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AN APPRAISAL OF THE CAPACITY OF NIGERIAN SOILS TO SUSTAIN FOOD SELF SUFFICIENCY

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ABSTRACT

Food production depends, to a great extent, on soil resources. Previous efforts towards self sufficiency in food production in Nigeria failed partly due to either a misconception of the quality of our soils or an underestimation of the role of soil in successful agricultural production or both. This paper highlights the importance of a proper understanding of the kinds of soils and their capacity for agricultural production in any strategy for self sufficiency in food production. Illustrating with some examples it shows the marginal capacity of Nigerian soils, their susceptibility to degradation and hence the need for careful management for continuous crop production. Among the strategies suggested is the need for detailed information on our soils and their suitability for various crops to be made easily available to farmers and other land users. A critical analysis of our crop production system vis-a-vis the capacity of our soils is also necessary to decide which crops to produce within the country and which are better imported. The enforcement of strict regulation against misuse of land through annual bush burning and indiscriminate quarrying and deforestation is also advocated. For successful implementation it is important that a committee of few serious-minded, honest and committed experts be set up to plan, monitor and report the progress being made.

INTRODUCTION

Self-sufficiency in food production in Nigeria today probably means producing enough food (cereals, tubers, pulses and nuts, vegetable oils, fruits and sugars and animal products) to feed 85 - 100 million people. With the present environmental, social, political and technological conditions this is an enormous task. It has been observed that the biggest challenge facing agricultural scientists working in the humid and subhumid tropics is the development of sustainable, viable and environmentally sound food production system for the uplands (Kang, 1987).

The acceptable know-how needed to achieve this is still lacking and the generation of alternative technologies is only emerging slowly.

This contribution concerns the soil aspect of the problem. The soil factors affecting food production are both human and technical. This paper concentrates on the technical aspect.

However it must be emphasized that unless the human aspect is well resolved all efforts on the technical solution will fail. No Matter the excellence of a technical innovation it cannot work if policy makers do not consider it of priority, infact it may not surface at all in the government plans.

The soil is an important factor in food production. Hartmans (1984) considers that the central problem of tropical agriculture is the inability of the land to sustain annual food crop for more than a few years. The soil acts as support and medium/source of nutrition for both plant and animal life. Its neglect will eventually lead to food crisis. All measures to increase food supply such as mechanization, improved crop varieties, disease and pest control, better marketing system cannot be successful unless the soil is in a suitable condition to support crop growth and development.

The failure of previous efforts to achieve self sufficiency in food production may be partly due to this. From the National Accelerated Food Production Programmes (NAFPP) of 1972 through the Operation Feed the Nation (OFN) of 1976 to the Green Revolution Programme of 1980 there is consistently a very minor consideration given to the role of soils in crop production. Although Aribisala (1983) recognised soil constraints of erosion, maintenance of soil fertility, lack of data on soil test and soil maps, the only noticeable action taken on soil in all these programmes was the supply of fertilizers at subsidized prices. But this may even be more harmful to crop production in the absence of relevant information. The emphasis of increasing the land area under cultivation was also glaring in all these grogrammes. This too may not be wholly desirable. Rather a combination of this approach with more of the efforts expended on increasing yield per unit area of land could be a better approach.

The optimum requirements for growth and development vary from one crop to another. Thus while virtually any piece of land can be used for most non-agricultural (urban, industrial) projects, crop production is highly discriminatory. Therefore a good knowledge of the soil resources of a country is paramount to the success of any programme for self sufficiency in food production. This paper therefore aims to emphasize the importance of adequate information on soil properties and land quality for a successful crop production programme. It also attempts to suggest factors considered noteworthy in such programmes.

Importance of Soil information

Soil information is vital to land use planning - the process of making recommendations regarding the allocation of land space for variety of human activities in a community - country, state or country. Experience from backyard gardening reveals that not all the spots within a few square metre plot are suitable for growing a given crop. The same is true of the land area of a state or a country.

