

The importance of crop cultivation in Nakuru town, Kenya

Dick Foeken* & Samuel O. Owuor**

Paper presented at the “Workshop on urban policy implications of enhancing food security in African cities”, Nairobi, 27-31 May 2002

Abstract

Urban poverty is increasing dramatically in Kenya. Farming in town is one of the ways people employ to cope with this problem. Based on a survey held in 1999 among a representative sample of almost 600 households, it is estimated that 27% of the Nakuru population is engaged in crop cultivation in town, although the real figure is likely to be higher. In 1998, they produced an estimated six million kilograms of crops, which covered about 30% of their energy requirements. Yields, however, are relatively low and vary with plot size and to a lesser extent the use of inputs (including labour used) and the sex of the person responsible. Although it is clear that crop cultivation is beneficial for the people involved (food supply, income, employment), its potential is much bigger given the low average productivity. To raise productivity, constraints that the people face have to be removed, including theft and the legal uncertainty regarding access to land and which crops can be cultivated.

Introduction

Urban poverty is increasing dramatically in Kenya. In the four years from 1994 to 1997, the percentage of people living in absolute poverty¹ increased by 15 to 20%. In 1997, the prevalence of absolute poverty in Nakuru town was 41% compared to about 30% in 1994 (Kenya 2001). Most of these people live in slums or slum-like areas with limited access to basic services such as adequate water, schools and health services. Many of the urban poor have no regular work and, hence, no regular income. Moreover, a relatively large percentage of their income is spent on rent and food. As a result of their poverty, these people are excluded from credit facilities with which some kind of small business might be set up.

People’s responses to (urban) poverty are twofold: first, they try to raise or at least maintain their income level and, secondly, they reduce their expenses. Raising or maintaining one’s income can usually only be done by diversifying income sources, mainly in the informal sector. Livelihoods have become increasingly dependent on the informal sector

* African Studies Centre, Leiden, The Netherlands / foeken@fsw.leidenuniv.nl

** Department of Geography, University of Nairobi, Kenya / samowuor@yahoo.com

¹ The ‘absolute poverty line’ is the income needed to obtain basic food and non-food items. For urban areas, this was Ksh 2,648 per month per person in 1997 (Kenya 2001: 11). This is equal to the official minimum wage as set by the government. Recently, on May 1st, 2002, the minimum wage was raised to Ksh. 3,500, which means that the number of people below the poverty line increases automatically as these official measures usually have little impact on the wages paid by the employers to their employees.

and on casual work. Expenses may be cut in areas like education and health (all the more so because under structural adjustment these services have become virtually unaffordable for many of the poor), and cuts can be made on material expenses, as well as on consumption and dietary patterns.

Growing numbers of the urban poor engage in illicit income-generating activities. Hawking without a license and in forbidden areas is common. Women in particular engage in brewing prohibited liquor and in prostitution, in spite of the health risks involved. Drug dealing and peddling is on the increase as well (Kanji 1996). Another illegal activity that has become widespread is growing food within the city limits. This is now an important coping mechanism in the context of cuts in food subsidies, increases in the cost of living and decreasing household purchasing power.

As any visitor can observe during the right season, crop cultivation (as well as livestock keeping) is very common in Nakuru town. This paper explores this practice in some detail. What crops are cultivated and on what types of plots? Who cultivates? What types of inputs are used and on which plots? Do different people use different inputs? What yields are being realised? Do harvests vary with types of plots, with household characteristics and with types of inputs? Why do people cultivate crops? What problems do they face? Who benefits and in what ways? How can crop cultivation in town be improved? What role does the municipality play? The paper tries to answer these questions and follows the sequence of the questions raised. First, however, a general discussion of crop cultivation in Sub-Saharan Africa and more particularly in Kenya is presented, followed by a brief description of Nakuru town and some methodological considerations.²

Urban crop cultivation in Sub-Saharan Africa

Farming in town is a common feature of Sub-Saharan Africa (Obudho & Foeken 1999). It is estimated that as much as 40% of the urban population in Africa is involved in urban agriculture (Mougeot 1994). Studies have been carried out across the continent and in Kenya,³ and from these, the following picture arises.

² This paper is largely based on a more extensive working paper (Foeken & Owuor 2002) and deals solely with crop cultivation. For livestock keeping in Nakuru town, see Foeken & Owuor 2000a and 2000b.

³ See e.g. Atakunda & Maxwell 1996 on Kampala (Uganda); Baxter 1994 on South Africa; Brock 1999 on Cotonou (Benin); Byerley 1996 on Gaborone (Botswana); Diallo 1993 on western Africa; Dongus 2000 on Dar es Salaam (Tanzania); Drakakis-Smith *et al.* 1995 on Harare (Zimbabwe); Drescher 1996 on Lusaka (Zambia); Eberhard 1989 on Cape Town (South Africa); Egziaber 1994 on Addis Ababa (Ethiopia); ENDA-Zimbabwe 1996 on Harare (Zimbabwe); Gbadegesin 1991 on Ibadan (Nigeria); Gefu 1992 on Zaria (Nigeria); Gumbo & Ndiripo 1996 on Harare (Zimbabwe); Lourenço-Lindell 1996 on Bissau (Guinea-Bissau); Maxwell 1994 and 1995 on Kampala (Uganda); Mbiba 1995 on Zimbabwe; Mianda 1996 on Kinshasa (Congo DR); Mlozi *et al.* 1992 on Tanzania; Mlozi 1996 on Dar es Salaam (Tanzania); Mosha 1991 on Tanzania; Obosu-Mensah 1999 on Accra (Ghana); Rakodi 1988 on Lusaka (Zambia); Rogerson 1994 on South Africa; Sanyal 1985 on Lusaka (Zambia); Sawio 1993 and 1994 on Dar es Salaam (Tanzania); Schilter 1991 on Lomé (Togo); Sheldon 1991 on Mozambique; Tricaud 1987 on Ibadan (Nigeria) and Freetown (Sierra Leone); Vennetier 1961 on Pointe Noire (Congo); Villien 1988 on Bangui (Central African Republic). For *Kenya*, see

Farming is undertaken wherever land is available. In built-up areas, this can be in one's own compound ('backyard farming' or 'on-plot farming') or on land belonging to someone else ('off-plot farming' or 'open space farming'), the owner being either the government or a private institution or person. Farming is particularly common on the outskirts of urban centres, on formerly rural land that has now become part of the urban centre due to boundary extensions ('peri-urban farming'). In these zones, both small-scale and large-scale farming can be found. However, as the urban centre grows, these areas gradually lose their rural character and farming becomes increasingly of the other two types.

