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Survey on Soil Conservation Practices among Food Crop Farmers in Zing Local Government Area of Taraba State, Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author PHJ conceived of the study, and participated in its design and coordination, carried out the field survey and helped to draft the manuscript. Author ALN performed statistical analysis and helped to draft the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

This study examined the awareness, preference and adoption of soil conservation practices among arable crop farmers in Zing Local Government Area of Taraba State. The study was a community based cross sectional study of a sample of 200 food crop farmers drawn from ten communities in Zing Local Government Area of Taraba State. A multistage purposive and random sampling technique was used in selecting the respondents used for the study. A total of 200 farmers were selected in ten out of the seventy-five major villages from the ten farming communities. Data generated were analysed using descriptive statistics, employing frequencies and percentages. Ranking technique was used to rank farmer's preference of conservation practice. The result indicated that most of the farmers (80%) practiced conservation techniques. Ten per cent, 4% and 6% of the farmers were aware of the practice but never practiced it, not aware and had practiced but given up, respectively. The most preferred practices were mixed cropping which ranked first, mixed farming, crop rotation and manure/plant residue application. Others were use of cover crops,

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use of fertilizer and bush fallow. Reasons for the practice of soil conservation techniques included immediate monetary gain (100%) and to increase yield (96%). Other reasons included improving soil fertility (78%), preventing erosion (76%), reducing heat stress (66%), and ensuring long-term sustainability of land (58%) and advice of extension agent (40%). Forty-eight per cent indicated that they were just doing what other farmers were doing. Farmers were aware of soil conservation practices and many were currently engaged in some of the practices.

Keywords: Awareness; preference; adoption; soil conservation practices.

1. INTRODUCTION

Nothing is more basic to long-term survival of the human species than the availability of fertile soils to maintain plant and animal population. Yet, soils of Zing local government area have been mined by erosion, constant cultivation and extraction of available nutrients. The productive 'A' horizon of a soil profile that contained most organic matter, available nutrients and essential living soil organisms is virtually gone in many places of the study areas due to long cultivation, leading to land degradation. Land degradation is the temporal or permanent lowering of the productive capacity of soil caused by over grazing, deforestation, inappropriate agricultural practices, over exploitation and other human induced activities [1]. Beinroth et al. [2], sees land degradation in terms of the loss of actual or potential productivity or utility of land as a result of natural factors. It is the decline in land quality or reduction in its productivity. Land degradation, mostly human induced, is potentially a more critical problem. Increasing population pressure, cultivation of the marginal agro-ecological environment susceptible to various types of land degradation and inappropriate soil management are resulting in serious soil productivity decline, especially under extensive farming practices.

According to [3] out of the approximately 2,976 million ha total land area in Africa, 2,145 million ha (72%) are problem soils with different production constraints (soil acidity, steeply sloping soils, low fertility, shallow and stony soils, saline and poorly drained soils). Out of these areas about 490 million hectares are affected by different types of degradation that include over grazing, deforestation, inappropriate agricultural practices and over exploitation [3]. It further noted that poor and inappropriate soil management are the main causes of physical, chemical and biological degradation of cultivated land. Junge et al. [4] noted that agrarian stagnation, plaguing food security in sub-Saharan Africa (SSA) since the early 1970s may exacerbate with the projected climate change along with the attendant increase in risks of soil and environmental degradation. Soil degradation and desertification are already severe issues in SSA, where smaller size and resource poor farmers follow extractive farming practices. Soil depletion and erosion thus, constitute a hazard whose containment is a prerequisite for national development, particularly in societies that are agriculture-based [5]. In many SSA, fallow periods are being reduced considerably and farmers are increasingly cultivating marginal lands susceptible to various forms of degradation. This is manifested by declining yields, decreasing vegetation covers, salinization and fertility decline and increasing erosion [1].

