



The Challenges Emanating from Soil Utilization Practices and the Levels of Conservation Education and Awareness Among Rural Farmers in Nigeria.

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Abstract

Sustainable Development is the utilization of resources to ensure the creation of materials and/or facilities/ devices that improve the well-being of man and his habitat in such a way and manner that the resources continue to be available for exploitation over a long period of time. However, many interacting factors of both nature and human activities continue to constitute great obstacles in the realization of the goal. This paper is aimed at adding to the awareness campaign in the aspects of soil utilization practices and the level of conservation awareness amongst our rural farmers who are responsible for over 70 % of local arable field crops produce. This work is an original scholarly research/ inquiry based on review of related pedagogic and didactic materials as well as observations in visits to farming communities. The results reveal soil degrading practices and low level of conservation awareness resulting from poor education (literally and practically) by government and /or private agencies occupied with sustainable development drive. The paper ends with useful suggestions that can impact positively on the awareness level and better practices by the rural farmers.

Key words: utilization, creation, habitat, conservation, resource, obstacles.

Introduction

Sustainable Development is the utilization of resources to ensure the creation of materials and/or facilities/devices that are gradually more advanced with the objective of improving the well-being of man and his habitant/living environmental conditions in such a way and manner that the resources continue to be available for exploitation and advancement over a long period of time. Development means the gradual growth of something so that it becomes more advanced, stronger, etc. (Oxford Dictionary).

Land is one of the principal factors of production and upon it man depends for great proportion of his needs for housing, food and water supply, materials for industries, minerals and energy resources amongst many others. And soil is the topmost layer of land. The thickness of this layer of soil depends on so many factors and therefore varies globally and

within national territory, that is, from place to place according to natural and human factors. These factors are soil formation factors and the factors/conditions the formed soil is subjected to and which can promote its development or degeneration or stagnation and deterioration. For the rural farmers in Nigeria, soil means so much to them for their agricultural production and the construction of their houses, store houses and shelters for their domestic animals.

Soil utilization practices in arable crops production are mode of bush clearing (which may involve soil disturbance), tillage practices, application of fertilizers to enhance soil fertility, application of herbicides to curb weeds, management of post-harvest field (exposed soil) and harvest remains, method of irrigation and sources of irrigation water, selection of types of crop and sequence of cultivation, shifting cultivation and bush fallowing, land ownership system and its effect on erosion control and proper land/soil development, etc.

The major challenges to the attainment of sustainable development goals is the exploitation of soil (land) for agricultural production, especially, arable crop production, and the management of wastes generated in farming/rural communities. The soil is very precious to the rural farmers even though they are unable to understand how tied they are to the soils and also unable to appreciate the need for its sustainable development by adopting good and proper (corresponding) conservation practices, which should include the stoppage of piece-meal land holding. We know that this small holdings results from excessive fragmentation on the basis of inheritance cultural practices which have taken place over the years and which have the tendency to continue as family trees grow bigger and bigger.

Reasonable level of western education and knowledge of the “modus operandi” of modern agricultural inputs management nitty-gritty together with the exigencies and climate change social and technical dynamics are lacking in the rural farming communities. The ill-deployment and poor commitment of agricultural extension agents under the Agricultural Development Programme (ADP) have not helped matters. All these forestated challenges confronting the rural farmers could have been reasonably mitigated if the level of education on conservation and the level of conservation awareness were conscientiously promoted and created respectively among rural farmers in an efficient Nigerian socio-economic development consciousness rather than the over-whelming greed and self-centeredness government agents are presently employing to pursue programmes that ought to be very well-meaning to the populace. We have witnessed agricultural extension agents applying for local farmers acidic reaction fertilizer like urea on acidic very sandy-loam soils which further increases the acidity of the soil in maize farms because of the limitation of the brand of industrial fertilizer available and the inadequate knowledge of the agents. There is widespread continuous burning of the field in the dry seasons, especially in areas where the local populace hunt for bush rats and rabbits and thus leaving the soil exposed to the intense heat and high temperature of the dry season resulting in rapid degradation of the soil. There is rampant and/or widespread poor tillages that continues to turn over only the top 5cm depth of the soil year after year. We have seen silty pond water being used year after year for local dry season irrigation farming of vegetables and which over time have led to the silting of the soil pores and consequently flooding and surface run-off causing erosion instead of infiltration of

water. We have also observed polythene materials being indiscriminately dumped around rural settlements and blown by winds all over with the possibility of being buried inside the soil over time leading to soil deterioration since they are not easily degraded while negatively affecting the drainage capacity of the soil.



