited access to agricultural credit facilities.

Based on the findings, it was recommended therefore that: Government of Anambra East through the Ministry of Agriculture including International Agricultural Organization should embark on awareness campaign to educate the farmers on different soil maintenance practices for improving arable crop production in Anambra state for food security. They should also ensure that adequate support is giving to extension agents for effective extension service delivery for enhancing farmers adoption of soil maintenance practices for improving arable crop production. They should endeavour to provide credit facilities to farmers to boost their morale and also facilitates adoption of soil maintenance practices for improving crop productions.

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