



# Farmer Use of Urban Waste in Kano<sup>1</sup>

CHRIS LEWCOCK

*Natural Resources Institute, Chatham, Kent, UK*

## ABSTRACT

Urban solid waste, principally street sweepings and household refuse, is used on a large scale as a minimally composted fertilising material by the near-urban (15-km range) farmers of Kano in Northern Nigeria. This use has developed over several centuries as a means of retaining and enhancing the productivity of the soil in this densely populated and intensively cultivated area. Until 20 years ago farmers collected the waste themselves, exchanging it for fuelwood brought into Kano on donkeys. More recently they have become dependent on municipal tipper lorries to deliver the waste. As the tippers have deteriorated, from 40 to 50 operational vehicles to 5 or 6, so access to the waste has become more difficult and more expensive. This paper describes what has led to the present situation and considers how the farmers and the urban managers may be able to respond.

Some brief remarks are made in conclusion on the possible general implications of the case study for approaches to the study of urban agriculture.

## BACKGROUND

Kano City in Northern Nigeria was founded in the 9th century and has a long history as a centre for trade across the Sahara, and between the Sahel and the tropical zone to the south. It is an important industrial base, primarily agricultural processing with a certain amount of heavy manufacturing. It is the capital of Kano State within the federal structure of Nigeria and the seat of the Kano Emirate, which retains considerable religious and political influence, especially in the rural areas around the city. The main urban area is divided between three local governments, Municipal, Dala, and Nassarawa. The present population of these three council areas is 1,363,400. There are a further 712,594 people in the local council areas within 10-15 km of the city (1991 Census). The 1962 census showed a population for Kano City of 249,281.

There is a high level of livestock and poultry keeping (and hence manure production) within the city. A survey by Shea in 1992 as part of the National Livestock Survey estimated that there were, amongst other beasts:

cattle: 12,918;

sheep and goats: 665,007;

rabbits: 47,605;

chickens and ducks: 319,570;

pigeons: 756,174.

Kano's average annual rainfall from 1961 to 1991 was 694.9 mm. The sub-Saharan location gives a distinct rainy season from about April/May to September/October. There have, however, been several drought years. There is often uncertainty about when the rains will start and, perhaps most importantly for crop planting, when they will be firmly established. There appears to have been a decline in rainfall totals and increased variability since the Second World War. Agricultural activity is generally confined to a single wet season, with limited opportunities for irrigation beside some rivers or where there is a higher water table.

### NEAR-URBAN WASTE USE IN THE 1960s

In the 1960s Dr Michael Mortimore carried out surveys of the interactions between Kano and its hinterland. He noted that in an extensive area of Northern Nigeria there was generally higher population density than elsewhere. He identified, in particular, a region approximately 65–95 km from Kano on a north-west, south-east axis marked by a steep increase in population density. This he characterised as the Kano Close Settled Zone or CSZ. The zone appears to correspond to a belt of brown and reddish-brown soils typical of arid and semi-arid regions. These soils are potentially fertile but are very free draining and require considerable fertilising inputs and water.<sup>2</sup>

Mortimore observed that as the rural population had increased in the CSZ, far from soil conditions degrading and agricultural productivity declining as might have been expected, it appeared that production had increased and soil conditions had been maintained. Mortimore attributed this to the interaction of a number of factors, including (in no priority order):

- greater individuation of land tenure;
- labour market changes;
- long-term political and economic stability permitting the development of international trade and a growing urban market;
- changes in farming practices from bush fallow to a more settled system dependent on crop rotation, and intensive use of household waste and manure.

In that part of the CSZ closest to Kano City (what we might call the near-urban area) farmers made substantial use of household waste and animal manure exported from the city to supplement their own household and livestock resources. In roadside surveys Mortimore noted, in 1962 1447 and, in 1969 1137, donkeys, carrying taki (manure, household waste, street sweepings and ash) out of the old walled city, representing between 140 and 185 tons per day. Return imports were fuelwood and farm produce of various kinds (and building sand). Mortimore estimated that in a 7.5-km radius 25% of the fertiliser needs of the farms was being met by waste from Kano at an average application of between 3.25 and 5.0 tons per hectare per annum. A much lower level of use was made in the next 7.5 km, falling to almost no market for the waste at 35–40 km.<sup>3</sup>

### THE 1994 CASE STUDY

The 1994 Natural Resources Institute (NRI) case study looked at whether and how this use of urban waste for near-urban agriculture is being sustained one quarter of a century later. Discussions were held with the State Agriculture Board (KNARDA) and the Waste Management Authority (KASEPPA), private waste collection and disposal operatives and researchers from the Bayero University

Kano (BUK). Meetings were held with farmer groups in three near-urban villages and more detailed interviews carried out with 47 farmers in these villages.