Plate 1. Land clearing by burning to hunt for bush rats and rabbit and left bare throughout the dry season. Most especially in the Middle Belt zone of Nigeria.



Plate 2. Poor disposal of wasted polythene material littering the surface and which would damage soil on incorporation.



Plate 3. Mixed cropping on poor soil tillage practice and polythene materials blown into the farm by wind.

Great majority (almost 100 %) of the agricultural extension agents sent to assist rural farmers are secondary school leavers and majority of which did not even obtained the mandatory five (5) credit pass in their final examination and as such are not knowledgeable enough for adequate soil management skill despite the trainings being given to them from time to time which centres mostly on the lighter principles of crop and livestock management.

According to Hugh (2009), “there is great need for more real soil conservation teaching in our school from lower grades of both public and private schools on up through the colleges and universities “Demand for pertinent information in the form of suitable teaching materials have mounted correspondingly. Farmers’ bulletins, technical bulletins and non-technical publications, motion pictures, photographs, exhibits, the agricultural press, radio, and television have been widely utilized to present facts and provide the latest information on sound conservation farming. Economic stability develops from good soil used intelligently and protected from erosion and unnecessary wastage of rainfall by excessive runoff. Basically, the economic stability of both city and rural populations depends on how farmers use and care for their land”.

Ross, W.A in the editor’s forward of Hugh, 2009, stated that “few are able to visualize the benefits which would accrue if all America’s soil could be adequately protected by sound soil conservation measures. The successful combination of human and basic land resources determines progress. **Economic stability and the wise use of soils are inseparable and soil lost cannot be restored.**

Hugh (2009) stated further that we cannot restore the soil after it is lost but can hold and improve what is left. According to him, top soil scattered over the bottom of the ocean cannot be returned to the fields and pastures from whence it came by any practical operation available to man. The implication of this is that, we must learn to hold, keep or guarantee the safety of the soil while it is still with us or within our reach. Thus, soil is an irreplaceable resource (Hugh, 2009).

According to Chude (2011) most countries worldwide are facing different magnitudes of food crises largely due to conflict and natural disasters, including droughts and flood linked to climate change. He stated further that the intergovernmental panel on climate change (IPCC) predicted that in the next decades, billions of people, particularly those in the developing countries (including Nigeria) will experience dramatic changes in rainfall patterns that will contribute to severe water shortages or flooding, and rising temperatures that **will cause shifts in crop growing seasons**. Changes in mean rainfall and temperature as well as the increase in extreme events will affect crops and livestock farming, forestry as well as fisheries. Many impacts, such as increased land degradation and soil erosion, change in water availability; biodiversity loss, etc will need serious attention.

According to Stephen (2011), the threats to the sustainable use of soil that led to the formation of European Soil Protection Strategy are soil sealing (land taken through urbanization, industrialization and transport), Erosion, Decline in Organic Matter, Contamination, Loss of Biodiversity, Compaction, Salinisation, Flooding and Landslides. He

said “these threats arise because we expect the soil to perform a range of functions each of which is important for human wellbeing and the environment:-

1. Production of biomass through agriculture and forestry;
2. Protection of the ground water and the food chain against contamination, and maintaining biodiversity by filtering, buffering and transportation activities;
3. Preservation of the gene reserve, which is by far the largest of the globe, and 3 - 4 times larger within the soil than that above ground, thus providing a very significant habitat;
4. Provision of the physical basis for infrastructural development such as housing, industrial production, transport, dumping of refuse, sports, recreation and others;
5. Serve as a source of raw materials, furnishing gravel, sand, clay and other materials for infrastructural development for example;
6. Preservation of the geogenic and cultural heritage by concealing and protecting archaeological and paleontological remains”.