Farming in town has increased enormously over the past two decades due to the economic crisis that prevailed in most African countries. For the poor, increasing their food security is usually the main motivation, and for some it is even a survival strategy. Nevertheless, many of the poor also sell some of their produce, partly to be able to pay for other basic household needs, but also because some crops are perishable and cannot be stored and/or because storage space is unavailable. For middle-income and high-income households, commercial considerations are usually of more importance than among the poor, although the consumption of self-produced vegetables and milk is often highly valued. But for most of these households, the basic reason to do so is the same as for the poor, namely, as is often stated by the farmers themselves, "to subsidise my income".

The majority of African urban farmers are women. In most parts of Africa, women have traditionally been responsible for household food provision and farming is relatively easy to combine with the care of children. Women also often have lower educational levels than men, so it is difficult for them to compete in a shrinking labour market. Farming may, thus, be the only option left to them in a situation of unemployment and poverty. Several studies have found that the number of female-headed households is disproportionately high among urban farmers. It has also been shown that recent migrants often do not practise urban farming. A person has to be settled and have access to the right networks in order to be able to gain access to a piece of land.

The crops grown are mostly basic food crops such as maize, beans, cassava, sorghum, rice and yams. A wide range of vegetables is also cultivated, some of which are often sold because of their perishability and because there is a ready market available. Some urban farmers grow crops such as tomatoes, spinach and lettuce solely for commercial purposes but this is more common in western Africa than in eastern and southern Africa. Tree crops are not very commonly found due to the uncertainty of land tenure that many urban farmers experience.

Urban farmers face various constraints such as irregular rainfall, drought, flooding, water logging, poor soils, pests and disease, and the destruction of crops by animals, all of which are no different from the problems faced by rural farmers. Other problems, however, are more specifically related to the urban context and particularly confront the poor who practise off-plot farming. Examples include uncertainty regarding land tenure, theft of

e.g. Dennery 1996; Foeken & Mwangi 2000; Freeman 1991; Gathuru 1993; Lado 1990; Lee-Smith *et al.* 1987; Lee-Smith & Memon 1994; Memon & Lee-Smith 1993; Mwangi 1995; and Mwangi & Foeken 1996.

crops, lack of capital and inputs, the threat of eviction and the possible destruction of crops.

In many African countries, urban farming is illegal. By-laws frequently date from colonial times and forbid all agricultural activity within the boundaries of urban centres. However, as the practice has become increasingly widespread over the last two decades, a change in policy has occurred. During the 1960s and 1970s, policies were restrictive in the sense that harassment and the destroying of crops were common measures taken by the local authorities. In the 1980s, however, a gradual shift in attitude took place and nowadays, urban farming is usually permitted as long as it does not become a nuisance. As far as crop cultivation is concerned, the height of a crop, particularly maize, is important because it is said that criminals can hide in it and mosquitoes are assumed to breed in the axils. In some urban centres, for example Dar es Salaam, the local authorities are encouraging the practice of urban farming in order to raise food-supply levels.

Urban agriculture is considered by many as an environmental hazard. It can cause soil erosion, contaminated water can be used for irrigation purposes and crops cultivated along roadsides are prone to air pollution. Since urban farming tends to be more intensive than rural farming, the use of chemical fertilisers, pesticides and insecticides can have an impact on the urban environment, causing pollution in not only the plants but also the soil and groundwater. The recycling of sewage and urban solid waste and turning it into compost is often put forward as a kind of panacea for both urban crop production and the improvement of the urban environment. Although environmental awareness is growing in Africa, such measures have not (yet) been put into practice.

Urban agriculture is attributed a potentially beneficial role in terms of the urban economy, urban food supply and urban development in general (Smit *et al.* 1996). Although largely an informal economic activity, urban farming provides employment as well as an income for those involved. This income can be directly realised through the sale of crops or indirectly as a result of the need to purchase less food (fungible income). At the town or city level, urban farming contributes positively to the provision of affordable food for poorer urban dwellers. However, because of its usually low productivity, the sector's potential in terms of food supply and employment is much higher than presently appreciated, as various studies have indicated (for an overview, see Nugent 2000).

Food producers in town, especially those in vulnerable groups, benefit directly in terms of increased food security (Armar-Klemesu 2000). In Nairobi, Mwangi (1995) found that farming households in a slum area were better off in terms of both energy and protein consumption when compared with non-farming households. Moreover, growing food also helps improve the quality of people's diets by providing fresh fruit and vegetables.

Finally, urban agriculture can play an important role in improving the urban environment and thus in urban development and planning. "Urban farming can help to create an improved micro-climate and to conserve soils, to minimise waste in cities and to improve nutrient recycling, and to improve water management, biodiversity, the O₂-CO₂ balance, and the environmental awareness of city inhabitants" (Deelstra & Girardet 2000: 47).

This is a very concise and general summary of some of the findings of studies under-

taken to date. Although the studies are numerous (see Obudho & Foeken 1999), the knowledge of urban agriculture in Africa is still fragmentary because most studies focus on one or two aspects of urban farming only and mostly in one specific urban centre (usually the national capital) or even a specific part or project within that centre. As Mougeot (1994) rightly observed, particularly lacking are studies in which urban farmers and non-farmers are compared, as well as studies in which various aspects and effects of urban agriculture are analysed. Although the present paper deals with crop cultivation only, a variety of aspects are covered. Moreover, the study did not take place in a national capital but in a medium-sized town (Nakuru), of which there are so many in Africa. Finally, the results are based on a general survey so that an overview of crop cultivation in Nakuru is obtained.

Nakuru town

Nakuru is located in the heart of the Great East African Rift Valley, 160 km northwest of Nairobi. With an average annual rainfall of about 950 mm, the town has a dry sub-humid equatorial climate. There are two rainy seasons: the long rains from March to May and the short rains from October to December.

Over the past 30 years, the population of Nakuru town increased fivefold from 47,000 in 1969 (Kenya 1970) to 239,000 in 1999 (Kenya 2000). At present, Nakuru is the fourth largest town in Kenya. The average annual growth rate between the censuses of 1989 and 1999 was 4.3%, which was much lower than the figure of 6.5% from the previous decade.