It was found that the farmers' use of urban waste continues; in some cases on a massive scale. On one farm, estimated at 1.5 ha, 50 tripper loads or approximately 185 tons of street refuse had been spread on the land in one season. The use of the urban waste appears to extend to a radius of about 10–15 km around the city. Almost all of the farmers we interviewed insisted on the importance of this waste to their farming activities. It was also found that the main means of access to the waste had markedly changed, from collection on donkeys to delivery by Kano State waste management tipper lorries.

#### *Waste composition and access*

The composition of the urban waste used by the farmers is quite varied. The main categories available are as follows: street and household refuse, unmixed manure, other material, e.g. tannery waste or abattoir offal, waste water.

*Street and household refuse.* Apart from a very small number of private collections from some industrial or commercial premises and higher quality residential estates, refuse collection in Kano is made from street-side dumps to which households bring their rubbish. Street sweepings, drain clearance materials (including human faeces from the extensive open sewers) and market wastes are also placed here. This material is then disposed of in controlled landfill sites, often former brick earth pits within or next to residential areas.

Farmers' access to this street refuse may be through two general routes. The first, if they are close enough to the city, is to collect it themselves from the roadside or from one of the landfill sites, usually still using donkeys. The now more common practice is to pay one of the drivers of the Kano State waste disposal service (KASEPPA) to bring the material to the farm.

Some sampling has been made of waste dumps in different parts of the urban area by researchers at Bayero University. These studies show, as might be expected from a city in a developing country, a high organic content including food waste, tree and garden clippings, combustibles such as paper, a high dust and ash content and a high moisture content. They do not specifically identify the proportions of animal and human faeces, which must be high. Only in a very sketchy manner has the chemical content been assessed.

There is no organised system for composting of street refuse. In practice, however, the waste is likely to be very thoroughly broken down.

Except in high-profile sites, the material will have to stand at the street side for a long time because of the inadequacies of the waste collection services. This leaves opportunities for people looking for recycling materials and for goats, sheep and cattle scavenging food scraps to turn the heaps over (and to add to them). Furthermore, the local government street sweepers will re-form or move the heaps from time to time, e.g. if they are blocking traffic or smelling unacceptable or burning. It is possible that the long dry season limits any leaching of nutrients from the standing materials.

The farmers sort the material when it is dumped on their fields, removing and burning any stones, rubble or unwanted metal. The heap may then be left to stand for a few more weeks and/or placed in smaller heaps on the fields where it will stand again until needed.

According to the farmers the quality can be very variable. Main concerns appear to be the level of rawness of the waste and the proportion of unwanted rubble and inorganics they might have to pay for and sort out. Different prices are paid for different quality loads of waste.

*Unmixed manure.* Manure produced at the city abattoir and from livestock kept by larger scale urban stock-keepers is sold off to rural farmers (and urban gardeners). The availability and use of this material is limited. We were advised by farmers that although it is of recognised good quality it is expensive to purchase and transport. Some livestock keepers store and 'mature' the manure for up to 2 years by which time it gets a higher price.

*Other solid waste.* Other urban solid wastes used include abattoir offal and tannery wastes. The latter was valued by the small number of farmers who used it though they noted that it was extremely 'hot', needing to be mixed with household waste and requiring a lot of water. A laboratory analysis of the material suggests that the long term effect of the tannery waste on the soil could be harmful due, in particular, to the high chromium content.

*Waste water.* Kano stands on the watershed between the Niger River and the Lake Chad Basin. The Challawa River to the south runs all year round. The Jakara River, which rises within the old city, and other streams flowing northwards, would normally be seasonal. However, because they carry the city's waste water they also flow all year round and support significant irrigated farming areas producing vegetable crops, tomatoes, chillies, lettuces and onions for the city and elsewhere in Nigeria. The water is very heavily polluted with household or industrial waste.