Generally, any soil is at its best when it is still in its natural state under the protective cover of natural vegetation which is lost the moment man begins to make use of the land on clearing the vegetation. In this situation, the soil is exposed to the danger of deterioration, desiccation and accelerated erosion. (Areola *et al.*, 2006)

According to Ojeniyi (2014), Research has shown that land clearing and tillage are indispensable in crop production while experiences indicated that tillage enhances oxidation of organic matter and release of nutrients whereas it degrades soil quality in the long run if not well managed. The use of destructive land clearance and tillage practices should be discouraged because they easily dispose the soil to erosion by water or wind. One of such is the scraping of large quantities of top soil and heaping them together in dome-shapes as mounds; a practice that exposes the land to erosion and eventually leads to loss of the humid top soils which can in turn lead to ultimate destruction of soil structure and productive capacity of the land.

“Eco-Physical Perturbation associated with land preparation in most of the maize-cassava production area, when not properly handled, often leads to irreversible environmental degradation with attendant low crop yield. **Consequently, appropriate land and soil management practices are not only critical in optimizing soil productivity but also a prerequisite for sustainable land use.** In south eastern Nigeria and other parts of the humid tropics, the most predominant soil management practices include fallowing and tillage. Soil fertility regeneration under the traditional farming system relies on the length of fallow period and type of vegetation. However, with increasing population fallow period have become drastically reduced to the point that it can no longer keep the soil fertile” stated Omenihu, *et al.*, (2014).

Table 1. Major Crops Grown in Nigeria by Region.

Crop category	Southern zone	Middle belt zone	Northern zone
Cash crops	Cocoa	Beniseed	-
	Rubber	Rubber	-
	Oil palm	Oil palm	-
Food Crops	Yam	Pigeon pea	Yam
	Cassava	Sweet potatoes	Cassava
	Maize	Cocoyam	Maize
	Rice	Plantain	Rice
	Cocoyam	Sorghum	Millet
	Plantain	Cowpeas	Soya beans
	Sweet potatoes	-	Pigeon pea
			Potatoes

Source: Asadu, 2012

“Smallholder farmers who use simple production tools, simple techniques and bush-fallow cultivation contribute two-thirds of farm production” in Nigeria (Asadu *et al.*, 2012). Above, the middle belt and the northern Nigeria which experiences a dry season of five to seven months (during which less than 25 mm of rainfalls) lies mostly in the Sudan Savanna and the semi-arid Sahel zone. The staples in these areas are millet, cowpeas and drought-resistant variety of sorghum, and maize (which is cultivated in wetter area). The principal commercial crops are cotton and groundnut. Early dry season irrigated crops like onions, tomatoes and other vegetables are also cultivated.

Materials and Methods

Study Area

Nigeria is a country lying between Longitude 3° and 15° East of the Greenwich Meridian and Latitude 4° and 14° North of the Equator. Thus, it is within the tropics with tropical climate, vegetation and soil. The soil range from poorly weathered thin layered and semi-arid brown type in the northern part, deep highly weathered and leached sandy/lateritic type in the mid-south (including the south-eastern parts) and alluvial type in the coastal areas. The climate is characterized by progressive drier conditions from the south towards the north. The rainfall, constituting the key climatic variable, creates alternating wet and dry seasons. In most areas, the peak of the rainy season occurs through most of the northern parts in August, when the south west monsoon wind from the Atlantic Ocean covers the entire country (Asadu *et al.*, 2012; Iloeje, 2003).

Certain working tools and agricultural practices are closely tied to the ethnicity and locations of the rural farmers. And these working tools and practices are capable of having influence on the soil, especially the tillage tools/implements

