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Effects of using municipal waste as fertilizer on soil properties in Jos area, Nigeria

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ABSTRACT

One of the major constraints to sustainable crop production on the Jos Plateau in Nigeria is low soil fertility status. Since the solution to the problem has long been perceived in terms of inadequate supply and distribution of inorganic fertilizers, maintenance of soil fertility has become one of the greatest problems facing both agricultural institutions and farmers in the area. With increased realization of the importance of organic fertilizers, which are now being used to provide useful supplement to inorganic ones, municipal waste is one of the organic fertilizing materials in use for quite some time now in Jos area. Farmers apply town waste in combination with poultry droppings and/or cow dung. Therefore, the objective of the study was to determine the effects of municipal waste application on soil properties. Two types of soil data were collected: Soil profile data and surface soil data. In each of the two study sites selected (Gangare and Naraguta) in the area, two profile pits were located, one in a farm where there has been application of town waste and the second in the adjacent reference area where there has been cultivation but no application of municipal waste. Stratified random sampling technique was adopted to collect surface soil samples. Standard procedures were applied in laboratory analysis. The results of soil analysis show that application of town waste has really modified the soil conditions. The surface soils in some areas have become very dark, classifying the soil as Mollisols. The levels of organic matter, total nitrogen, available phosphorus, exchangeable bases and CEC have been greatly enhanced. However, the contents of some trace elements have increased too.

1. Introduction

One of the major constraints to sustainable crop production on the Jos Plateau in Nigeria is low soil fertility status (Olowolafe and Dung, 2000; Olowolafe, 2004). Since the solution to the problem has long been perceived in terms of inadequate supply and distribution of inorganic fertilizers, maintenance of soil fertility has become one of the greatest problems facing both agricultural institutions and farmers in the area (Phillips-Howards and Kidd, 1991). The withdrawal of fertilizer subsidy in the mid-nineties and the subsequent scarcity and high cost of obtaining the commodity ushered in a much more realization of the importance of organic fertilizers which are now being used to provide useful supplement to inorganic ones (Olowolafe, 2002). Municipal waste is one of the organic fertilizer materials in use for quite some time now in Jos area. Farmers apply municipal waste in combination with mineral fertilizers, and sometimes with poultry droppings and/or cow dung. The use of municipal waste to maintain soil fertility in urban and peri-urban arable cultivation has been reported (Allison et al., 1998; Pasquini, 2002). Municipal waste has great potential because it can be exceedingly nutrient rich and so can be used as fertilizer while at the same time its utilization in this way can also assist in alleviating the waste disposal problems in some of our towns and cities (Esrey and Anderson, 2001; Drechsel et al., 2002; Pasquini, 2002). But unfortunately, most municipal waste sludge can be laden with microbiological agents and more seriously with heavy metals (Haigh, 1993). The practice can set up a specter of serious land contamination should the metals accumulate (Eterevskaya et al., 1992). Therefore, the objective of this study was to determine the effects of municipal waste application on soil properties.

2. The study area

Jos Area is located on the Jos Plateau in the central part of Nigeria (see Fig. 1). The Plateau lies between latitude 8°30′ and 10°30′N and longitude 8°20′ and 9°30′E. The average elevation of the study area is about 1250 m above sea level. Though the climate of the area is markedly influenced by its altitude and position across the seasonal migration of the Inter-Tropical Discontinuity (ITD), it is the wet and dry type classified as Tropical rainy (Aw) climate by Koppen (1923). It has a mean annual rainfall of about 1260 mm (1050–1403 mm),