In any community there is competition between agricultural and non-agricultural industries for land. This competition becomes more serious with increase in industrialization which comes with civilization. If such a situation persists, and it inevitably will, the risk of losing agricultural land to industrial use is very high unless adequate information on the quality of the land/soil is available. Even then the government must take steps in terms of strict legal measures to preserve such lands for agricultural use. At the moment there is no such information on the land area of this country or even for any state. The best that we know is that of the approximately 98.3 million hectares of land in the country about 60-70% are cultivable (Aribisala 1983, Oloruntoba, 1984). There is no information on where this is or its distribution in the country, the degree of suitability for cultivation and the limitations. Such information cannot be used as basis for land use planning even if policy makers agree to consider such an approach for allocating land to various uses.

It is therefore most probable that some excellent agricultural lands have been and are still being lost to the industrial sector. This situation must be arrested otherwise all the strategies for self sufficiency in food production will be a myth. The government therefore should set in motion projects to assemble information on the agricultural value of our soils.

Availability of soil information

Although a reasonable amount of data on soil types, their extent, main characteristics and suitability for agricultural production exist in Nigeria, these cannot be said to be available to prospective users as such. This is because they are mainly found with the institutions (Research Stations, Ministries of Agriculture etc) or individuals that conducted the studies from which the data were generated. For instance, information on the classification and characterization of the soils of Eastern Nigeria (Jungerius, 1964), that of Klinkenberg and Higgins (1986) for the Northern Nigeria and that by Smyth and Montgomery (1962) on the soils of Central Western Nigeria is mostly restricted to each of the regions concerned. Even within these regions the information contained is restricted to the use of Agricultural officers and researchers, with the poor farmer still following his "trial-by-error" system.

Another factor which makes soil information unavailable to farmers is the form in which it is presented. Soil survey reports usually contain a lot of soil science terminologies which make little or no meaning to a farmer and at times to an agriculturist who is not a soil scientist. This is why the land evaluation section of such reports is of much more interest to all farmers, as such sections often deal with the capability (e.g. kg of maize per ha) of the land area(s) on his farm for agricultural production rather than the taxonomic composition. Most of the existing information contain more of the latter than the former.

Until recently, there has been no information on a large proportion of the soil areas in Nigeria. In realization of the vital role of soil information to successful food production, the Federal Government established the Department of Agricultural Land Resource (FDALR) in 1980. One of the basic objectives for the establishment of this Department is to focus attention on the various soil problems which have made agricultural production in Nigeria a very difficult task. To achieve this goal, FDALR has undertaken soil survey, soil fertility and erosion control projects in various parts of the country. Part of this is the reconnaissance (1:250,000) soil survey which has just been completed. Even with this we may not be able to derive much benefit because there is no National Soil Classification system. Thus the mapping units of the soil Map of Nigeria are geological / geomorphological units rather than taxonomic units even if at the highest level of the Order in Soil Taxonomy.

Soil classification is the grouping of similar soils based on their profile characteristics. Information on soil classification is basic to land use decisions and helps in communication within and between communities. Fertilizer recommendations and soil management decisions are based on soil classes. Recently soil classification is being used as the basis of agrotechnology transfer (Silva, 1985). In the absence of a national soil classification system (analogous to a national language such as English) farming experiences cannot be easily transferred from one region (North, East or West) to another in the country because each of these operate different classification systems.

In the reconnaissance soil survey of the country, FDALR employed the international system (FAO, 1974) and Soil Taxonomy (Soil Survey Staff, 1975) using classes at higher categories which are only broadly defined. For effective use of soil classification for agrotechnology transfer, benchmark soil studies are essential, and these are based on soil series which is a low category level of classification with detailed definition. Differences between soil series reflect differences in response to use and management, hence they should also be the basis for soil testing/fertilizer studies and recommendation. As stated earlier, in Nigeria, soil classification (at the series level) in the Northern states (Klikenberg and Higgins, 1968) differs from that in the Eastern States (Jungerius, 1964) and this in turn differs from that in the Western States (Smyth and Montgomery, 1962; Mudorch *et al,* 1976). In such a situation, even when the soils in any areas of these regions are the same, the difference in classification may hamper a direct transfer of a newly developed agrotechnology. Besides it is an obstacle to national land use planning.