*Changes in waste composition.* Little historical information is available on the composition of Kano urban waste. In very recent years plastic bags have become prevalent. A useful indicator of the extent of near-urban waste use is the circle of plastic bags on fields around the city to about 10–15 km distance. Although, as a proportion of the waste volume or weight the plastic is minor, the bags are unsightly and present some health hazard to livestock trying to eat, but unable to digest, them. It is worth mentioning that Kano's economy, along with the rest of Nigeria, has been virtually stagnant for some time, with the result that changes which might have taken place in waste composition, e.g. increased non-compostable packaging materials, have been relatively restrained.

#### *Use made of urban waste*

The farmers surveyed showed a preference for household and urban waste as a soil ameliorant or conditioner because it provides a general slow release of nutrients and a long-term input to the soil condition as opposed to the fast acting but relatively short-term input from artificial fertilisers. They also pointed out that artificial fertilisers require much greater certainty about water supply, a very important consideration in a region of unreliable rainfall patterns. The survey suggested a general preference on rainfed plots (the majority) to employ household refuse or street refuse in conjunction with ground preparation and planting, before the rains or relatively early in the cycle of plant growth. Thus there arises a seasonable demand for urban solid waste building up to May/June rains. Artificial fertilisers tend to be used at planting, after germination and at subsequent precise growth periods. On the (very small sample of) irrigated plots, where water supply is by definition better controlled, it is noticeable that there was a greater preference for artificial fertilisers.

In Nigeria artificial fertiliser is heavily subsidised, although subsidies are being reduced. It is also extremely scarce, the limited supply being controlled by the Government and distributed through inadequate bureaucratic channels. It is therefore rather difficult to judge what would be the preferred balance of use for the farmers between artificial fertilisers and urban waste. The survey

showed that urban wastes are used as a supplement to other household waste and/or as a complement to artificial fertilisers. The materials are generally used at different points in the crop cycle and applied selectively to different crops. They also seem to be used for different purposes, the wastes to enhance the long-term soil structure and moisture retention, the artificial fertiliser for improved crop growth. Thus, even if there were sufficient available artificial fertiliser at acceptable prices, it is probable that farmers would still have a substantial demand for organic materials.

Table 1 summarises the fertilising options for near-urban farmers. Each vertical column relates to a type of fertilising/soil conditioning agent, thus the column on artificial fertilisers summarises utility, availability and costs. Each horizontal line permits comparison of, e.g. the level of experience which farmers have of the different materials. The farmer has, potentially, a wide range of materials or combination of materials from which to choose.

### THE URBAN WASTE MANAGEMENT PROBLEMS OF KANO

Kano has a major, and politically highly sensitive, waste disposal problem. Kano households generate an estimated 450 tons of waste per day (at 0.33 kg per head). The waste disposal authority only manages to collect a small percentage of this. In 1982 the PAI Consultancy noted that there were 40 waste disposal trucks in Kano. There are now only 5 or 6 operational. Other equipment, e.g. waste loaders, often has to be hired in to deal with emergencies. The result is that large quantities of waste are left by the street side for very long periods or dumped in illegal landfills. A number of reasons for this dismal situation were put to the study team. They include long-term reduction in local government ability to raise revenue and, hence, chronic underfunding of maintenance and equipment purchase; a shortage of high-grade technical training; and prolonged uncertainty about whether the local government councils or Kano State should be managing the service.

The farmers expressed considerable frustration that in recent years urban waste has become more difficult and more expensive to obtain, mainly due to the near-collapse of the State waste disposal service. Except where they were primarily growing irrigated crops the farmers seemed convinced that their agricultural output would be badly hit by losing this nutrient source. In one village (which was probably the poorest village surveyed and the most difficult for lorry access) it seemed that little urban waste was now being delivered at all.

Our survey indicated, however, that the farmers are prepared to pay, in some cases very substantially, for waste of acceptable quality. Figures given to the study team by KASEPPA on their collection costs compared with what farmers are willing to pay suggest that each lorry load of waste delivered to the rural area should be making a profit. It is also possible to envisage that the market for the urban waste could be extended further out into the CSZ where the same traditions of use of roughly composted household waste and similar agricultural practices exist. This would raise additional revenue and help get rid of more waste.

