Impact of Intensive Market Gardening on the Nutrient Status of Hydromorphic Soil in the Ojo Area of Lagos Metropolis, Nigeria

A.O. AWETO

and

G.M. OGURIE*

Summary
This study evaluates the impact of intensive market gardening on the nutrient status of hydromorphic soil in the Ojo area of Lagos metropolis. Following 15–20 years of continuous market gardening, the organic matter content of the 0–10 cm layer of the hydromorphic soil has been reduced to 75 percent of the level found in a swamp forest soil used as a control. The extent of the organic matter decline in the cultivated soil is slight compared with the degree of organic matter diminution in well-drained soil used for shifting or continuous cultivation. This is due to the low degree of humus mineralisation in water-logged soil and the application of organic manure.

In spite of regular application of both organic and inorganic fertilisers, the levels of exchangeable calcium, magnesium, potassium and sodium are lower in the 0–10 cm and 10–20 cm layers of the intensively cultivated hydromorphic soil used for market gardening than in the swamp forest control areas. The mean level of extractable manganese is lower in the 10–20 cm layer of the cultivated soil. These differences are due to nutrient immobilisation and removal in harvested vegetables, and to nutrient loss from the market gardening plots through erosion. There is, however, a build-up of available phosphorus in the surface layer of the market garden soil due to the application of inorganic phosphate fertilisers.

The levels of mineral nutrients in the surface layers of the cultivated soil are within the optimal ranges for most arable crops, suggesting that the soil is not impoverished. This is due to the judicious application of both organic and inorganic fertilisers, and is indicative of the fact that hydromorphic soils can support continuous cultivation under proper management.

Introduction
The clearing of natural ecosystems, such as climax forest, and their subsequent replacement by agricultural ecosystems is accompanied by environmental changes. Such changes affect the vegetation, micro-climate and soil. Changes in the soil are particularly important as they may determine crop yield and soil productivity and should influence the management strategies to be adopted by a farmer to ensure that the soil fertility is maintained at a satisfactory level. In the forest zone of Nigeria, studies on the impact of cultivation on soil properties have been confined to the relatively fertile, well-drained inland soils, i.e. the alfisols and oxisols. Such studies include those which examine the impact of tree crops on the soil (Areola, 1984; Aweto, 1987; Aborisade and Aweto, 1990), and the effects of shifting and continuous cultivation of field crops and their response to fertilisers (Obigbesan and Amalu, 1985; Aweto, 1988; Obiefuna, 1989; Ikeorgu and Odurukwe, 1990).

The impact of cultivation on coastal soils in...
Nigeria has not been documented. This is partly attributable to the fact that farming is not a major economic activity in areas close to the coast because the soils are either too sandy and excessively drained, or because they are water-logged and consequently unsuitable for most arable uses.

In the last two decades or so, some swampy (hydromorphic) coastal soils near Lagos have been used for intensive market gardening. This development resulted from the great and sustained demand for vegetables in Lagos metropolis, which has a population of about 3 million people. Aghimien et al. (1985), Aghimien (1988) examined the characteristics of hydromorphic soils in southern Nigeria, but did not evaluate their response to cultivation. The present study examines the impact of intensive market gardening on the nutrient status of hydromorphic soils in the Lagos coastal area.

Study Area

The present study was carried out in Ojo, a town located some 15 km west of Lagos, but now merged with the city of Lagos as a result of the city's expansion. Today, Ojo town forms a part of Lagos metropolis. The area is nearly flat, generally low-lying and close to sea level. These factors, combined with the proximity to the sea and heavy annual rainfall, averaging 1,800 mm, has made the area swampy and very prone to water-logging. During the rainy season the ground water table rises to within a few centimetres of, or even slightly above, the ground surface. The climate is humid, equatorial, with a double-peak rainfall regime, the rainy season lasting from March to November. Rain falls throughout each month of the year, with at least 25 mm of rain falling during the dry season months of January, February and December. The average annual temperature is high, being 26.7°C, with a small annual range of under 4°C. The relative humidity of the air is high, rarely falling below 80 percent except in the afternoons.

Ojo town is quite close to the coast and hydromorphic soils are prevalent in the area. Water-logging usually occurs when the water table is less than 2 m from the ground surface (Shanan, 1987), and the resulting hydromorphic soils are characterised by poor drainage, implying the presence of excess moisture in the soil (Brady, 1984). The soils possess dull colours, being usually greyish with mottling occurring at depths below the surface. The soils in the Ojo area are sandy, being derived partly from sandy marine sediments. According to the United States Soil Taxonomy, the hydromorphic soils in the Ojo area are typical tropaquents.

The natural vegetation is mainly swamp forest in which raffia palms (Raphia vinefera and Raphia hookerii) feature prominently (Fig.1). The oil palm (Elaeis guineensis) also occurs in the swamps, while Alchornea cordifolia is occasionally encountered. Ferns dominate the ground flora of the swamp forest.

Market Gardening in the Ojo Area

Parts of the swamp in the Ojo area, adjoining the Lagos–Badagry expressway, have been cleared and used for intensive production of vegetables during the last 15–20 years. The swamp vegetation was initially cleared during the dry season when the swamps were more accessible as a result of the lowering of the ground water table. Thereafter, the topsoil was heaped into beds about 1 m wide by 5 m long and 20 cm high (Figs. 2 and 3). The construction of these beds helps to improve topsoil drainage, especially during the rainy season when the water table comes near the surface. Poultry dung mixed with sawdust is applied to the soil, as well as inorganic chemical fertilisers, especially urea, compound NPK fertilisers and superphosphates.

The vegetables grown are mainly green leafy vegetables, including lettuce and cabbage, and local vegetables such as Amaranthus candatus, Celosia argenta and Corchorous olitorius. Onions and some varieties of peas are also grown in rotation on the beds, but usually a bed is used for growing one vegetable at a time. Adjoining beds in the same farm plots are used for growing different vegetables. The farmer is not therefore engaged in monoculture, but in multiple cropping. Different crops on the same farm are not strictly intercropped with one another as is the case of shifting cultivation or the traditional rotational bush fallow system of arable farming commonly practiced in the forest and savanna regions of the country. The farmers practise continuous cropping and the land is not usually put under fallow at any time of the year. Commonly, as soon as one crop of vegetable is harvested another crop is planted, and up to seven crops may be raised on the same farm in a year. Before each bed is replanted, it is clean-weeded and inorganic fertilisers and poultry dung, mixed with sawdust and small chips of