It is thus obvious that a national soil classification at the series level is needed as it serves as a sound basis for understanding and communicating information on soil characteristic including fertility and chemistry, physical conditions and soil water and conservation and potential for agricultural production. The information on soil fertility, fertilizer needs, type, rates, time and methods of application which had existed 3 to 4 decades ago would have found better use and greater impact on increased food production if there had been a national soil series classification system.

Information on the agricultural value of soils occupying the land area in Nigeria is more scarce than of soil classification. This may be because in ideal soil survey procedure soil classification precedes land evaluation. Land evaluation is the assessment of the suitability of a piece of land for alternative kinds of use such as agricultural, urban, recreational etc (FAO, 1976, Dent and Yang, 1981). It is the main process involved in land use planning. At the moment there is no national land evaluation system in Nigeria. A number of foreign systems, especially the FAO 'Framework' (FAO, 1976) and the USDA systems (Klingebiel and Montgomery, 1961) have been adopted by some workers. However, because the USDA system was developed for a different environment it may not be expected to be perfectly applicable here. The FAO Framework which is just a guideline that can be adapted to any environment has not been given a national adoption, although reliable sources have hinted of the plan underway by FDALR to evolve a suitable Land Evaluation System for Nigeria based on the FAO Framework.

Major Soil Classes in Nigeria

Most of the major soils in Nigeria have been classified at the higher categorical level of the soil Taxonomy (Soil Survey Staff, 1975) and the FAO (FAO, 1974). Studies up to date show that at least 7 of the

11 soil orders of the soil Taxonomy occur in Nigeria (Table 1). Two of these, Alfisol and Ultisol, are most dominant, followed by Inceptisol and Entisol, then Oxisols and Vertisols which are found only in few places. A brief description of the soils in as follows:

Alfisols are soils with a clayey B Horizon and exchangeable (Ca + Mg + K + Na) saturation greater than 50% calculated from neutral NH_4OAC-CEC.

Ultisols are soils with a clayey B horizon and base saturation less than 50%. They are acidic, leached soils usually in the humid areas.

Oxisols are strongly weathered soils but have very little variation in texture with depth. Some strongly weathered, red, deep porous oxisols contain large amount of clay-sized Fe and Al oxides.

Entisols are soils with little or no horizon development in the profile. They are mostly derived from alluvial materials.

Inceptisols are soils with limited profile development. They are mostly formed from colluvial and alluvial materials.

Soils derived from volcanic ash belong to the order Andisol (Soil Survey Staff, 1992).

Vertisols are dark clay soils containing large amount of swelling clay minerals (smectite). The soils crack widely during the dry season and become very sticky in the wet season.

The order being the highest category of the system, each of these has wide variability. They therefore contain soils differing in morphological, physical, chemical and mineralogical properties. Thus in one soil order, there can be hundreds or thousands of soil series.

In Nigeria the kind of soil occurring in a place is closely related to the climate and vegetation and, to a lesser extent, the parent material (Ogunkunle, 1990 and 1993; Ogunkunle, and Onasanya, 1992). Thus Alfisols are mainly found in the upland areas of the drier savanna, while Ultisols occur mostly in the upland of the wetter forest zone. However, Inceptisols, Entisols and to some extent Vertisols occur more commonly in flood plains, valley bottoms, along river courses and generally in lower slope locations of the landscape in any of the climate-vegetation-geology zones. Coincidentally, Alfisols are more common in the Pre-Cambrian Basement Complex regions with metamorphic and igneous rocks while Ultisols are predominant in the sedimentary regions.

Soil management problems and analysis

Principally Nigerian soils are dominated by low-activity clay Alfisols

Table 1 **Soil Orders of the U.S. Taxonomy recongised at locations across Nigeria**