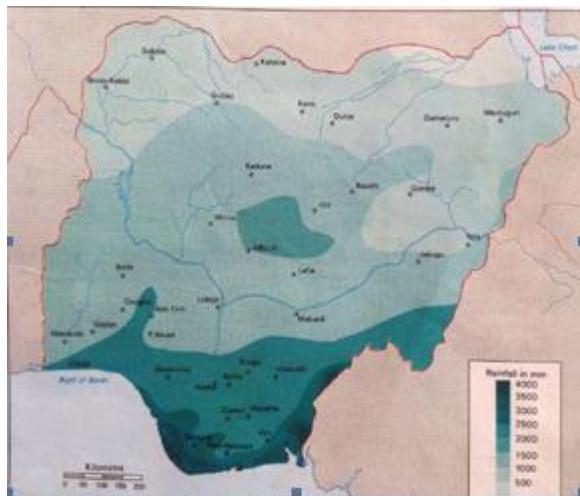


Figure 1. Map of Nigeria Geology
Source: Senior Secondary Atlas, 2004

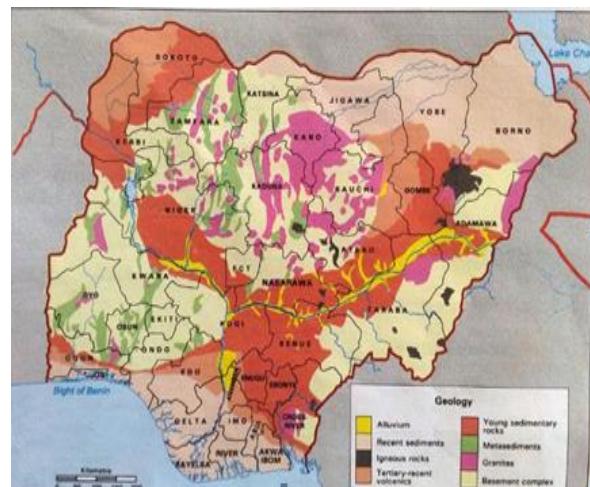


Figure 2. Mean Annual Rainfall Map of Nigeria
Source: Senior Secondary Atlas, 2004



Figure 3. Map of Nigeria Soils
Source: Senior Secondary Atlas, 2004

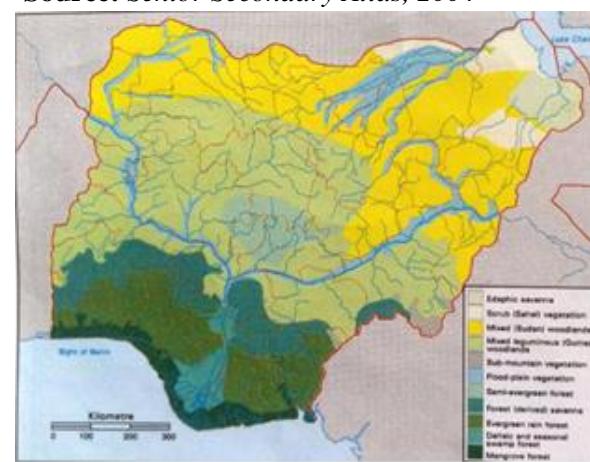


Figure 4. Vegetation Map of Nigeria
Source: Senior Secondary Atlas, 2004



Figure 5. Map of Nigeria 2004 political/
Administrative
Sources: Senior Secondary Atlas, 2004



Figure 6. Map of Nigeria Showing the Major
Ethnic Group
Sources: Senior Secondary Atlas, 2004



Figure 7. Food Crops Map of Nigeria
Source: Senior Secondary Atlas, 2004



Figure 8. Map of Nigeria; Livestock
Source: Senior Secondary Atlas, 2004

Method

The scholarly inquiry is based firstly, on review of related literatures and secondly on personal visitations to and the observations in several rural farming communities in Nigeria. These include Mayo-Belwa and Ngurore in Adamawa State; Dikwa and Gumsuri in Borno State; Irokhin and Ekiadolor in Edo State; Pindiga and Duku in Gombe State; Akokwa and Ohaji-Egbema in Imo State; Kachia and Kwello in Kaduna State; Gwamba and Bagizza in Kebbi State; Oja-odan and Meko in Ogun State; Ilia and Ifetedo in Osun State; Gwande and Yerimawa in Sokoto and Rafinkada and Garin Dogo in Taraba State. The choice of locations and states was influenced by accessibility, the rural nature with farming activities and need for spread with the study area. All three authors were involved in area closest to their homes.

The basic arable and plantation crops husbandry practices and materials of rural houses are similar in all locations. These visits were over a reasonable period of time and for purposes that were not originally for this present work. All sections of the country have large rural farming communities with over 70% of food locally produced coming from the rural farmer

Results and Discussion

The observations were based on the negativity of the equipment and materials implored in the basic practices associated with soil utilization and on whether the farmers were actually aware of what they ought to do and what they ought not to do against the backdrop of their level of education and access to educating materials and agents/agencies (whether governmental or non-governmental). The practices included land tenure system, bush clearing, farming system, tillage and seedbed preparation, application (type, mode and time) of chemicals (herbicides, fungicides/pesticides and fertilizers, etc), harvesting and collection of main produce, post-harvest soil management, housing materials, (types and sourcing), erosion (water and wind), land/soil sealing (limit in the size of land/soil available for farming) and soil conservation practices if any.