Important economic sectors of Nakuru are commerce, industry, tourism, agriculture and tertiary services. Because of its rich agricultural hinterland, Nakuru is called the ‘farmers capital’ of Kenya and is famous for its agro-based industries. Besides being the ‘farmers’ capital’, farming *within* the boundaries of the municipality is widespread. Three forms of farming can be distinguished. First, there is large-scale farming at the fringes of the town. These are the huge farm of the Rift Valley Institute of Technology in the west and the Prison Farm in the northwest. Second, there is a lot of small-scale farming in the peri-urban areas (defined here as the areas between the built-up area and the town boundary), particularly but not exclusively in the southwestern part of the town, which was incorporated after the 1992 boundary extension. With the growth of the town’s population, many of these small farms have been subdivided into smallholder or urban residential plots. Nevertheless, farming is still the dominant activity. Third, there is the less visible form of *intra-urban* agriculture, i.e. within the built-up area. Though very common, compared with the farming activities in the *peri-urban* areas, intra-urban farming is generally a more modest activity (‘micro farming’), largely due to lack of space. It is the latter type of urban farming this paper deals with.

Method

In June-July 1999, a survey among a representative sample of 594 households in the built-up areas of Nakuru town was carried out. A largely structured questionnaire was used (for more details on the methodological aspects, see Foeken & Owuor 2000a). Information was collected on demography, migration history, economic activities, urban crop cultivation, urban livestock keeping, rural farming activities and general food-security issues. The information regarding crop cultivation covered the 1998 growing period. The large majority of the respondents were household heads (40%) or spouses (47%), with the rest being other household members.

Urban farming is defined here as any agricultural activity within the boundaries of an urban centre. Moreover, a lower plot size limit of one square metre is employed. Of the 594 households, 209 (35%) could thus be classified as urban farmers. Of these, 160 (27%) cultivated crops, while 121 (20%) kept livestock in town. In September-October 2000, a more detailed questionnaire was administered to 30 urban farmers. They consisted of 10 crop cultivators, 10 livestock keepers and 10 mixed farmers (i.e. engaged in both crop cultivation and livestock keeping), all randomly selected from the same three farming categories of the 1999 survey. The questionnaire used in this second survey was of a semi-structured nature, with many open questions concerning urban farming activities. Hence, there is additional information on crop cultivation from 20 households.

Plots, crops and inputs

The 160 crop cultivators cultivated 180 plots or 1.1 plots per household, but the plots were not equally distributed over town. Plots for crop cultivation were particularly over-represented in the medium and low-density housing areas. Many dwellings in the high-density areas have no compound and between the houses there is less space than in the less densely housed areas. Most of the plots were located in the farmers' own compounds (61%). This is the category of 'on-plot' farmers. Hence, almost four out of ten plots were located *outside* the homesteads ('off-plot' or 'open space'). The percentage of plots in the cultivator's own compound was somewhat higher in lower-density estates. Nevertheless, over half of the plots in the high-density areas were also in the people's compounds.

The average plot measured 964 square metres.⁴ This means that in 1998 roughly 5,200 acres of land were under crops in the built-up areas. However, there is a wide range of sizes, varying from one square metre to 16,000 square metres (1.6 hectares). Plots in people's compounds were generally smaller than those located elsewhere.

One third of the plots used for crop cultivation were owned by the cultivators themselves, another 46% of the plots were owned by a landlord, while 14% of the plots were on government land. Three respondents did not know who the owner of their plot was. Plots

⁴ For comparative purposes: 1,000 square metres is one tenth of a hectare or a quarter of an acre.

owned by landlords were generally smaller than those owned by the cultivators themselves, while plots owned by the government were relatively large.

A wide range of crops was cultivated in Nakuru in 1998. The three crops that stood out as by far the most important in terms of the number of households cultivating them (around 60%) were kale (*sukuma wiki*), maize and beans. Other common crops are onions, spinach, tomatoes, Irish potatoes, bananas, cowpeas and spider plant (locally known as *saget*). Mixed and inter-cropping was common, though the majority of the plots had no more than three crops. In eight cases, ten or more different crops were found on one single plot. On about a dozen plots, only one crop was being cultivated. There appeared to be no relationship between plot size and the number of crops per plot. Even on the smallest plots (<10m²) all ten major crops were represented, even the more bulky ones.

To some extent, the type of crops cultivated depends on the location of the plot. The variety of crops cultivated in the homesteads was much larger than on the plots located elsewhere. 'Typical' compound crops were kale and bananas and to a lesser extent spinach, onions and tomatoes. Bananas were almost exclusively found in compounds. Maize and beans were found on about half of the compound plots and on 75% and 68%, respectively, of the plots further away. Distance is a limiting factor regarding the choice of which crops to grow and is related to the perishability of the crop, the risk of theft and the use of inputs including labour.

Land ownership is another limiting factor. All crops could be found on plots owned by either the cultivator or by a landlord because over 70% of these plots were located in people's own compounds. Growing crops on government land or on land where the user does not know who it belongs to is much riskier. Hence, on these plots mainly maize and beans and to a lesser extent kale and cowpeas could be found.

The choice of what to grow is also to some extent determined by the person responsible for cultivation. Men were more inclined to grow staples like maize and beans than women, while women, on the other hand, more often cultivated vegetables such as spinach, onions and *saget*. In general, women are more inclined to grow a greater variety of crops. This is related to their traditional function as the household's food provider, attempting to achieve a more balanced diet.

Inputs in crop cultivation include such factors as labour, tools, material inputs, farming techniques, information etc. In this paper, we deal mainly with material inputs and to a lesser extent with labour and information (extension services). The most important material inputs are fertilisers (chemical, manure, crop residues, urban waste), chemical pesticides and insecticides, local or improved seeds/seedlings, and irrigation. Very few of the respondents said they used none of these inputs. Almost all crop cultivators used at least one type of fertiliser, mostly of the traditional (i.e. organic) type: manure, crop residues and urban waste. The manure came either from people's own farm (mixed farming in town) or from a neighbour. Crop residues almost always came from the farmer's own (urban) farm. Chemical fertilisers were used by about one third of the crop cultivators. The use of (chemical) pesticides and insecticides was not widespread: about 30% and 10% of the

cultivators respectively. Most farmers used local (traditional) seeds and seedlings, although more than half used improved materials as well. Finally, irrigation was practised by almost half of the cultivators. All except two obtained their water from a tap (even though the use of domestic water for irrigation purposes is illegal). One of the latter two used sewage water for irrigation and the other applied cattle urine.

Usually, crop cultivation is not a full-time job, though 14% of the crop cultivators interviewed said it was. More than a quarter of the crop cultivators had also used hired labour. This appeared to be more common on plots that had been in use for longer and on plots owned by the cultivator him/herself. Richer households and bigger households were more inclined to hire additional labour while female heads rarely employed hired labour.

