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The use of town refuse ash in urban agriculture around Jos, Nigeria: health and environmental risks

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Abstract

This paper reports on a study that examines the health and environmental risks of using town refuse ash in urban vegetable production in Jos, Nigeria, in terms of heavy metal accumulation in the food chain. Soil and crop samples, collected from five study farms, and samples of the river water used for irrigation, were analysed for seven heavy metals Fe, Mn, Zn, Cu, Ni, Cd and Pb. On the basis of the field data the paper discusses: (1) the potential soil deficiencies and toxicities; (2) the probable links between soil heavy metal levels and fertilisation practices; (3) the heavy metal concentrations in crop tissue in relation to crop growth and human health. The findings suggest that soil concentrations of the seven metals fall within 'typical' soil levels, and that there should not be any problems of either toxicities or deficiencies for crop growth. There was evidence of slight accumulation of Zn, Cu and Cd on some of the farms with a history of town refuse ash use. However, in all farms lettuce crops contained very large concentrations of Fe, and Pb concentrations that were 20 to 40 times higher than the WHO/FAO maximum recommended level in leafy vegetables for human consumption. The Cd content of carrot tissue was 10 times higher than the WHO/FAO recommended limit. The relatively small number of soil and crop samples precluded any formal attempt at correlating the concentrations of heavy metals found in the vegetable crops with the farm levels. Nevertheless, the data suggested that these were not linked. The paper goes on to consider various potential sources of the metals found in the crops, including irrigation water, town refuse ash and air-borne dust, and discusses additional health and environmental risks pertaining to the use of town refuse ash. Undoubtedly, the heavy Pb and Cd contamination of certain crops indicates the urgent need for future studies to ascertain the precise source of these metals, and although the practice of using town refuse ash does not appear to have resulted in large-scale contamination of soil in the farming area, there are a number of unsafe practices associated with it that call for the identification of strategies for the safe utilisation of urban waste in Jos.

Keywords: Town refuse ash; Heavy metals; Vegetable crops; Jos Plateau

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1. Introduction

The production of food in the city has a long history, both in the developed (in the form of allotment gardens) and developing world. Since the early 1990s, in particular, there has been increasing recognition amongst the scientific and development community of the rising importance of food production in city areas, particularly in those parts of the world that have been characterised by economic collapse (Mbiba and Van Veenhuizen, 2001). Urban and peri-urban agriculture (UPA) can offer wide-ranging benefits. It can contribute substantial amounts to the proportion of food consumed in the city: Sweet (1999), for example, has estimated that 15–20% of the world's supply of vegetables and meat is produced in urban areas, and FAO (1999) estimates that 800 million urban dwellers are actively engaged in UPA, 200 million providing food for markets (FAO, 1999). UPA is practiced for a variety of reasons, for crisis management when markets are not working (e.g. in Cuba), as a strategy to overcome cash shortages or even for commercial purposes. As well as improving food security and nutrition, and creating employment for the jobless (Lynch etal., 2001), UPA can offer a range of environmental benefits, including improved waste recycling, and additional health benefits such as improved physical and psychological health due to increased physical activity (Lock and van Veenhuizen, 2001).

The reaction to UPA has been varied. In some cases UPA has faced strong opposition from city authorities, because of a range of negative health, environmental, economic and cultural aspects (Tinker, 1994), comprising contamination of crops with pathogens, chemical residues and heavy metals (Lock and van Veenhuizen, 2001), soil degradation (Quansah et al., 1997), surface and groundwater pollution with agro-chemicals (Lock and van Veenhuizen, 2001), conflicting land and water issues (Lynch et al., 2001) etc., and the perception that agriculture is not an appropriate activity for urban areas (Kalebbo, 1998). Kampala City Council (Uganda) was notorious for opposing UPA and practiced crop slashing to enforce prohibition. However, in 1994 it decided to liberalise the practice, and is now designating urban farming as 'official land use' (Kalebbo, 1998). Kampala has not been alone in acknowledging the importance of city food production, for UPA has been legalised in Accra (Ghana), Dar es Salaam (Tanzania) and many cities in South Africa. The problem is that the numerous health and environmental risks make it difficult for developing country city authorities to decide whether to legalise and include agriculture as an urban planning issue.

Although there are some who believe that UPA is damaging to the environment, others suggest that that it could instead be the answer to a number of important environmental problems (Binns and Lynch, 1998). One of these is the problem of waste disposal. Urban centres produce most of the world's waste and between a third and half of this goes uncollected (Sweet, 1999). It contributes to urban pollution and health risks, yet it has great potential because it can be exceedingly nutrient rich. By disposing of urban waste on city plots, farmers would obtain a cheap supply of nutrients while alleviating the waste disposal problem at the same time. There are many examples of waste utilisation in the developing world (for a comprehensive review see Allison et al., 1998), including the use of night soil (e.g. in Ghana—Owusu-Bennoah and Visker, 1994), composted waste (e.g. in Calcutta—Kundu, 1995), untreated and unsorted waste (e.g. in Senegal—Haramata, 1991), wood and household waste ash (e.g. in Nigeria—Hoffman et al., 2001) and wastewater (e.g. in Senegal, Burkina Faso and Mauretania—Gueye and Sy, 2001).

The Jos Plateau has been the location of vegetable gardening since the early 20th century because of the tin mining in the area that led to the development of a large expatriate community. The process of expansion of dry-season irrigated vegetable production began with Nigeria's petroleum boom in the 1970s, which was accompanied by an increased demand for vegetable produce by the growing urban and affluent population. This expansion was encouraged by the presence of a market but it was also enhanced by the Plateau's favourable temperate climate, its central position in relation to the rest of Nigeria, its relatively high degree of accessibility by road, rail and air, and the recession in the tin mining industry, which freed up a considerable labour force (Adepetu, 1985). Production was further stimulated with the implementation of the Structural Adjustment Programme in 1986, which with its stated aim of self-sufficiency, caused food importation to cease abruptly (Porter, 1992). Since the 1990s, expansion has continued,