In Nigeria, human induced soil degradation is a common phenomenon. Its severity is high for 37.5% of the area (342, 917 km^2), moderate for 4.3% (39, 440 km^2), and low for 26.3% (240, 495 km^2) [6]. Soil erosion is the most widespread type of soil degradation in the country and has been recognised for a long time as a serious problem [7]. The expansion of agriculture into marginal areas, deforestation, the shortening and elimination of fallows, inappropriate farming practices and low input inevitably have several environmental and economic impacts in Nigeria where the resilience ability of the soil is limited [8]. Mbagwu et al. [9] observed that soil erosion caused a yield reduction of about 30 – 90% in some root sensitive shallow lands of southern Nigeria. Land degradation will remain an important global issue for the 21st century because of its adverse impacts on agronomic productivity, the environment and its effect on food security and the quality of land [10].

Scherr [11] observed that soil provide living things with food, fibre and fuel. It supports wildlife and rural and urban activities. From the end of the 1940s to the beginning of the 1990s, over 90% of the degradation of the productive lands was due to overgrazing, deforestation and inappropriate agricultural practices. The changes in the soil affect over 2 billion people, most of the people (852 million) suffering from hunger

particularly in sub-Saharan Africa [11]. In Nigeria, over 80% of the cropland region is ravaged by erosion [12]. The mean annual loss of crop productive capacity through land degradation in SSA is estimated to be 25 million tonnes [13]. This has led to low yield, famine, low standard of living, decrease in availability of fuel wood, food insecurity, poverty and migration of rural dwellers [14]. Rural farmers often aim at maximizing immediate returns from the land regardless of erosion. It has been noted that yields of crops are higher on crop farms with conservation practices than farms without conservation practices in the same ecological zone [15-17]. Aromolaran [18] observed that land owners received the benefit of soil conservation in the long term. Among the benefits are prevention of soil erosion and increasing crop yield through soil fertility improvement. The author further stated that maintenance of soil productivity in the long run is a proper social goal of conservation, but it is only a minor economic factor influencing small scale farms. It has been noticed that there is a paucity of information regarding soil conservation practices among small scale farmers in the study area.

Therefore, this paper is aimed at examining farmers' awareness, preference and adoption of soil conservation practices in Zing Local government Area of Taraba State. This is important owing to the fact that farming is the major occupation of the inhabitants and high incidences of soil degradation especially erosion is recorded there.

2. METHODOLOGY

2.1 Study Area

The study was conducted in Zing Local Government Area of Taraba State, Nigeria. Zing lies between latitude 8° 45' and 9°10'N and longitudes 11°35' and 11°50'E. It has a total land area of 867 km^2 and a population of 127, 362 inhabitants with an annual growth rate of 3.0% [19]. The study area consists of six districts with 75 major villages; each village having approximately farm families ranging from 255 – 783 [20]. The climate of the study area is typically a tropical climate marked by dry and rainy seasons. The mean annual rainfall ranges from 819 to 1761 mm spreading over seven months (April to October). The study area is within the Savannah grassland belt particularly in the Guinea Savannah sub-region characterised by scattered deciduous tall trees with broad leaves and tall grasses. The major soil types are the hydromorphic and ferruginous tropical soils. The soil type is a mixture of loams and sands, and on the hilly terrain, deep loamy soils are found in between rocks. On the relief configuration, the study area can be categorised into two zones, highland mountain range and lowlands. The highlands occupy the southern region stretching from west to south in chains of mountain with elevation ranging from an average of 1, 800 – 2, 400 metres high forming the Atlantica, Shebshi and Adamawa massifs ranges. The lowland which occupies about 60% of the region hosts most of the settlements in the region. Major food crops cultivated in the area include yam, sorghum, Bambara nut, groundnut, millet, maize and rice.

