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ASSESSMENT OF THE USE OF SUSTAINABLE SOIL MANAGEMENT PRACTICES AMONG ARABLE CROP FARMERS IN MUBI SOUTH LOCAL GOVERNMENT AREA OF ADAMAWA STATE, NIGERIA

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Abstract

The research work assesses the use of Sustainable Soil Management Practices (SSMPs) by arable crop farmers in Mubi South Local Government Area of Adamawa state, Nigeria. The Data was obtained from 107 respondents selected through multi-stage random sampling techniques. The data obtained were analyzed using descriptive and inferential statistics. The study revealed that 35.5% of the farmers were within 26-35 years, majority (80.3%) had formal education, farmers were aware of SSMPs. There was a significant ($p<0.05$) relationship between the respondents' awareness and usage of cover cropping, organic manure and mulching. Organic manure, crop rotation, mixed practices, improved varieties, cover cropping and mulching were the major sustainable soil management practicesadopted by arable farmers in the study area. The study concluded that arable farmers were aware of sustainable soil management practicesand there is significant association between respondents' awareness and use of cover cropping, organic manure and mulching at 5% level. The significant association means that the higher the respondent's awareness, the higher the likelihood of respondents' use of SSMPs and the study recommended that extension agents should educate farmers on the use of SSMPs and government should provide incentives to support Farmers that use SSMPs.
Keywords:*Sustainable, Soil, Management, Practices.*

INTRODUCTION

Maintaining optimal soil quality is crucial for the environmental and economic sustainability of agriculture. Soil degradation affects plant growth, crop yield, quality, production costs, and increases soil erosion and nutrient leaching Ball, *et al.* (2017). Improving the soil's physical properties is particularly challenging, requiring considerable time and financial resources. The combination of soil type (texture: sandy, loamy, silt, and clayey) and soil management (tillage, crop rotation, and fertilization) has a significant impact on the long-term economic impact on farms (Mueller, *et al.,* 2009). Sustainable Soil Management Practices (SSMPs) has been recognized as important factor in maintaining good soil condition for sustained agricultural production. Unsustainable use of soil has several environmental and economic impact, especially in West Africa where the resilience ability of the soil is limited (Eat, 1995). The avoidance of soil loss by improved management of the natural resource is important to combat low agricultural production, food insecurity, and the rapid increase in levels of poverty. Killham (2010) reported that, the limited prospects for increasing overall land area under crop production, along with declining yield of major food crops in many parts of the world raise concerns about the capacity to feed a world population expected to exceed 7.5 billion by

2020.Mosier and Kroeze (2000) further, *s*tressed that widespread decline of soil fertility also raise questions about the sustainability of current agricultural production levels, maintenance of animal health through soil-mediated supply of goods and herbage and wider range of ecosystem goods and services that soils must provide. The soil resource base is the critical component of agro-ecosystems and must be managed sustainably to safeguard food security.

According to Edeoghon*et al*. (2008) sustainable agriculture is an agricultural system adapted to a particular area so that crop and animal production do not decline over time and are reasonably stable over normal fluctuations of weather. Past researchers have generated numerous sustainable soil management practices (SSMPs) that can be used by farmers to improve soil productivity. Some of these practices include; mixed cropping, cover cropping, crop rotation, integrated pest management, alley cropping organic manure application, improved varieties, green manure, minimum tillage system and mulching (Dros*et al*., 1996 and IITA, 1999). In recent years farmers have acknowledged prioritizing the invitation of holistic integration of traditional realistic conservations such as hillside-terraces, stone- lines and bunds, earth-contour, sand-bags, trash lines, organic manure and mulching packaged to deliver profitable crop production in sufficient quantities (Tekwa and Bellel, 2009).

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. 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 Adamawa State. The study thus, assessed use of sustainable soil management practices(SSMPs) by arable crop farmers in Mubi South Local Government Area of Adamawa State, Nigeria.

MATERIALS AND METHODS

Study Area

The study was carried out in Mubi South Local Government Area (LGA) of Adamawa State, Nigeria. The LGA is located in the North Eastern part of Adamawa State, Nigeria. It has a total land area of 680 square kilometer (km^2), with the population size of 128,937 (NPC, 2006). It shares borders in the North with Mubi North LGA, Hong LGA to the West and Maiha LGA to the south. Also, it has international border with Cameroon with Mandara Mountain to the east. Mubi South is located between latitude 13°15'E and longitude $10^0$5'N. The area is marked by tropical wet and dry climate, where dry season starts from November to March, while wet seasons last between April and October. The mean annual rainfall ranges from 700 mm to 1050 mm (Udo, 1970; Adebayo, 2004). The vegetation is typically a Sudan Savannah type, which connotes grassland interspersed by shrubs and few tress, mainly Acacia, Eucalyptus, Locust bean trees, among others (Adebayo, 2004; Tekwa and Usman,2006). The predominant physical features in the area is the Mandara mountain, which extends through the length of Mubi south Tekwa and Bellel, (2009) stressed that the area usually has mixed assemblages of scattered granite on a gentle steep slope with dissected surfaces. The land use type is basically arable farming and livestock production.