Soil Order	Location	Parent Material	Author
Alfisol	Uhonmora - North Bendel	Shale	Soil Sc. Soc. of Nigeria (SSSN 1980)
(Luvisol - FAO	Onigambari - near Ibadan	Bassement complex (colluvium)	" (1983)
	Kadawa (Kano State)	Acolian drift over concretionary gravelly material	" (1979)
	Vom, near Jos	Rayfield Deposit on Granite	" (1982)
	Ibadan (IITA)	Basement Complex banded biotite gneiss	" (1983)
	Kano		Lekwa (1981)
	Kaduna	Loess over colluvium and saprolite	Esu (1982)
Ultisol (Acrisol)	Owerri	Old deltaic alluvium/Coastal Plain Sands	Soil Sc. Soc. of Nigeria (SSSN 1981)
	Nifor, Benin City	Coastal Plain Sands	" (1980)
FAO	Ijebu-Ode	Abeokuta formation (Sedimentary)	" (1983)
	Ikenne	Cretacious sandstone	Juo and Kang 1978
Entisol	Koko (Bendel)	Alluvium	Soil Sc. Soc. of Nigeria (SSSN 1980)
(Gleysol,	Epe (Ogun State)	Recent Alluvium Deposit	"
Areosol,	Kurna (North Kano)	Aeolian Sand	"
Lithosol)	Ibadan	Basement complex - Alluvium/Colluvium	"
	Kano	-	Lekwa (1981)

Table 1 (contd.)

Soil Order	Location	Parent Material	Author
Inceptisol. (Cambisol) FAO	Owerri	Coastal Plain Sands	Soil Sc. Soc. of Nigeria (SSSN 1981)
	Benin	Coastal Plain Sands (Alluvial-colluvial deposits)	" (1980)
	Kadawa (Kano State)	Aeolian sandy drift over iron pan	" (1979)
	Vom and Haipang near Jos	Newer Basalt	" (1982)
	Kano	-	Lekwa (1981)
Oxisol (Ferralsol) FAO	Badagry		South West zonal Soil Corr. Committee (1979)
	Ilutitun	Tertiary sandstone	) Harpstead (1974)
	Ife	Amphibolite	)
	Mokwa	Cretaceous sandstone	)
Vertisol (Vertisol - FAO)	An area = at 9° 37 N, and 11° 52 E (Northern Nigeria)	Ferromagnesian or calcareous rocks; Calcareous and non-calcareous shales	) Klinkenberge and Higgins (1968)

and Ultisols. They are so called LAC because of their limitations and unique management requirements that adversely affect their potential for crop production (e.g. Table 2). These limitations include acidity and Al toxicity, low nutrient reserves, nutrient imbalance and multiple nutrient deficiencies.

Ultisols are relatively more prone to erosion particularly on exposed sloping land. Alfisols have major physical limitations, they are extremely susceptible to crusting, compaction and their low moisture-retention capacity causes frequent moisture stress to crops. In addition they acidify rapidly under continuous cropping, particularly when moderate to heavy rates of acidifying fertilizers are used.

It is obvious that continuous cropping for even a decade or half on these soils without a stable means of fertility restoration will result in zero yield. Where land is abundant, long fallow periods facilitate restoration of soil productivity. But available data (Olayide *et al.,* 1980, Hartmans, 1984) show that the size of an average traditional Nigerian farm is 2 ha and this has been found to be no more sufficient under the current production systems. A numer of alternative approaches have been tried and reported to be successful. Lal (1974) suggested appropriate management of the soil surface through the use of residue mulch and minimum tillage. Loss of nutrients during cropping can be the inherent low exchange and buffering capacities of LAC soils, maintenance of adequate level of soil organic matter and judicious crop-residue management play important roles in sustainable crop production.

In view of the complex nature of the problem, an integrated soil fertility management system, combining the use of fertilizers and biological and organic nutrient sources have been advocated as the most desirable nutrient - management system for these soils (Kang and Wilson, 1987). This in essence is what alley-cropping system is all about.

Results of long-term studies at the International Institute of Tropical Agriculture (IITA) showed significant improvement in soil properties under alley cropping. Erosion was reduced/controlled, the soils had higher organic matter and nutrient status than the control. Prunings added as mulch also substantially increased moisture retention in the top soil (Kang *et al.,* 1985). However, further research is needed to select more suitable multi-purpose woody species for alley cropping particularly for acid soils and high elevations. In addition, testing of the alley cropping and farming concept for the drier areas of northern Nigeria needs to be carried out.

Self sufficiency and soil characteristics

In view of the fragile nature of most Nigerian soils as revealed by available information, it may be necessary to reconsider the meaning of self sufficiency in food production as we know more about these soils. If we consider self sufficiency in food production as the supply or production of the food need of the population entirely from within the country, then our soils must be made to produce these food items at all cost. However, this may not be wise after all. A careful analysis of the problem is necessary.