2.2 Sampling Technique and Data Collection

A multistage purposive random sampling technique was used in selecting the respondents used for the study. Ten communities making up the ten wards of the Local Government area were considered for the study due to the concentration of farmers producing food crops in these communities. The selected communities were Zing A1, Zing A2, Zing B, Monkin A, Monkin B, Lamma, Bubbong, Bitako, Yakoko and Dingding. These communities were spread across the six districts which were used as clusters for sample collection. From these clusters a simple random sampling technique was then applied, in selecting the villages and subsequently in picking the individual food crop farmers. In selecting sample size, 30% of the villages in each district of the ten wards in the local government area were purposively selected, bringing a total of 10 villages selected out of the seventy-five. From the villages a total of 200 farmers were randomly selected for the purpose of questionnaire administration. The proportion of these respondents in each sample village was obtained using the [21] proportional allocation technique formula, thus:

$$\mathbf{nh} = \frac{Nh\ x\ n}{N}$$

Where:-

nh= the number of the individual sample villages
Nh = the number of farmers in the individual villages

n = the number of questionnaires distributed among the sampled villages
N = the total number of farmers in the sample villages

Data used for this study were generated from both primary and secondary sources. The primary data was sourced through the use of a structured questionnaire administered to the farmers during the 2013/2014 farming season, while the secondary data were collected from TADP and other literature sources.

2.3 Data Analyses

The data collected were analysed using preference ranking technique:

$$\text{Index} = \frac{\Sigma XiWi}{N}$$

Where, Xi = individual levels, Wi = respective weight assigned to each response starting with preferred = 0.5; more preferred = 0.75 and most preferred = 1; and N = total number of respondent in each group. Descriptive statistics using frequency converted to percentages was also employed in analysing the data obtained.

3. RESULTS AND DISCUSSION

Farmers' awareness and practices of soil conservation practices were identified and each of these practices were analysed and presented in Table 1. Most of the farmers (80%) were currently engaged in the practice of manure/plant residue application which involves leaving plant residues on the furrows to rot and add to soil nutrient. The farmers who were aware of the practice but never practiced it amounted to 10% while 4% were not aware and 6% had practiced but given up. All the farmers in the area were currently engaged in mixed farming and mixed cropping. This agrees with [22] who reported that mixed farming and mixed cropping had been traditionally practiced and were still very common in Nigeria. Iheke and Onyenorah [5] also reported mixed cropping as the preferred practice in Ohafia, Nigeria. Majority of the farmers (80%) in the study area were currently engaged in using fertilizer. Fertilizers were applied on farm purposely for direct supply of plant nutrients, especially on depleted soils. About 10% of the farmers had given up on the practice probably due to non-accessibility and high cost.

Majority (80%) of the farmers in the study area were very much aware of the practices of crop rotation, bush fallowing and shifting cultivation. Currently, 80% of the farmers were engaged in crop rotation and shifting cultivation and 70% in bush fallowing. They were aware that soil nutrients rejuvenate after the soil lay fallow for some time. Similar assertion was made by [23]. Akinnagbe and Umukoro [24] also reported that most farmers perceived non adoption of adequate conservation practices as one of the major causes of soil degradation.

Farmer's preference for a particular soil conservation method is presented in Table 2. The most preferred practices by majority of the farmers were mixed cropping (90%), followed closely by mixed farming (84%) and manure/plant residue which had 80% preference and crop rotation (76%). Using ranking index mixed cropping was ranked first with ranking index of 0.98, followed by mixed farming (0.95) and then crop rotation (0.94). Although, manure/plant residue having 80% preference was ranked fourth, next to crop rotation with 76% preference. Use of cover crop, use of fertilizer and bush fallowing with 70% preference each were at par and ranked fifth, while shifting cultivation with 60% preference and ranked sixth were also most preferred soil conservation practices. The least ranked preference was terracing with ranking index of 0.66. Unlike the result obtained by [5] who ranked manure and plant residue as the first, this study observed mixed cropping as the first in ranking.