The major observations are:

1. Application of chemicals (inorganic fertilizers, herbicides, fungicide/pesticides) without regard to the compatibility between soil solution reaction (pH) and the active ingredient in the chemicals. Thus, there is no matching of chemicals with the type/nature of soil once they are effective against the target and tolerated by the crops.
2. Every rural farmer in Nigeria scraping top soil for building of houses and other forms, and the use of tall strong grasses for roofing as well as construction of mat for compound fencing is common in the northern part (Plates 6, 7 and 8).
3. Clearing of land is mainly by trees felling, shrubs and grasses (if fresh) by slashing with matchets, allowing to dry up and setting of fire (burning process) (Plate 1).
4. Regular fragmentation of land in the course of sharing the properties of dead adult male amongst the children leading to increase in the piece-meal land-holdings. In some case farmers hold small pieces of land of less than one (1) acre (0.4 hectares) scattered in so many locations far from each other.
5. Mixed cropping is most common in the southern part and inter-cropping of new crop towards the harvesting of previous is common in the northern and middle belt parts of the country (Plate 3).
6. Severe gully erosion features wiping out rural farming communities in Garin-Dogo (Taraba State), Auchi axis in Edo State and several location in the souther eastern while sheet erosions are rampant and prominent in the southern state (Plate 4 and 5).
7. Regular re-heaping of the very friable/loose sandy or powdery and structure less top soil to make heaps, ridges and beds for planting is common using big head local hoes and in few communities there is use of ill-prepared tractor-disc plough and tractor-disc harrow aggregates that scrap only the surface with poor turning of scraped soils that leaves the grasses and remains not buried and top soil pulverized instead of being buried. These occur mostly in the central and northern part since tractors aggregate tillage is hardly employed by rural farmers in the wetter southern part, where the use of small head long handle West African and West Indian hoes rampant (Plates 3, 11 – 15).
8. No properly planned crop rotation in space and time (moving crops around in certain number of plots/farmland from one cropping season year to another). It is either mono-continuous cropping which is common in the central and northern parts or shifting cultivation plus bush fallowing which is common all over the country. Unfortunately the length of fallow has dropped to only 2-3 years (cropping seasons) due to insufficient availability of land caused by increases in population and decline in land for farming
9. Poor disposal of wastes from houses or homes and livestock rearing units. These waste could have been useful in compost manure making that could have aided soil fertility boosting (Plate 2, 6 and 10).

- 10.** Poor and low level of tillage incorporation of crops post-harvest remains and grasses remains into the soil.
- 11.** Application of phosphorous and potassium fertilizers in the form of NPK at the wrong time and use of wrong method as well as wrong depth.
- 12.** No mulching of the exposed surface in row crops to avoid excessive evaporation in the northern part and to promote percolation and avoid run off and quick flooding in the wetter southern part. All over the country the soil are left bared (exposed) during the dry season which of course is longer in the northern part with more intense sunshine (Plate 1).
- 13.** Selling of soil made bricks which promotes soil lost (Plate 7). If about two-thirds of farm production is held by the local/rural farmers, one cannot overestimate the magnitude of the worrisome soil utilization practices and the bleak the future seems to hold in view of the rapidity with which land available for agriculture is decreasing.
- 14.** Poor levels of education and conversation awareness in rural areas, as shown by the table 2 below:-

Table 2. *Level of Literary Education of the Local Rural Farmers in Percentage (%) among 10 (ten) farmers interviewed*