Receiving assistance was not common in Nakuru town — only ten respondents — but occurred somewhat more frequently on larger plots (perhaps more visible to the extension officers?) and on plots only recently given over to cultivation. The latter might be related to the finding that younger crop cultivators as well as more educated ones received more assistance than older cultivators and less educated ones. Perhaps, the young and relatively well-educated are better able to find ways of gaining assistance than the older and the less-educated.

It is hypothesised that the use of inputs varies with certain plot characteristics (size, location, distance, ownership), household characteristics (income, size) and characteristics of the person responsible for crop cultivation (sex, marital status, educational level, age). To simplify matters, three mutually exclusive categories of material inputs are compared: chemical inputs, 'sustainable' inputs (i.e. those that are organic, can be recycled and may lead to reasonable yields: manure, crop residues and improved seeds) and irrigation.

Since location and plot distance and, to some extent, size are interrelated, it is not surprising that these characteristics show the same tendencies regarding the use of inputs. Chemical inputs were used more on plots located *outside* people's compounds, somewhat further away and relatively large in size. However, for the use of sustainable inputs, these characteristics showed no differences. Sustainable inputs were more commonly used on plots owned by the users themselves and that have been in use for longer. Irrigation was more often practised in compounds, which is not surprising as most of the water came from people's taps.

Despite the costs involved, the use of chemical inputs is not related to household income. However, richer households did use sustainable inputs and irrigation more often. As households increased in size, more chemical and sustainable inputs were used. This could be expected since there are more mouths to feed. Irrigation shows no relationship with household size and its use is more dependent on the presence of a tap than on anything else.

As for the person responsible for the household's crop cultivation, the large majority were either the male head (on 27% of the plots), the spouse (49%) or the female head (13%). One of the clearest differences regarding the use of inputs concerns the sex of the person responsible. Men were more inclined to use chemical inputs than women, though

women irrigated more often.⁵ A further differentiation of the women into spouses and female heads shows that it is particularly the latter category that practised a relatively 'input-poor' type of crop cultivation. Whatever category of inputs is considered, the female heads used it less frequently. This applies in particular to chemical inputs.⁶ This is likely to be due to the usually low welfare level of female-headed households. Other characteristics of the person responsible, such as educational level, occupational status and age, showed few differences in the use of inputs.

Yields

Crop yields are determined by various factors but by far the most important is the weather, and in particular the amount of rainfall and its distribution throughout the growing season(s). For instance, harvests were quite bad in 1999 and 2000 because of drought. The data presented here concern the 1998 harvests, which was a fairly normal year in terms of rainfall. Other determinants include such factors as labour inputs, material inputs as defined above, farming techniques, etc. The data available are mainly on the types of inputs used, whether additional labour had been hired and whether any assistance had been received.

Table 1 shows the average amounts harvested per crop-cultivating household and per crop type (i.e. the ten most commonly cultivated crops). At first sight, the harvests of the various crops (column 3, in kg) appear modest. Nevertheless when looking at, for instance, maize, the 101 households cultivating this crop harvested about 22,600 kg in 1998, which amounts to some 2.7 million kg *for the built-up area* of Nakuru as a whole (based on the assumption that there were about 70,000 households in 1999⁷). Likewise, the Nakuru crop cultivators produced about 1.1 million kg of kale, 0.8 million kg of beans, 140 tons of onions, 390 tons of spinach, 60 tons of tomatoes, 330 tons of Irish potatoes, 220 tons of cowpeas, 13 tons of bananas and 70 tons of spider plant. If the other 30 less important crops were also included, it is estimated that total crop production in the built-up area of Nakuru town in a normal year would amount to about 6 million kg. If the peri-urban areas of Nakuru town were to be included, this figure would be even higher.

⁵ Chemical fertilisers were used by 57% of the men and 27% of the women. The figures for chemical pesticides were 48% and 25% respectively. Irrigation was practised by 51% of the women, compared with 28% of the men.

⁶ Only 10% of female heads used any chemical input as opposed to 63% of male heads and 50% of spouses.

⁷ This is calculated as follows. The 1989 population of Nakuru Municipality was 164,000 and the number of households 46,741 (Kenya 1997). Hence, the average household size in 1989 was 3.5. The 1999 population was 239,000 (Kenya 2000). With an unchanged average household size, the number of households in 1999 would have been about 68,000. Assuming, however, that the average household size has decreased to 3.4 (which may be a conservative estimate as average household size is likely to be somewhat lower), the number of households then becomes about 70,000.

Table 1 Harvests of major crops cultivated in Nakuru town

crop type	(1) % households cultivating (N=160)	(2) N	(3) average amount harvested (in kg)*
kale (<i>sukuma wiki</i>)	68.1	109	84
maize	63.1	101	224
beans	58.8	94	75
onions	28.1	45	26
spinach	22.5	36	92
tomatoes	21.9	35	15
Irish potatoes	20.0	32	88
cowpeas	17.5	28	67
bananas	16.9	27	4
spider plant (<i>saget</i>)	11.9	19	33

* Only households cultivating that crop (see column 2). During the survey, harvests were given in many different units. To make the figures unequivocal and hence comparable, all units have been translated into kg. As this method implies an element of speculation, the presented average harvests have to be considered as indications only.

Source: 1999 survey

The average harvest from all crops was almost 300 kg per plot (Table 2). With an average plot size of almost 1,000 square metres, the productivity, i.e. the average amount harvested per square metre, was a modest 0.3 kg.⁸ However, there are important differences between the various plot size classes. In general, productivity is higher as plots are smaller.⁹ Of course, one could expect a relatively higher output from the smaller plots as many

Table 2 Mean harvest (all crops) by plot size

plot size (m ²)	N (plots)	mean harvest (kg)	mean plot size (m ²)	harvest per m ² (kg)
<10	18	121	6	20.17
10-99	47	175	37	4.73
100-999	50	191	373	0.51
1000+	53	578	2670	0.22
All plots	168	301	964	0.31

Source: 1999 survey

⁸ In Tables 2, 3 and 4, eleven cases (plots) had to be deleted. Four of these were outliers, i.e. unrealistically high yields on very tiny plots. In the other seven cases, the respondent had indicated “no harvest”, either because s/he did not know or the plot still had to be harvested or the plot had been left idle. Due to the way of obtaining the data (hindsight information), the figures should be seen as no more than indications. What matters are the tendencies.

⁹ Kruskal-Wallis test, significant relationship, p=0.000.

were located in the people's own compound where one is inclined to pay more attention to them than to plots further away.¹⁰ But since many of the plots of the other size categories were also located in the households' compounds,¹¹ it is clear from the figures in Table 2 that plot size is an important determinant of crop yield.