A major constraint on mobilising this potential source of financing for waste disposal is that at present it is the drivers who, without permission, receive the money from the sale of waste to farmers. If, for example, ten tipper trips are made in one day (which would be feasible) the driver might raise the equivalent of one month's salary. They are naturally very reluctant to surrender such a lucrative income source. Alternatives such as private contracting have been considered (and tried already in other Nigerian cities). A private waste disposal operator spoken to, however, whilst agreeing that waste collection and disposal



Table 1. Continued

		Fertilising materials				
		'On-site' wastes	'Off-site' wastes		Others	
Artificial		Household and own livestock waste + crop residues	Kano abattoirs + goat market	Kano households	Tannery + other industry	Local abattoir slaughter
NPK, UREA, SPP, CAN		Manure, dust, weeds, ash, etc.: degraded	Manure, offal etc. 'Raw'	Manure degraded	'Kaseppa' sweepings + rubbish	Waste water
Variables						2 Main streams: indust./ domestic
Potential of materials						
Precisely defined for crops		Generally available to crops	Same as household (worse)	Same as household (better)	Same as household (much worse)	Not known
Short term		Slow release/ long term				Very 'hot'
Fast release		Possible input to soil				
Possible input to soil		humus + ash				
structure from carrier		Variable				
Farming regime (particular considerations)						
Hybrid seeds		Rice preference for livestock manure!	Same as household	Same as household	Same as household	Known to include urea; has killed crops; crops taste
Used after planting		Used before planting				
Used for growth periods		Used for growth periods				
Knowledge						
Experience		Not completely understood by farmers	Some uncertainty	Some uncertainty	Some uncertainty	Great uncertainty
Information services		Actively promoted by Govt. Agri. Agencies		Contact via D.A.	Chance contact with drivers!	Not known

C: composting; A: application; D.A.: District Agricultural Office.

in Kano was potentially a profitable business, was reluctant to invest in new vehicles etc. in the current political circumstances.

One or two of the farmers mentioned that they either had or were considering hiring vehicles. One possibility for them was to take up the present spare capacity in the sand lorries which ply in and out of the city. This would, however, be a major financial investment on which farmers would probably require support and assistance and which, for some, might not be affordable.

#### *Other key issues*

One difficulty in addressing the issue is the apparent lack of perception amongst policy-makers (both in the agriculture sector and the waste managers) of the importance of the urban waste for near-urban farmers and its probable significance for the overall economic productivity of the region.

There is a lack of knowledge about important aspects of the waste and its resource value:

- Little is known about the safety of the waste materials, from their discard by householders or others, up till their use on fields and presence in crops and livestock. Since the present wastes include human faeces and a variety of unassessed industrial materials this should be a matter of some concern.
- There is only very limited information on the broad composition and volumes of the waste (this is especially true of the industrial waste) and of trends in the short and long term.
- Little research has been done on the chemical characteristics of the urban wastes, or on how the different fertilising materials act together or separately and their potential short- and long-term impact upon productivity of the land. This knowledge is not being conveyed to the farmer who could make best use of it.

### **CASE STUDY RECOMMENDATIONS**

In the case study a number of recommendations were made as to how the present situation might be ameliorated and what further research might be required to support this.

Early action is needed to ensure that constraints on farmers' access to urban waste are eased. The waste management agency should carry out a basic refurbishment of collection and disposal vehicles in order to guarantee minimum delivery levels. This could be achieved through capturing the revenue stream from sale of urban waste to rural farmers. Detailed study should then be made of the means by which the urban waste delivery service can be placed on a technically, managerially and financially sound long term-footing.

The waste management agency, the local government authorities and the Kano State Agricultural Research and Development Agency (KNARDA) should create new consultative arrangements on urban waste disposal. These should involve the farmers associations, traditional community leaders, and others aiming to improve the reliability of urban waste disposal, and supply to the farmers.

Advisory services for farmers, in particular the KNARDA extension agents, should be geared up to provide more detailed advice and information about the potential uses (and hazards) of urban wastes, based on the above research.

Consideration should be given to increasing private sector involvement in the service. This could include commercial contractors, drivers and operatives cooperatives, and waste consumer groups such as the near-urban farmers. The



Governmental agency could then concentrate on its regulatory functions, for example those concerning landfill site management and cleanliness standards.