S/No	Location(s) Visited represented by State	Non- Primary		Primary		Secondary		Ordinary diploma equivalent		Degree	
		1	2	3	4	5	6	7	No.	%	No.
		No.	%	No.	%	No.	%	No.	%	No.	%
1	Adamawa	5	50	2	20	1	10	1	10	1	10
2	Borno	8	80	1	10	1	10	0	0	0	0
3	Edo	2	20	3	30	2	20	1	10	2	20
4	Gombe	5	50	2	20	2	20	1	10	0	0
5	Kaduna	5	50	3	30	1	10	1	10	0	0
6	Kebbi	8	80	1	10	1	10	0	0	0	0
7	Ogun	3	30	3	30	2	20	2	20	0	0
8	Osun	3	30	3	30	3	30	1	10	0	0
9	Sokoto	8	80	1	10	1	10	0	0	0	0
10	Taraba	3	30	3	30	2	20	1	10	1	10
Average % (all states)		5.0	50	2.2	22	1.6	16	0.8	80	0.4	40

Table 3. Level of Conservation and Sustainable Development Goals Awareness, in Percentage (%) among 10 (ten) farmers interviewed outside of routine shifting cultivation Practice

S/No	State Visited	0 – 5 %		6 – 10 %		21 – 40 %		41 – 70 %		71 – 100 %	
1	2	3	4	5	6	7	8	9	10		
		No.	%	No.	%	No.	%	No.	%	No.	%
1	Adamawa	9	90	1	10	-	-	-	-	-	-
2	Borno	9	90	1	10	-	-	-	-	-	-
3	Edo	9	90	1	10	-	-	-	-	-	-
4	Gombe	9	90	1	10	-	-	-	-	-	-
5	Kaduna	9	90	1	10	-	-	-	-	-	-
6	Kebbi	9	90	1	10	-	-	-	-	-	-
7	Ogun	9	90	1	10	-	-	-	-	-	-
8	Osun	8	80	2	20	-	-	-	-	-	-
9	Sokoto	9	90	1	10	-	-	-	-	-	-
10	Taraba	9	90	1	10	-	-	-	-	-	-
Average % (all states)		8.9	89	1.1	11	-	-	-	-	-	-

Table 4. Level of Access to regular educating information in easy to follow medium and easy to understand language among 10 (ten) farmers interviewed

S/No	State Visited	Radio	Television	Agric. Ext. Agent	Agric. Shows + Motion Pictures	Newspaper Write-up	Agric. Bulletins
1	2	3	4	5	6	7	8
		No.	%	No.	%	No.	%
1	Adamawa	8	80	0	0	2	20
2	Borno	8	80	0	0	2	20
3	Edo	5	50	3	30	2	20
4	Gombe	7	70	0	0	3	30
5	Kaduna	7	70	1	10	2	20
6	Kebbi	6	60	2	20	2	20
7	Ogun	7	70	1	10	2	20
8	Osun	7	70	1	10	2	20
9	Sokoto	7	70	0	0	3	30
10	Taraba	5	50	1	10	4	40
Average % (all states)		7.1	71	0.9	90	2.4	24



Plate 4 and 5. Gully Erosion Devastating Community and destroying the Land

Sources: Personal Field Work, 2015



Plate 6. Houses built from top soil and roof from grasses that could have been used for manure and mulching and soil littered with waste polythene materials



Plate 7. Bad tillage of top soil to mould block for housing



Plate 8. Part of Old Kano showing houses build with top soil



Plate 9. Soil left bare after Scraping the top soil



Plates 10. Poor disposal of wasted polythene material littering the surface and which would damage soil on incorporation

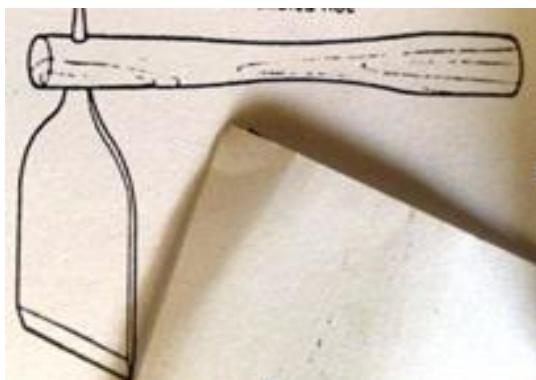
Plates 11 – 15. Some common tillage tools/implement which do not promote proper soil tillage



