The effects of over cultivation on some soil properties, nutrients response and yields of major crops grown on acid sand soils of Calabar South-Southern part of Nigeria

O. S. Bello, M. G. Solomon and O. A. Iyapo

Department of Soil Science, University of Calabar, Calabar, Nigeria, Email salibello2002@yahoo.com

Abstract
Most of the arable land in Nigeria is characterized by fragile soils, having undergone intensive weathering, leaching and they are dominated by low activity clay, are infertile, have low nutrient response and are either acid or posses tendencies to become acid due to continuous or over cultivation. Soils especially around the cities in Nigeria are used for growing vegetables, cereals like maize, legumes like melon, soybean and cowpea which have been cultivated continuously for a period upward of 20 years due to the lack of arable land and the good market for the crops. Studies were conducted on the soil properties, soil reaction (pH); total nitrogen, organic carbon, base saturation, microbial populations (fungi and bacteria) and the determination of crop response to nutrient applications. The results obtained showed that the pH is acidic ranging from 4.1 to 5.1 and values of total nitrogen, organic carbon, base saturation, microbial populations and the identified nitrogen fixers are low. There is about a 60% yield reduction for the cultivated crops. The uptake of the applied nutrients by the crops is low consequently the soil is generally of low productivity.

Key Words
Over-cultivation, soil properties, fragile soils, microbial populations, response to nutrients, yield

Introduction

Agricultural practice around the densely populated areas of the world is characterized by overcultivation and continuous cultivation of land (Nair 1979). In this situation, there is continual loss and removal of soil nutrients by the harvested produce. The cultural practices adopted cause the nutrient cycle to deteriorate and affect the sustainability of the system (Kang 1990). Crop production in these areas in Nigeria is very far from being sustainable and yields are far below their potentials (SSSN 2008). This is due mainly to fragile soils, lack of nutrients, soil degradation destroying soil structure and soil erosion (Bello and Iyapo 2008).

Materials and methods

Soil samples were collected randomly from a well managed control site and seven farms that had been planted to crops under continuous cultivation for about 10 years, located around the city of Calabar, Nigeria. Soil was taken from a depth of 0-20cm using a soil auger. The composite representative samples were analyzed for their physical, chemical and biological properties using the standard soil analytical methods of Odu *et al.* (1986). The soil, are characterized with high acidity (Table 1) with the major nutrients like organic carbon, total nitrogen, potassium very low, this could be attributed to the continual removal of nutrients from the soils year in year out (Kang 1990).

Results and discussion

Table 1. Physical and chemical properties of the soil.

Location	pH	OC	Total N	AVP mg/kg	K	ECEC	Clay	Silt	Sand	Texture cla
		%	%			(cmol kg^{-1})		%		
Control	4.7	1.20	0.09	65.0	0.08	4.28	10.7	8.6	30.70	Sandy loan
Ask-Atu	4.3	0.90	0.07	50.00	0.05	3.33	10.8	2.7	86.60	Sandy loan
Atimbo	4.4	0.30	0.02	9.75	0.09	3.00	14.8	3.7	81.60	Sand loam
Anantigha	4.9	0.83	0.07	43.25	0.07	4.00	3.7	7.7	88.60	Sandy
Calabar south	5.1	0.68	0.05	100.00	0.08	3.48	4.7	8.7	86.60	Loamy san
Uncial Quarters	4.6	0.86	0.09	70.75	0.08	4.12	6.6	6.8	86.60	Loamy san
Unicla farm	4.7	0.90	0.06	66.00	0.08	3.62	10.7	8.9	84.6	Sandy loan
Mean value	4.6	0.81	0.06	56.40	0.08	3.69	8.86	6.43	85.04	Sandy loan
Range	43-5.1	0.30-1.20	0.02-0.09	9.75-100	0.05-0.09	3.00-4.28	3.7-10.8	2.7-8.9	80.6-88.60	
SD	0.33	0.34	0.03	10.02	0.02	0.47	4.07	2.68	4.14	
CV %	7.6	4.0	42.86	19.1	28.6	11.80	42.8	38.8	4.9	

The micro-organisms (Table 2) are generally scanty and have low populations which could be attributed to the continuous tampering with the soil ecology and application of chemicals and fertilizers that eliminate the microbial populations. High available P is due to continuous application of phosphorus based fertilizer. The yields (Table 3) of the cultivated crops are generally low showing that the soils no longer support good crop yields. There is need for proper land use planning around the cities to enable the availability of a large expanse of land for agricultural production since the demand for food is always higher around cities. In addition, organic farming should be encouraged.

Table 2. Microbial isolates and population distribution in the samples.

Location	Bacteria isolates	Bacteria count	Fungi isolate	Fungi count
Control	Micrococcus	$18x10^6$	Rhizopus	$5x10^3$
	Bacillus subtillis	$17x10^6$		
Asok Atu	Micrococcus	$10x10^6$	Rhizopus	$3x10^3$
	Bacillus subtillis	$7x10^6$	Mucor	$2xw^3$
		$9x10^6$		
Atimbo	Micrococcus	$4x10^6$	Rhzopus	$2x10^3$
	Bacillus subtillis	$8x10^6$	Mucor	$3x10_3$
Anantigha	Bacillus subtillus	$10x10^6$	Rhizopus	$2x10^3$
	Klebsiella	$12x10^6$	Mucor	$2x10^2$
Calabar south	Baarllis subtillis	$7x10^6$	Rhizopus	$2x10^3$
	Klebrela	$12x10^6$	Mucor	$2x10^3$
Unical quarters	Baallus klebbela	$9x10^6$	Rhizopus	$2x10^3$
		$4x10^6$	Mucor	$2x10^3$
Unical farm	Bacillus substillia	$5x0^6$	Mucor	$4x10^3$
	klebsIella	$8x10^6$		
	Micrococcus	$4x10^6$		

Table 3. Yield of arable crop planted on the plots.

Location	Maize (shelled grain yield) t/ha	Pumpkin (biomass yield) t/ha	Cassava (tuber yield) t/ha	Green (Amananthus) (biomass yield) t/ha	Water hot (biomass) t/ha
Control	2.3	6.8	13.9	7.5	6.5
Asok-Atu	0.4	2.3	6.2	3.1	2.2
Atimbo	0.3	2.3	5.8	3.0	2.3
Anantigha	0.6	2.1	5.2	2.8	2.4
Calabar south	0.8	2.0	5.0	2.6	3.5
Uncial quarters	0.7	2.3	4.7	2.7	2.8
Unicla farm	0.9	2.7	5.5	3.2	3.6

Conclusion

There is need for proper land use planning around the cities to enable the availability of large expanse of land for agricultural production since the demand for food is always higher around the cities. In addition, organic farming should be encouraged.

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