The results for the reasons for choosing particular soil conservation practices by farmers were presented in Table 3. Multiple responses were recorded. All the farmers chose immediate monetary gain as the main reason for engaging/ adopting soil conservation measures. In addition, 96% stated to increase yield as the reason why they adopted certain soil conservation measures. Furthermore, 78%, 76%, 66%, 58% and 40% indicated improving soil fertility, preventing erosion, reducing heat stress, and ensuring long term sustainability of land and advice of extension agent, respectively as the main reasons for adopting certain soil conservation measures. Finally, 48% indicated that they were just doing what other farmers were doing. The choice of a particular soil conservation practice(s) depend on the farmer's socio-economic status. Owombo and Idumah [25] reported that there certain factors–social and institutional factors that affect the likelihood that farmers will adopt a technology. Therefore, the authors concluded that adoption of a particular practice depends on the socio-economic status of the respondents.

Table 1. Awareness and practice of soil conservation practices

Soil conservation practices	Awareness Status							
	Aware but never practiced		Not aware		Currently engaged		Practiced but given up	
	Freq	%	Freq	%	Freq	%	Freq	%
Manure/plant residues	20	10	8	4	160	80	12	6
Use of cover crops	16	8	4	2	140	70	40	20
Mulching	32	16	20	10	120	60	28	14
Use of fertilizer	8	4	0	-	172	86	20	10
Crop rotation	20	10	0	-	160	80	20	10
Bush fallowing	0	-	0	-	140	70	60	30
Shifting cultivation	0	-	0	-	160	80	40	20
Minimum tillage	80	40	48	24	72	36	0	-
Zero tillage	140	70	0	-	60	30	0	-
Mixed farming	0	-	0	-	200	100	0	-
Mixed cropping	0	-	0	-	200	100	0	-
Strip cropping	60	30	80	40	60	30	0	-
Terracing	40	20	140	70	20	10	0	-
Agro-forestry	120	70	8	4	60	20	12	6

Source: Field survey (2014).

Table 2. Farmers' preference of soil conservation practices

Soil conservation practices	Preferences						Ranking index	Rank
	Most preferred		More preferred		Preferred			
	Freq.	%	Freq.	%	Freq.	%		
Manure/plant residue	160	80	24	12	16	8	0.930	4
Use of cover crops	140	70	40	20	20	10	0.900	5
Use of Fertilizer	140	70	40	20	20	10	0.900	5
Mulching	136	68	44	22	20	10	0.895	8
Crop rotation	152	76	48	24	0	-	0.940	3
Bush fallowing	140	70	40	20	20	10	0.900	5
Shifting cultivation	120	60	60	30	20	10	0.875	9
Minimum tillage	40	20	120	60	40	20	0.750	11
Zero tillage	40	20	60	30	100	50	0.675	13
Mixed farming	168	84	24	12	8	4	0.950	2
Mixed cropping	180	90	20	10	0	-	0.975	1
Strip cropping	0	-	160	80	40	20	0.700	12
Terracing	8	4	112	56	80	40	0.660	14
Agro-forestry	100	50	40	20	60	30	0.800	10

Source: Field survey (2014).

Table 3. Reasons for choosing particular soil conservation practice

Reason for adopting soil conservation practices	Frequency	*Percentage
To increase yield	192	96
To improve soil fertility	156	78
To prevent erosion	152	76
To ensure long-term sustainability and productivity of land	116	58
To prevent or reduce heat stress	132	66
To ensure immediate monetary gain	200	100
Advised by extension agent	80	40
Just doing what others are doing	96	48

** = Multiple responses*
Source: Field survey (2014)

4. CONCLUSION

Soil degradation is one of the factors militating against crop yield by depleting soil nutrients in the top soil. This study examined the awareness, preference and adoption of soil conservation practices among arable crop farmers. Results from the study had shown that farmers in the study area were aware of many soil conservation practices and many of them were currently engaged in them. The most preferred practice was mixed cropping and was ranked first among the various practices. Farmers practice soil conservation probably due to the numerous advantages of soil conservation practices to the farmer. Government through its relevant agencies and organizations should therefore put in place policy framework that would educate the farmers through regular extension contact on the appropriate method of the practices.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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