11. Big head hoe which can not promote realization of modern tillage requirement



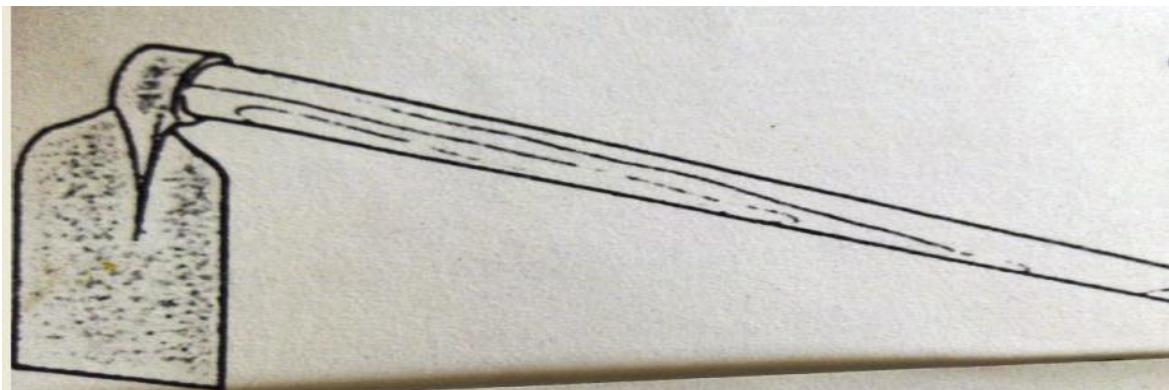
12. Disc Harrow with improper adjustments of working organs and depth



15. Short handle hoe



14. Disc plough with improper adjustments of working organs and depth.



15. West African hoe which cannot promote realization of modern tillage requirement

The results (shown in words and photos) have pointed out clearly the unwholesome soil utilization practices among rural farmers. It is up to the government and its agencies charged with the responsibilities of agricultural and rural development and sustainable development goals to conscientiously start working for the purpose of socio-economic advancement of the Nigerian State.

Further attention must be drawn to the fact that the moment the natural vegetation covering the soil is cleared and man begins to use the land, it is exposed to three types of danger namely **Deterioration, Desiccation and Erosion**.

The deterioration involves loss of soil fertility (marked by fall in humus and nutrients content coupled with breakdown of soil structure). A deteriorated soil will exhibit a fall in crop yields and nutritional quality; increase growth of weeds if used as farmland; decreases resistance to erosion, and reduction in the ability of crops cultivated on it to resist pests and diseases.

Desiccation is the progressive drying out and hardening of soil body due to prolonged exposure to high temperature (intense insolation). The evidence of this process in soil, is the occurrence in the soil profile of iron stone gravel; laterite crusts and clay pans. The surface can become so hard that little water can infiltrate into it. This situation generates excessive water run off thus causing serious erosion. This is common in sudan and sahel savanna where overgazing and annual bush burning expose the land to intense isolation. Research has shown that the preventive measures include provision of adequate water through irrigation, adequate cover for the soil on farmlands; planting of cover crops; controlled grazing of the land and control of bush burning.

The manner of soil utilization can promote erosion by water or wind. The erosion by water can be **Splash** (break up of soil aggregates by the impact of rain drop such that the soil particle fly out in all directions); **Sheet** (removal of soil in thin layer by runoff water over broad gently sloping surface) and **Gully** (which creates deep gorges or valleys which divide land surface and hinder movement and the cultivation of land). The sheet erosion, is the most widespread of the water erosion and it affects the humus, clay and nutrients which are found in the top soil.

So, much soil for agriculture is lost when farmers scrap top soil for construction of houses for themselves and domestic animals and storage facilities. The wrong applications of chemicals have led to soil pollution, soil underground water pollution and have also affected soil solution reaction (pH). How do we apply urea to an acidic/slightly acidic reaction sandy-loam soil? It will only make the soil more acidic which might become toxic to crops with less tolerance of such soils.

The non-corresponding tillage practices and piece-meal ownership of land by individuals do not make it easy to design and manage comprehensive erosion control or drainage measures in most of the rural farming communities. There is need for more aggressive soil conservation education and awareness creation among rural farmers in Nigeria.

Conclusion

It is obvious from the fore stated that the mode of utilization of soil by rural farmers in Nigeria substantially negates the dictates of sustainable development. And unless something is done urgently the worrisome situation will continue to worsen with severe impact on food and raw materials supply and eventually the socio-economic stability of the country. The challenges are still surmountable at the level they are now and the challenge is on all of us.

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