Table 2: Some properties of soils at some locations across Nigeria

Location	Parent Material	Soil Type	Depth (cm)	Texture (%) Clay	Silt	Sand	pH (H_2O)	Exchangeable Cations cmpl/kg^{-1} Ca	Mg	Na	K	ECEC cmol/ kg^{-1}	BS %	C %	N %	P PPM
Ibadan	Basement	Ferric	0-5	24	23.8	52	6.0	5.38	2.29	2.29	0.11	8.73	91	1.80	0.138	10.5
	Complex	Luvisol	5-15	30	11.8	52	6.3	5.38	2.30	0.18	0.11	8.97	89	0.90	-	0.9
(SSS, 1985)	(Granite	(Alfisol)	15-25	53	16.8	36	5.6	2.90	0.69	0.16	0.11	4.67	83	0.78	0.063	0.5
	Gneiss															
	Overlain		25-42	49	20.8	30	5.9	2.35	0.67	0.18	0.09	3.79	87	0.12	0.040	0.6
	by Colluvial		42-60	47	22.8	30	6.2	2.20	0.91	0.20	0.09	3.89	87	0.02	0.044	0.5
			60-90	47	28.8	34	6.1	1.95	1.15	0.20	0.36	4.16	88	0.02	0.040	0.4
Jos	'Newer	Gleyic	0-16	18	40	42	4.5	2.25	1.20	0.46	0.32	5.48	77	1.50	-	1.0
	Basalt	Luvisol	16-45	30	44	26	4.5	2.20	1.56	0.34	0.29	4.94	89	0.76	-	1.2
(SSN, 1982)		Alfisol	45-63	38	38	24	4.9	2.10	1.58	0.37	0.29	4.59	95	0.58	-	2.9
			63-89	44	30	26	5.0	3.00	1.80	0.43	0.30	6.33	87	0.56	-	10.9
Uhonmora	Sed	Plinthic	0-10	27	14	59	5.1	9.00	2.25	0.19	0.45	13.39	89	3.44	0.238	0.84
(Bendel)	Shale	Luvisol	10-19	30	7	63	5.0	5.25	1.75	0.09	0.17	11.16	66	3.06	0.154	0.84
(SSN, 1980)		(Alfisol)	19-33	33	6	61	4.85	4.50	2.75	0.09	0.01	13.65	54	2.78	0.126	0.49
	Overlain		33-45	39	6	55	5.10	3.75	1.00	0.09	0.17	12.01	42	2.94	0.126	0.46
	by		45-83	47	4	49	4.75	4.00	2.00	0.09	0.15	16.44	38	2.50	0.112	0.49
	Colluvium		83-112	44	6	50	4.75	3.50	1.00	0.09	0.10	14.34	83	2.36	0.084	0.49
			112-150	39	4	57	4.65	2.75	1.75	0.14	0.17	14.41	33	2.06	0.070	0.39
			150-200	43	18	39	4.20	6.25	3.75	0.53	0.17	25.60	41	1.80	0.028	0.49

Table 2 (contd.)