Sources of Data

Data for the study were collected from primary source. The primary data was collected through the use of well-structured questionnaire.

Sampling Procedure

The sample population for this study was arable crop farmers. A multi-stage and systematicsampling technique was employed to draw the respondents from sampling frame of 510 farmers obtained for the study. The first stage was that five (5) wards out of the ten (10) available wards were selected. Secondly, the selection of 2 villages in each ward.The third stage was the drawing of respondents from each of the selected villages at each 5^{th} intervals from the sampling frame, giving the total of sample size of 107 who were administered with questionnaires. At one and two stages random sampling (lottery method) was employed to draw the wards villages.

Method of Data Analysis

Descriptive and inferential statistics were employed for the analysis of data. The descriptive statistics such as tables, frequency and percentage while the inferential statistics involved the use of Chi-square test which was used to determine the relationship between the farmers' awareness and use of sustainable soil management practices in the study.

The Chi-square is expressed as:

$$X^2 = \frac{\sum (Fo - Fe)^2}{Fe}$$

Where:
X^2 = chi-square
Fo = observed values
Fe = expected values

RESULTS AND DISCUSSIONS

Socio-Economic Characteristics of Farmers

The analysis of socio-economic characteristics of farmers showed that majority (64.5%) of male correspondents were males that involved in arable cropping. This may be due to the fact that females depend on their husbands in taking farming decision which may influence the use of SSMPs by their female counterparts. This is in agreement with the findings of Edeoghon*et al*., (2008) in Edo State, that reported more males' involvement in arable cropping. The study also revealed that higher percentage of the respondents were youths with the age bracket of 15-40 years who are likely to be receptive to use new practices of farming including SSMPs (Ringe-Metzger and Diehl (1993). Ringe-Metzger and Diehl (1993) classified respondents into four categories; children(0-9years),youth (10-15years),adult (16-60years) and old people (61years and above) as basis for explanation.

Findings on the level of education revealed that larger percentage of the respondents had high education (54.2%) which could have a positive effect in their ability to understand and use modem SSMPs with about (63.6%) of the respondents had 10 years farming experiencewhich will help them to improve their production techniques and to increase their productivity.Furthermore, the result on the respondents' means of acquisition of farm land revealed that 61.7% of them inherited their land. This shows those majorities have access to their own lands and would lead to early adoption SSMPs.

This disagrees with the findings of Arifalo, and Mafimisebi,(2011) who reported that the predominant method of land acquisition in Oyo State were purchased and acquired land through renting or gifts.

Table 1: Socio-economic characteristic of farmers (n=107)

Variables	Frequency	Percentage)
Gender		
Male	69	64.5
Female	38	35.5
Age		
15—25	24	22.4
26—35	38	*35.5*
36—46	31	29.0
Abo45	14	13.1
level of education		
Non formal education	8	7.5
Primary school	18	16.8
Secondary school	23	21.5
Tertiary institution	58	54.2
Fanning experience (years)		
1—10	39	36.4
11—20	42	39.3
2—30	17	15.9
31 above	9	8.4
Source of land		
Inherited	66	61.7
Purchase	16	15.0
Renting	21	19.6
others	4	3.7
Farm size (ha)		
1-5	82	76.6
6-10	11	10.3
11-15	4	3.7
16 above	10	9.4
Extension contact:		
Yes	47	43.9
No	60	56.1
Annual Income in (thousand)	60	56.1
10-100	47	43.9
Above100		

Source: field survey, 2019

Farmers Awareness of Sustainable Soil Management Practices (SSMPs)

The result in Table 2 shows that higher percent of the respondents were aware of the SSMPs. These includes mixed cropping, crop rotation, mulching, cover cropping, organic manure, improved varieties, integrated pest management, minimum tillage and green manure. These were indicated by 94.4%, 84.1%, 83.2% and 81.3% of the respondents respectively. The respondents' high level of

awareness could be due to high level of education and farming experience. These results is in conformity with the findings of Akinbile and Odebode (2002) who reported that farmers in Osun state were aware of these sustainable agricultural practices. The result further revealed that few of them (28.0%) were aware of alley cropping in the study area. The respondents' lack of awareness of this could be due to few extension workers to create awareness on the importance of alley cropping system of SSMPs. This result is in agreement with the findings of Edeoghon*et al*, (2008) who reported that farmers in Edo state were not aware of alley cropping.