One explanation for the higher output as plots decrease in size can be the use of material inputs. In Table 3, an attempt is made to show the relation between the use of inputs on the one hand and productivity (harvest per m²) on the other, first by taking the eight types of inputs together, and then for the three groups of inputs distinguished in the previous section: chemical inputs, sustainable inputs and irrigation. The table shows that the use of *more* inputs in general leads to higher yields. The figures also reveal that the use of one chemical input does not make a difference but that the use of two or three does. The number of sustainable inputs has no direct influence on productivity level. Finally, and hardly surprising, irrigation has a positive effect on crop yields.¹²

Table 3 Mean harvest (all crops) by use of material inputs

inputs	N (plots)	mean harvest (kg)	mean plot size (m ²)	harvest per m ² (kg)
no. of inputs				
0-2	52	96	466	0.21
3-4	68	292	1247	0.23
5-8	48	536	1103	0.46
no. of chemical inputs ¹				
0	85	135	549	0.25
1	45	248	1153	0.22
2-3	38	736	1669	0.44
no. of sustainable inputs ²				
0	28	123	426	0.29
1	57	207	845	0.24
2-3	83	426	1227	0.35
irrigation				
no	92	253	1313	0.19
yes	76	359	541	0.66

Notes: 1. Chemical fertilisers, chemical pesticides, chemical insecticides.

2. Manure, crop residues, improved seeds/seedlings.

Source: 1999 survey

¹⁰ The average harvest from the plots in the households' own compounds was twice as high as from the plots elsewhere (0.49 and 0.24 kg/m², respectively).

¹¹ For instance, 87% of the plots in the 10-99 m² category, 64% of those in the 100-999 m² category and 38% of the 1,000+ m² category were located in compounds.

¹² There are no significant relationships between number of inputs (be it all inputs, number of chemical inputs or sustainable inputs) on the one hand and productivity on the other. However, there are strong positive correlations between number of inputs and total harvest (Spearman's rank correlation: all inputs: corr. coeff. = 0.45; chemical inputs: corr. coeff. = 0.50; sustainable inputs: corr. coeff. = 0.39). Finally, there is a significant positive relationship between irrigation and productivity (Kruskall-Wallis test, p=0.000).

Another factor to account for the high yields of small plots concerns labour. For instance, the smaller a plot, the more frequently the cultivator will be inclined to weed it as it is not so time-consuming. Moreover, it was surprising to find that hired labour was used much more frequently on the *smallest* plots *and* on the *largest* plots. The average harvest of the plots where hired labour had been used was twice as high as that of plots where no additional labour had been hired.¹³

Farming techniques also determine how much is produced. No direct observations have been made, but who received technical assistance and who did not was recorded. Although there were only ten crop cultivators who had received assistance, it is conspicuous that their productivity was almost three times higher than all other cultivators put together.¹⁴

Table 4 shows mean harvests and productivity for some household characteristics. As far as household income is concerned, yields per square metre were somewhat higher in the lowest income group and even more so in the highest income group. The former could be explained by the fact that the poor rely more on urban farming for their livelihood than those who are better off. The relatively high yields of the rich households may be caused by the fact that irrigation is more common in this group than in the other ones.

One could expect larger households to realise bigger harvests because, in theory, they have more labour at their disposal. This is to some extent confirmed by the figures in Table 4. The largest households (8+ category) seemed to have a relatively low productivity but given the large average plot size in this group and the fact that they realised about the same

Table 4 Mean harvest (all crops) by household characteristics

household characteristic	N (plots)	mean harvest (kg)	mean plot size (m ²)	harvest per m ² (kg)
household income (Ksh/month)				
<5,000	45	357	930	0.38
5,001-10,000	62	228	972	0.23
10,001-20,000	39	237	1003	0.24
20,001+	18	608	859	0.71
household size				
1 member	7	137	179	0.77
2-4 members	55	257	1157	0.22
5-7 members	74	256	651	0.39
8+ members	32	516	1529	0.34
person responsible				
male head	42	401	936	0.43
female head	22	137	688	0.20
spouse	85	241	1071	0.23
other h'hold member	17	483	677	0.71

Source: 1999 survey

¹³ Namely 0.42 and 0.24 kg/m² respectively.

¹⁴ Namely 0.76 and 0.28 kg/m² respectively.

yields as the 5-7 members category (with less than half the average plot size), their productivity can be viewed from a different perspective. The relatively high yields of the seven single-person households is conspicuous, but is probably closely related to the combination of small plot size and intensive labour.

Finally, it makes a difference as to who is responsible for crop cultivation. In general, men obtained higher yields than women.¹⁵ This is related to the men's higher level of inputs, especially chemical fertilisers and chemical pesticides. Female heads in particular had very poor yields (Table 4), not only compared with male heads but also with the spouses of male heads, because the spouses cultivate much larger plots. 'Other household members' include children, a brother or sister of the head, or a parent. The fact that they obtained quite high yields is possibly due to higher labour inputs.¹⁶

Benefits

In assessing the benefits of urban crop cultivation, different levels and aspects can be distinguished. How much does it contribute to the food supply of the households concerned? How much does it contribute to household income? How much does it contribute to the food supply of Nakuru town as a whole? How many people find employment in this sector? These questions are dealt with below.

It is possible to assess the contribution of the food produced to the energy requirements of the producers themselves and of the Nakuru population as a whole. In 1998, the six million kilograms of crop production (in the built-up area) constituted about 8% of the total energy requirements of the population of Nakuru. If the producers consumed all of it themselves, it would constitute about 30% of their energy requirements. However, about 75% of the harvest of the ten main crops was consumed in the producers' households. Hence, the contribution to the producers' energy requirements would amount to about 22%.¹⁷

Since roughly a quarter of all produce is sold, an estimated 1.5 million kilograms of crops produced within the built-up area of the town were marketed locally. Thus, many other households benefit from urban food production by obtaining food at prices that are likely to be lower than normal market prices.

The importance of crop cultivation in Nakuru can also be measured in a more subjective way, namely by the relevance attached to the activity by the people concerned. For the large majority of the respondents, the extra food produced was mentioned as one of the main reasons to cultivate crops in town. For some, income was more important, while for

¹⁵ Namely 0.46 and 0.24 kg/m² respectively. The difference cannot be explained by differences in plot size, as the average sizes are not very different (861 m² for the male heads and 1033 m² for the female heads and spouses together; see Table 4).

¹⁶ None of the relationships in Table 4 are statistically significant.