Location	Parent Material	Soil Type	Depth (cm)	Texture (%) Clay	Silt	Sand	pH (H_2O)	Exchangeable Cations cmpl/kg^{-1} Ca	Mg	Na	K	ECEC cmol/ kg^{-1}	BS %	C %	N %	P PPM
Owerri	Old	Dystric	0-13	41	12	74	4.9	0.07	1.9	0.15	0.23	5.6	53	0.84	0.076	3.0
(SSN, 1981	Deltaic	Nitosol	13-29	18	14	68	4.8	0.5	3.8	0.18	0.26	6.2	74	0.39	0.039	2.5
	Alluvium	(Ultisol)	29-56	22	12	66	4.7	0.4	1.9	0.11	0.22	5.2	49	0.30	0.034	1.5
	(Sed)		56-84	28	12	60	4.6	0.3	0.8	0.11	0.20	4.7	29	0.21	0.021	1.0
			84-102	24	12	54	4.6	0.5	0.2	0.10	0.21	5.0	20	0.21	0.027	1.0
			102-125	38	16	46	4.7	0.5	1.2	0.13	0.29	6.1	34	-	-	1.0
			125-180	44	12	44	4.6	0.4	0.3	0.10	0.24	5.9	17	-	-	2.5
Kano	Aeolian	Gleyian	0-5	4	22	74	8.1		10.6	1.25	0.62	6.4	-	1.6	0.12	33
(SSN, 1979)	Drift Over															
	Concret-	Solonsetx	5-20	8	22	70	9.3	Ca + Mg	23.6	5.50	0.32	8.9	-	0.26	0.08	21
	ionary	(Alfisol)	20-44	16	24	60	9.9		15.4	11.75	1.15	13.5	-	0.05	0.08	18
	material		44-73	20	14	66	9.9		12.4	14.25	0.85	12.5	-	0.03	0.12	2
			73-148	44	16	66	9.6		13.4	14.50	0.50	16.4	-	0.04	0.09	2
			148-1178	20	19	61	9.2		8.4	10.00	0.42	19.12	-	0.04	0.11	2

The nature of Nigerian soils suggests that they may perform better under trees than with arable crop because fertility decline is slower in the former. This suggests that if the other soil properties (e.g. depth) are adequate, the southern part of the country can be concentrated on adaptable, economic permanent crops (e.g. oil palm, cocoa, citrus, coconut) and the north or part of it should be used for adaptable arable crops and livestock. Crops that cannot be fairly economically produced in the country can then be imported from other countries. It is expected that money realised from the exportation of cash crops will pay for imported food crops leaving a reasonable profit. This may be the only way out, if political consideration and/or differences will not make it impracticable.

It is also necessary, in the face of dwindling amount of land available to agriculture, to emphasize increase in yield per area of land rather than increasing the area cultivated. This must be accepted in all strategies if we expect them to work.

Agricultural value of Nigerian soils

From the foregoing, it is clear that Nigerian soils are "fragile" and their natural capacity for agricultural production is low or nearly so. However, for land use planning, this information is not specific enough and cannot be used as basis for allocation of parcels of land to specific uses. There is wide variation in the quality or reliability of various assessments of agricultural values of soils carried out by different individuals/agencies in Nigeria. At one extreme are those with classes of "poor, fair, good and very good" (e.g. Modorch *et al.,* 1976) without much explanation or guidance to the meanings of these either in terms of expected crop yield or profit. At the other extreme are those that follow strictly an established land evaluation system. Table 3 shows examples of the latter and the capability of the soils at each of these sites across the country. With reference to Table 3, it is obvious that Class 1/S1 soil is scarce in Nigeria. Out of the 7 locations shown, it occurs in only two (Benue flood plain and Niger Basin) and constitutes only 8 - 16% of the areas.

Apart from losing our best agricultural lands to other uses the absence of national land evaluation system makes it more difficult and expensive to determine the appropriate management system for a site that has come into agriculture. It is even much more difficult to consider the capacity of the soils in the area for a number of alternative uses.

The most widely used land evaluation system in Nigeria is the USDA Land Capacity Classification LCC (Klingebiel and Montgomery 1961). It was intended for use in farm planning, and has been so used. But the class definitions are so broad that it has been found to be not specific enough for many agricultural uses (Young, 1976). For instance, in LCC there are 8 classes with quality decreasing from I (no limitation) to VIII (most limitation), classes I to IV are "arable", while V -VIII are "non-arable". It is also common to find that a site may not be suitable for one use and may be suitable for another or it may be class I for one use e.g. arable crop like maize and be class II or III for a permanent crop like

Table 3 Capacity (USDA-LCC) of some Nigerian soils for agriculture

STATE	LOCATION	PROPORTION (%) IN CAPABILITY CLASS								SIZE OF AREA (ha)
		I	II	III	IV	V	VI	VII	VIII	
Oyo	Ofiki, Oyo North	-	26	52	10	12	-	-	-	
Plateau	N'gell, Nr Jos	-	22	26	25	5	22	-	-	12,000
Ogun	Shagaum Odogbolu									
	Ijebu-Ode Road	-	31	43	-	20	-	5	-	2,900
Benue	Lower Benue	8	4	64	12	-	5	-	-	80,000

STATE	LOCATION	Proportion (%) in suitability (FAO) class (Arable Maize)					SIZE OF AREA (ha)
		S1	S2	S3	N1	N4	
Rivers	Yenagoa	-	50	45	5	-	80,000
Niger	Mokwa (Niger basin)	16	30	25	21	8	3,200
Kano	Kano	-	33	45	22	-	2,080

cocoa - as illustrated in Fig. 1. The broad definition of LCC makes it less adaptable in such situations.