A series of research studies should be initiated to improve: understanding of the inter-relationship between urban generation of and rural demand for urban waste; the information base for decision-making in this area. The information bases created should incorporate an ongoing monitoring process of key factors.

Priority study areas would include:

- Measurement of the changing volumes, chemical and physical characteristics of Kano urban wastes and their transformation at different stages of the collection and disposal process. Analysis should be made of their potential value as fertilising materials as part of the near-urban farming regions. Attention should be given to industrial wastes and night soil.
- Assessment of the health hazards which may arise at different points in urban waste use and recommendations on mitigation measures.
- Research into other situations with similarities to or contrasts with Kano.

### CONCLUSIONS

The study demonstrates that agriculture in a city region may have an important part to play in resource flow management, in this case waste management.

One key to constructing 'the sustainable city', especially in developing countries, is to develop a systematic understanding of the role of agriculture in the life and environment of the city region as a whole. In most cities the farming production systems cut across the apparently clear physical boundaries between built-up and rural areas. The Kano case study illustrates this interdependence by looking at the generation of urban waste and the resource needs of near-urban farmers. Other topics which might have been considered include the use of seasonal labour from the town to carry out tasks such as ground preparation, planting, weeding and harvesting, the importance of the urban market for perishable green leafy vegetables, the use of near-urban farm plots as essential food and income sources for urban residents.

Farming systems vary considerably from city region to city region, and generalisation, in the present state of knowledge, should only be made with great caution. In the case of Kano there has developed long-term familiarity with the use of household and livestock waste in farming. The waste is particularly valuable because of the free-draining nature of the soil and the variability of the rainfall, both factors increasing the importance of soil ameliorants. Similar phenomena can be seen elsewhere in West Africa, for example in Benin. Would there, however, be a similar demand in an area without a long-term tradition of waste use? Would the waste be wanted in an area with a moisture-retaining soil and reliable rainfall? Nairobi or Dar-es-Salaam, for instance, were created on 'virgin' sites without a pre-existing urban-rural agricultural tradition. It might be that other cities could make greater use of urban waste in ways described here. Whether or not that turns out to be feasible will depend on careful preliminary analysis of their particular agro-ecological, cultural and historical circumstances!

City managers intending to use farming as a method of waste disposal, the avowed aim of many municipal composting schemes, should perhaps take the case study as a cautionary lesson. The use of urban waste in Kano has been demand rather than supply led. The local farmers are, if they have adequate information and other things being equal, capable of understanding and exploiting opportunities to maintain or enhance their production through the use of urban waste products — if they will be genuinely valuable. Thus the

introduction of transport of waste by tipper lorry greatly reduced the previous drudgery of carting thousands of donkey loads of waste from the city. The subsequent breakdown of administration of the waste disposal system has now, however, trapped the farmers in a very difficult situation.

The 'no-tech' approach to composting of the waste material illustrated in the case study should also be noted. The farmers, at present, find great benefit in roughly composted materials. It may be that greater value could be obtained through improving the waste quality. However, would the extra costs of sophisticated collection and composting systems be affordable or add a great deal to current productivity levels? It is worth researching the questions, but the answers cannot be assumed. One of the main failings of municipal composting in many places has been a total ignorance of the needs and characteristics of the farming system. Even 'low-tech' approaches can become bureaucratic obstacles and too expensive for poorer farmers.

### NOTES

1. This paper is based on a study carried out for the Overseas Development Administration, Agronomy and Cropping Systems Research Programme (ACSP) in January–March 1994. Valuable advice and assistance were given by, amongst many others, ACSP Programme Manager David Jackson and Mal Mohamed Liman from the Geography Department of Bayero University Kano. The views expressed in this paper are, however, the sole responsibility of the author and do not necessarily reflect those of NRI or ODA. A first presentation of material from the case study was made at a workshop on urban waste management led by the Development Administration Group (DAG) of the University of Birmingham in May 1994, sponsored by the ESRC. It is anticipated that the workshop proceedings will be published in book form in 1995. A copy of the case study report may be obtained by writing to Chris Lewcock at NRI, Chatham Maritime, Kent ME4 4TB, UK.
2. M.J. Mortimore, "Some Aspects of Rural–Urban Relations in Kano, Nigeria", *Colloques Internationaux du CNRS*, Paris (1972).
3. *Ibid.*