¹⁷ See Foeken & Owuor 2002 for the calculation of the energy from urban crop cultivation (Appendix 3) and of the percentages self-consumed (Appendix 2).

five respondents the cultivation of crops was more of a hobby. For over 40% of the respondents, the produce from urban crop cultivation constituted half or more of the food they consumed. For another 51% it added 'less than half' or 'a small portion'. Only a small minority stated that urban crop production was of negligible importance in terms of household food consumption. As could be expected, the contribution of urban crop cultivation to household food consumption, as perceived by the respondents, was larger among low-income households than among high-income households.¹⁸

In more general terms, urban crop cultivation formed for the large majority of the respondents at least an 'additional food and/or income source'. For about a quarter it was a 'major source'. Some (7%) even stated that they 'could not survive without it'. These percentages show no marked differences for different income groups. For poor and rich households alike, crop cultivation is both a food and income source. Only the percentage of households stating that they 'could not survive without urban crop cultivation' was higher in the lowest income group (14%) than among the other groups (4.5%).

It is difficult to assess the importance of urban crop cultivation in terms of employment. In Nakuru as a whole (i.e. in the built-up area), some 19,000 persons in the town were directly involved in the cultivation of crops in 1999.¹⁹ For 14% of the persons responsible for their household's crop cultivation in the sample (i.e. some 2,650 people in the town), it was a full-time job. The 19,000 persons are those household members who participate in the cultivation process. In reality, this number may be higher as in many households more than one person may be involved. Although for all these people it is unpaid labour, urban farming generates income as about one quarter of all produce is sold. In addition, in more than a quarter of the crop-cultivating households hired labour was used. In other words, for about 5,200 persons urban farming constituted a form of paid labour.²⁰ For these people, working in urban crop cultivation is an income-generating activity, albeit of an irregular and seasonal nature.

Potential

It has already been noted that the average crop yield was quite low (0.3 kg/m²) and that the productivity of small plots was much higher than that of larger plots. Consequently if the productivity of the small plots could be realised by *all* plots, a much larger harvest would be possible. It is unrealistic to take the high productivity of the very small plots (20 kg/m²) as a starting point, but even if the targeted productivity level were a modest 1 kg/m², the

¹⁸ For 60% of the poorest crop cultivators (i.e. those with a monthly household income of Ksh 5,000 or less), the self-produced crops constituted at least half of the food consumed in the household. This applied to 23% of the highest income group (over Ksh 20,000/month).

¹⁹ Calculated as follows: 27% of the sampled households cultivated crops. Assuming that there were about 70,000 households in Nakuru town in 1999 and that one person per household is the one doing the work, the total number of people directly involved is 18,900.

²⁰ Calculated as follows: 27.5% of the crop-cultivating households used hired labour = 44 households or 7.4% of the total sample. For 70,000 households in Nakuru as a whole, the figure is then 5,185 persons.

total crop harvest would be three times higher than it was in a fairly normal year like 1998. Given that the production in that year contributed an estimated 8% to the total energy requirements of the Nakuru population, it would mean that urban crop cultivation (in the built-up area) could contribute at least 25%. In theory, if the productivity of the plots in the 10-99 square metre category could be realised (4 kg/m²), a town like Nakuru could be self-sufficient as far as crops are concerned, at least in years with sufficient rainfall.

However, a number of limitations have to be overcome to increase current yields. From the perspective of the farmers, various problems were encountered affecting yields. Of these, theft of crops, inadequate rainfall, destruction by animals and pests/insects were mentioned most frequently. Of these, theft is a typical urban problem. This has been found to be a major problem in many other studies as well. Only a few respondents mentioned other urban constraints such as harassment and lack of space/land. The same applies to such problems as a lack of inputs, capital and labour. Conspicuously, 26 cultivators (16%) said not to have had any specific problem, in other words were content with the yields realised. This probably shows that quite a number of crop cultivators are not aware of the potential of this activity.

Not all problems can be easily solved. Rainfall will always be a critical factor. Raising yields implies that more inputs and capital are needed, but these are serious constraints for many farmers. Other problems, however, can be tackled more easily, for example, theft, destruction by animals, pests/insects, disease, etc. The fact that only few urban crop cultivators received any assistance may be significant in this respect.

Uncertainty regarding access to land is another limiting factor. Forty per cent of the plots were located outside the people's own compounds. More than 20% of the plots were either owned by the government or the owner was unknown. And indeed, yields were relatively high on the *shambas* in compounds and low on plots owned by the government or where the owner was unknown. Hence, if the cultivator could be certain that s/he could use a plot undisturbed for a period of perhaps five years, s/he would undoubtedly be more inclined to invest in farming activities that in turn would result in higher yields.

In assessing the potential of the sector, the ecological aspect is a critical factor. Urban farming is often considered a menace for towns in terms of the environment and the health of the people, even though crop cultivation is usually considered less harmful than livestock keeping. Nevertheless, crops cultivated on polluted sites or irrigated with untreated water or polluted with exhaust fumes are thought to be unhealthy. This is to some extent confirmed by a study by Nyandwaro (forthcoming). The soil on the dumpsite, where maize and beans are extensively cultivated, showed high concentrations of heavy metals such as zinc, lead, cadmium and mercury. Concentrations of heavy metals, particularly cadmium, in sewage water, which in some areas is widely used for irrigation, were also high. Soils in these areas were quite heavily polluted with zinc and lead. As a result, plants cultivated in the area of Rhonda Sewage showed high concentrations of zinc. Plants growing near roads and prone to exhaust fumes appeared *not* to contain higher

concentrations of heavy metals than plants grown at a greater distance from traffic.²¹

Attitudes regarding urban farming among *non*-farming Nakurians as well as officials were quite negative (Nyandwaro forthcoming). In general, farming in town is considered to be unhygienic. And although attitudes towards urban livestock keeping are more negative than towards urban crop cultivation, the quality of crops grown in town was generally thought to be lower than that of crops from rural areas. More specifically, crops grown on dumpsites and those irrigated with sewage water were widely felt to be contaminated and to constitute a health risk. About half of the respondents had a similar opinion about crops cultivated near large industrial complexes or along roadsides.

Among farmers, there appeared to be an awareness of the potentially negative environmental and health impact of crop cultivation in town, particularly because of the use of chemical inputs (Nyandwaro forthcoming). Soil, groundwater and crop pollution were all mentioned. Some of the farmers indicated that they intended to stop using chemical inputs and use alternatives instead.

A positive environmental observation is that most livestock waste in town, and especially that of large livestock, is being reused for local crop cultivation (Foeken & Owuor 2000b). Still, there is an opportunity here for the local authorities to cooperate further with local community groups (although there are already good examples of this type of cooperation in Nakuru).