The FAO Framework (FAO 1974) is more recent than the LCC but it has two main advantages on the latter: (1) It is only a guideline which can be modified to suit the peculiar situation of any environment. (2) The Land Suitability classes are specifically defined (e.g. Fig 1). Following the suggestion of the establishment of a national soil series classification system, it should be accompanied by the evolution of a modified FAO Land Suitability Evaluation (LSE) for the Nigeria environment (e.g. Ogunkunle and Okusami 1988).

Agricultural information systems

The term agricultural information system (AGRIS) used here refers to data stored in computerised form. For soils it is based on data from a large number of soil profiles, coded in a standardized form, either stored on paper tapes or on discs being used by microcomputers. It can then be processed in any desired manner within the system and output as tables and maps which can be directly supplied to the user or printed in a soil memoir.

This kind of automated data-handling system is highly efficient and can be used to store, retrieve and manipulate resource data such as soil profile data, land evaluation data, crop yield data etc., for all the ecological zones in the country. If such facilities can be provided in each State capital, a farmer and/or land user can obtain accurate information on their land in terms of soil properties, land quality, expected yield of major crops at specified management levels etc. This will obviously result in the optimum use of each parcel of land in the country.

With the increasing access to computer facilities, the adoption of AGRIS is highly feasible in the country. Besides it is essential for the suggested national soil series classification and the land evaluation systems because of the huge amount of data involved. Otherwise the expected impact of these on agricultural production may not be realised.

Control of misuse of Land

With limited land available to agriculture the fragile nature of the soils, no effort should be spared in preventing any activity that may tend to destroy or damage our soil.

Annual bush burning: Organic matter is a more important factor in Nigerian soils than in soils with high activity clay minerals because it is the main colloidal fraction responsible for holding soil nutrients against leaching, particularly in the topsoil. Due to higher temperature, the rate of organic matter decomposition is high, thus any action that will further reduce soil organic matter must be discouraged or prohibited. The practice of annual bush burning in the dry seasons in the savanna regions (about 80% of the country) not only destroys soil organic matter but also removes materials that can be used for mulching. Previous efforts to discourage this practice through the mass media has not worked hence it is suggested that government considers and enforces a stricter measure.

Quarrying: Digging of big pits for sand or gravel for building purposes is

a big business in many parts of the country. However this has led to very serious gully erosion which has proved most difficult to control. Available data (Gowon, 1985; Ofomata, 1981) reveal that over 70% of the country suffers from one form of erosion hazard or the other. Majority of these were caused by indiscriminate quarrying and it is threatening the availability of land for agriculture. We strongly feel the government should take a serious look at this too before it is too late.

Deforestation: It is also becoming common to find individuals clearing (bulldozing) large pieces of land for agriculture without due consideration for the result of this on soil loss. Recently the government started a move to encourage tree planting to restrict desert encroachment and increase wood production. When it is realised that soil loss through erosion is to a large extent an irreplaceable loss then the public must be made to know the serious adverse effect of indiscriminate deforestation on food production. We strongly believe that only government decrees that are enforced can be effective in curbing or eradicating misuse of land in Nigeria

Implementation Committee

The successful implementation of strategies being put forward requires that a group of people be duely assigned to see them through. We suggest the formation of a group of few (5) serious minded, honest and committed soil scientists into a committee serving on a full-time or permanent basis. After analysing the strategies, the committee will advise the government in terms of priorities and the "mondus operandi". The committee is expected to monitor every aspect of the implementation for possible modification and progress report. This may be a realistic starting point towards self sufficiency in food production in Nigeria

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