Table 2: Farmers Awareness of SSMPs

SSMPs*	**Aware**		**Not Aware**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Mixed cropping	101	94.4	6	*5.6*
Crop rotation	90	84.1	17	15.9
Mulching	89	*83.2*	18	16.8
Cover cropping	87	81.3	20	18.7
Organic manure	87	81.3	20	18.7
Improved varieties	79	73.8	28	26.2
Integrated pest management	65	60.7	42	39,3
Minimum tillage	60	56.1	47	43.9
Green manure	59	55.1	48	44.9
Alley cropping	30	28.0	77	72.0

Source: field survey, 2019

Farmers' Awareness and Use of SSMPs

The farmers' awareness and used of selected SSMPs were determined using chi-square test as presented in Table 3. The result shows that there is significant association between respondents' awareness and use of cover cropping, organic manure and mulching at 5% level. The significant association means that the higher the respondents awareness, the higher the likelihood of respondents' use of SSMPs. These results agrees with the findings of (Okingbo, 1977; and Edeoghon 1997) who reported that the higher the respondents' awareness, the higher the use of sustainable agricultural practices.

Table 3: Relationship between farmers' awareness and use of SSMPs

SSMPs	**X^2cal**	**X^2-tab**	**df**	**P-value**	**Remarks**
Mixed cropping	0.03	3.841	1	0.05	Ns
Cover cropping	12.04	3.841	1	0.05	**
Organic manure	4.41	3.841	1	0.05	**
Mulching	12.11.	3.841	1	0.05	**
Improved varieties	0.35	3.841	1	0.05	Ns
Crop rotation	3.54	3.841	1	0.05	Ns

Source: field survey, 2019

**=significant at 5% level; NS= Not significant

Farmers Adoption of Sustainable Soil Management Practices

The result in table 4 shows the most important SSMPs adopted by the famers in the rank order of hierarchy. This revealed that mixed cropping, organic manure and crop rotation were adopted by 91.6%, 85.1%and 84.1 % of the respondents respectively. Mixed practices, with crops such as cow pea and groundnut add nutrients to the soil. Organic manures such as animal dungs make soil to be highly fertile and crop rotation allowed the leguminous plants help to fix nitrogen into the soil and the soil organism increase in nitrogen fixation. These results are in agreement with the findings of Odeoghon,*et al. (*2008) in Edo State, that all the respondents were aware of mixed cropping, majority of the respondents are aware of cover cropping and organic manure.

The Table also shows that improved varieties, cover cropping and mulching were adopted by 73.8%, 72.9% and *58.9%* of the respondents respectively. Improved varieties such as treated seeds are resistant to pest and disease attack. Cover cropping help to improve the texture and structure of the soil and check erosion, surface run-off, leaching are prevented and mulching keeps the soil temperature at good condition both to crops and micro-organism activities in the soil, This reduces soil moisture loss by evaporation and it can add organic matter to the soil, The result agrees with the findings of Akinbile and Odebode (2002)who reported that farmers in Osun State identified and used mixed cropping, cover cropping, mulching and minimum tillage system.Green manure improves the activities of the soil organism like earth worms, termites, bacteria, fungi and it also assist in regulating the soil PH. Minimum tillage helps in minimizes losses of nitrogen on the soil surface and reduces soil erosion. Integrated pest management help to maintain the soil nutrients by increasing the activities of soil pest in the land and Alley cropping can help in reducing weeds growth. The soil could become well aerated and also help to prevent evaporation, thereby retaining water in the soil. This in conformity with Adeola (2010) who observed that farmer's adoption of soil conservation was as a result of its being available and affordable.

Table 4: Farmers Adoption of Sustainable Soil Management Practices

SSMPs*	Frequency	Percentage (%)
Mixed cropping	98	91.6
Organic manure	91	*85.1*
Crop rotation	90	84.1
Improved varieties	79	73.8
Cover cropping	78	72.9
Mulching	63	*58.9*
Green manure	59	55.1
Minimum tillage	57	53.3
Integrated pest management	*45*	42.1
Alley cropping	27	25.2

Source: field survey, 2019

CONCLUSION AND RECOMMENDATION

The study concluded that arable farmers were aware of sustainable soil management practicesand there is significant association between respondents' awareness and use of cover cropping, organic manure and mulching at 5% level. The significant association means that the higher the respondents awareness, the higher the likelihood of respondents' use of SSMPs.Organic manure, crop rotation, mixed practices, improved varieties, cover cropping and mulching were the major sustainable soil management practicesadopted by arable farmers in the study area. The study recommended that

extension agents should educate farmers on the use of SSMPs and government should provide incentives to support Farmers that use SSMPs.

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