Other limitations lie at the level of the municipality. According to municipal by-laws, farming is forbidden within the town's boundaries. The problem for the municipality is that enforcing such rulings is difficult and thus farming in town has become a common phenomenon. Nowadays, the municipality allows crop cultivation as long as the crop is less than one metre high. Maize is thus forbidden, the argument being that thieves and other criminals can hide on plots growing that crop. Nevertheless, maize can be seen growing everywhere and although crop slashing has hardly ever occurred recently — and indeed, very few of the respondents mentioned harassment as a constraint — cultivators cannot count on being 'spared'.

Despite the finding that average yields are quite low, the perception of most farmers is different. Of the 20 respondents in the crop-cultivating households in the in-depth survey, only two were *not* satisfied with their yields. Nevertheless, most respondents did admit that yields could be improved. Money is often an important constraint. Several farmers indicated that if they had sufficient money they would be able to irrigate their crops better or buy chemicals, fertilisers and certified seeds or materials to fence their plot to keep out loose animals. The government could come in here by providing credit facilities. One respondent, saying she "could do better", indicated an alternative way of obtaining credit, namely by joining a farmers' savings and credit society.

²¹ That does not mean that growing crops along (major) roads is without risks. In Dar es Salaam, relatively high accumulations of lead and cadmium were found in the topsoil along one of the major roads compared with locations at some distance of roads, even though these levels were (still) below any critical threshold (Amend & Mwaisango 1998).

Only three farmers said they would be able to improve their yields if they had more space. Others stressed technical improvements on their existing plots, such as crop rotation, applying manure to increase soil fertility or using more chemical inputs. One respondent came up with an innovative idea showing his resourcefulness as well as his environmental awareness. By keeping chickens on his plot, he said he could improve his crop yields “by shifting the chicken house to various parts of the plot, so that I can use that part as a seed bed because it has manure from the chicken droppings”.

It should be noted that when asked about possible improvements to their urban farming practices, many respondents referred in their answers in the first instance to their livestock-keeping activities. Livestock generate more income than crops, which are grown mainly for subsistence. Investing in livestock is seen as more profitable than investing in crop cultivation.

Conclusions

The increase of crop cultivation in Nakuru town can only be assessed in the context of increases in the cost of living and decreasing household purchasing power. Indeed, the reasons given for turning to this activity confirm that for most people it is a way to secure their food supply and reduce costs on food purchases. Nowadays, almost 30% of the Nakuru households are engaged in crop cultivation in town. However, this estimate may be too low, as many people do not consider the growing of crops in their compounds to be a form of agriculture. Altogether, an estimated six million kilograms of crops were produced in 1998. This covered some 30% of the energy requirements of the households involved or 8% of the energy requirements of the town's entire population.

The importance of these figures speaks for itself, all the more so because yields could, at least potentially, be much higher. Plot size proved to be a major determinant of productivity: the smaller the plot, the higher the yield. In other words, if larger plots could be as productive as smaller plots, Nakuru could produce a substantial part of the food crops it needs within its own boundaries. However, as shown by this study, more irrigation, more inputs, more labour and more technical assistance are required. In general, this involves more capital, which is a major constraint for low-income households, and for female-headed households in particular. More research on the technical aspects of farming in town is necessary in order to obtain detailed knowledge about the present farming practices and to be able to raise the productivity. How productive the sector can be is shown by the example of Havana where yields of 14 kg/m² are realised (see Gonzalez Novo & Murphy 2000). Closer to home, in the Tanzanian cities of Dar es Salaam, Arusha and Dodoma, trials have shown that yields of leafy vegetables can be raised substantially to a level much higher than at present in Nakuru (Jacobi 1997).

Urban planners tend to consider urban farming as a temporal feature. According to the *Strategic Nakuru Structure Plan*, this vision prevails in Nakuru as well: “Economically, urban agriculture is a transitory activity which eventually gives way to more traditional

urban functions” (MCN 1999: 44). Besides the fact that agriculture has always been part of any urban economy (and in that sense can be seen as a traditional urban function), it should be realised that “although some forms of urban agriculture are based on temporal use of vacant lands, urban agriculture as such is a permanent feature of many cities in developing (...) countries and is thus an important component for sustainable city development” (de Zeeuw *et al.* 2000: 162).

How urban agriculture can be integrated into urban planning policies was the subject of a five-day workshop held in Havana in October 1999 (Bakker *et al.* 2000). The following recommendations were formulated (de Zeeuw *et al.* 2000). First, urban agriculture should be integrated in urban land use policy by removing legal restrictions and by integrating agriculture in urban development planning (urban zoning, promotion of urban agriculture as a temporal use of vacant public and private lands, promotion of multi-functional land use and encouragement of community participation in the management of urban open spaces, and inclusion of space for individual or community gardens in new public housing projects and private building schemes). Secondly, urban agriculture should be integrated in urban food security and health policy by improved access of urban farmers to agricultural research, technical assistance and credit services, by improved systems for input supply and product distribution, and by creating awareness of health risks through urban agriculture. Finally, urban agriculture should be integrated in environmental policy by promotion of safe re-use of urban organic wastes and waste water by urban farmers, and by promotion of ecological farming methods.

All this may sound rather utopian in the Sub-Saharan African context. In the case of Nakuru town, however, some preconditions for successful policy formulation and implementation are fulfilled. First, there is a generally positive attitude towards urban agriculture on the side of the local authorities as well as the population. Secondly, in the context of *Localising Agenda 21*, Nakuru town strives for sustainable urban development; hence there is the political will to integrate urban agriculture in the urban planning process. Thirdly, among the Nakuru farmers there is a general awareness of the environmental dangers of their activities. And finally, community-based organisations in the fields of urban agriculture and environmental management do exist in Nakuru and, moreover, have good working relations with the local authorities.

Acknowledgement

We wish to thank Wijnand Klaver for his assistance with the statistical tests and Ann Reeves for the English correction.