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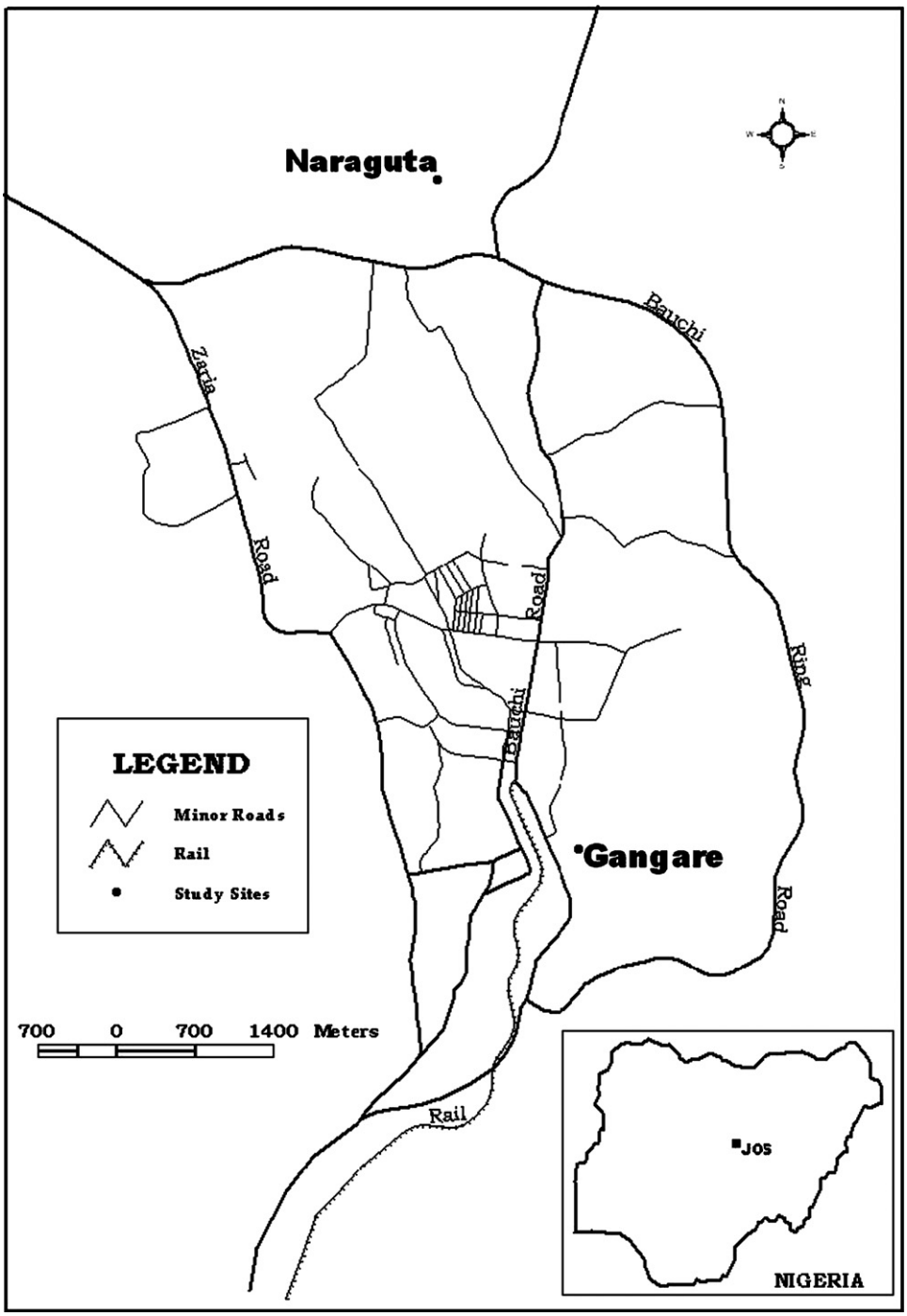

Fig. 1. Map of study area (Jos City).

peaking between July and August. The mean annual temperature is about 22 °C, but mean monthly values vary between 19.4 °C in the coolest month of December when the area comes under the influence of the cool and dry desiccating north-easterly tropical continental air mass (harmattan) and 24.5 °C in the hottest month of April. The soil moisture regime is ustic and the soil temperature regime is inferred to be isohyperthermic (USDA, 1999). The area lies within the northern Guinea Savanna vegetation zone, an open woodland with tall grasses (Keay, 1953). The geology of the Jos city area comprises Precambrian basement complex rocks (migmatites, gneiss and older granites) and some areas of younger granites (Macleod et al., 1971). Entisols, Inceptisols, Alfisols and Ultisols are the major soils in the area (Olowolafe and Dung, 2000). Granites constitute the major underlying rocks where farmers apply waste and the soils are known to be of low fertility status (Olowolafe and Dung, 2000; Olowolafe, 2002), which justifies the needs for fertilizer application.

3. Method

3.1. Fieldwork

The study was carried out in two different study sites (Naraguta and Gangere) where farmers have been using municipal waste