References

- AMEND, J. & E. MWAISANGO (1998), *Status of soil contamination and soil fertility. The case of urban agriculture in Dar es Salaam*. Dar es Salaam: Urban Vegetable Promotion Project.
- ARMAR-KLEMESU, M. (2000), Urban agriculture and food security, nutrition and health. In: N. Bakker *et al.*, eds., *Growing cities, growing food. Urban agriculture on the policy agenda*, pp. 99-118. Feldafing (Germany): Deutsche Stiftung für internationale Entwicklung (DSE).
- ATAKUNDA, G. & D. MAXWELL (1996), Farming in the City of Kampala: Issues in urban management. *African Urban Quarterly* 11(2-3): 261-272.
- BAKKER, N., M. DUBBELING, S. GUENDEL, U. SABEL-KOSCHELLA & H. DE ZEEUW, eds., *Growing cities, growing food. Urban agriculture on the policy agenda*. Feldafing (Germany): Deutsche Stiftung für internationale Entwicklung (DSE).
- BAXTER, J. (1994), *Urban agriculture in South Africa: General perspectives and local experience*. Johannesburg: University of Witwatersrand.
- BROCK, B. (1999), Actual and potential contribution of urban agriculture to environmental sanitation: A case study in Cotonou. In O. Smith, ed., *Urban agriculture in West Africa: Contributing to food security and urban sanitation*, pp. 126-137. Ottawa: International Development Research Centre (IDRC).
- BYERLEY, A. (1996), *Urban agriculture in Botswana: A preliminary investigation of extent, issues and potential (a minor field study)*. Uppsala: Swedish University of Agricultural Sciences.
- DEELSTRA, T. & H. GIRARDET (2000), Urban agriculture and sustainable cities. In: N. Bakker *et al.*, eds., *Growing cities, growing food. Urban agriculture on the policy agenda*, pp. 43-66. Feldafing (Germany): Deutsche Stiftung für internationale Entwicklung (DSE).
- DENNERY, P. (1996), Urban producers' decision-making in Kibera, Nairobi, Kenya. *African Urban Quarterly* 11(2-3): 189-200.
- DE ZEEUW, H., S. GUENDEL & H. WAIBEL (2000), The integration of agriculture in urban policies. In: N. Bakker *et al.*, eds., *Growing cities, growing food. Urban agriculture on the policy agenda*, pp. 161-180. Feldafing (Germany): Deutsche Stiftung für internationale Entwicklung (DSE).
- DIALLO, S. (1993), *Urban agriculture research in West Africa: Record, capacities and opportunities*. Ottawa: IDRC, Cities Feeding People Series, Report no. 5.
- DONGUS, S. (2000), *Vegetable production on open spaces in Dar es Salaam – Spatial changes from 1992 to 1999*. Dar es Salaam: Urban Vegetable Promotion Project.
- DRAKAKIS-SMITH, D., T.A.S. BOWYER-BOWER & D. TEVERA (1995), Urban poverty and urban agriculture: An overview of the linkages in Harare. *Habitat International* 19(2): 183-194.
- DRESCHER, A.W. (1996), Urban microfarming in central Southern Africa: A case study of Lusaka, Zambia. *African Urban Quarterly* 11(2-3): 226-245.
- EBERHARD, R. (1989), *Urban agriculture: The potential in Cape Town: Literature review*. City of Cape Town: Town Planning Branch, Working Paper 89/E2.
- EGZIABHER, A.G. (1994), Urban farming, cooperatives, and the urban poor in Addis Ababa. In A.G. Egziabher *et al.*, *Cities feeding people: An examination of urban agriculture in East Africa*, pp. 85-104. Nairobi/Ottawa: IDRC.
- ENDA-ZIMBABWE (1996), *Urban agriculture in Harare: Results and recommendations of a household survey conducted in Harare*. Harare: ENDA-Zimbabwe.
- FOEKEN, D. & A.M. MWANGI (2000), Increasing food security through urban farming in Nairobi. In: N. Bakker *et al.*, eds., *Growing cities, growing food. Urban agriculture on the policy agenda*, pp. 303-328. Feldafing (Germany): Deutsche Stiftung für internationale Entwicklung (DSE).
- FOEKEN, D. & S.O. OWUOR (2000a), *Urban farmers in Nakuru, Kenya*. Leiden/Nairobi: African Studies Centre/Centre for Urban Research, ASC Working Paper no. 45 (also on website www.cityfarmer.org/nakuru.html)
- FOEKEN, D. & S.O. OWUOR (2000b), Livestock in a middle-sized East-African town: Nakuru. *Urban Agriculture Magazine* 1(2): 20-22.
- FOEKEN, D. & S.O. OWUOR (2002), *Crop cultivation in Nakuru town, Kenya: Practice and potential*. Leiden/Nairobi: African Studies Centre/Centre for Urban Research, ASC Working Paper.

- FREEMAN, D.B. (1991), *A city of farmers: Informal urban agriculture in the open spaces of Nairobi, Kenya*. Toronto: McGill University Press.
- GATHURU, P.K. (1993), Women in sustainable urban improvement: Urban farming in an informal settlement of Nairobi. *Urban Perspectives* 4(1): 14-24.
- GBADEGESIN, A.S. (1991), Farming in the urban environment of a developing nation. A case study from Ibadan metropolis in Nigeria. *The Environmentalist* 11: 105-111.
- GEFU, J.O. (1992), Part-time farming as an urban survival strategy: A Nigerian case study. In: J. Baker & P.O. Pedersen, eds., *The rural-urban interface in Africa: Expansion and adaptation*, pp. 295-302. Uppsala: The Scandinavian Institute of African Studies.
- GONZALEZ NOVO, M. & C. MURPHY (2000), Urban agriculture in the City of Havana: A popular response to a crisis. In: N. Bakker *et al.*, eds., *Growing cities, growing food. Urban agriculture on the policy agenda*, pp. 329-347. Feldafing (Germany): Deutsche Stiftung für internationale Entwicklung (DSE).
- GUMBO, D. & T.W. NDIRIPO (1996), Open space cultivation in Zimbabwe: A case study of Greater Harare. *African Urban Quarterly* 11(2-3): 210-214.
- JACOBI, P. (1997), *Importance of vegetable production in Dar es Salaam, Tanzania*. Dar es Salaam: Urban Vegetable Promotion Project.
- KANJI, N. (1996), Review of urbanization issues affecting children and women in the eastern and southern African region. New York: Unicef.
- KENYA, REPUBLIC OF (1970), *Kenya population census 1969, Vol. 1*. Nairobi: Government Printer.
- KENYA, REPUBLIC OF (1997), *Nakuru District development plan 1997-2001*. Nairobi: Government Printer.
- KENYA, REPUBLIC OF (2000), *Economic survey 2000*. Nairobi: Government Printer.
- KENYA, REPUBLIC OF (2001), *Poverty reduction strategy paper for the period 2001-2004*. Nairobi: Ministry of Finance and Planning.
- LADO, C. (1990), Informal urban agriculture in Nairobi, Kenya: Problem or resource in development and land use policy planning. *Land Use Policy*, July 1990: 257-266.
- LEE-SMITH, D., M. MANUNDU, D. LAMBA & P.K. GATHURU (1987), *Urban food production and the cooking fuel situation in urban Kenya*. Nairobi: Mazingira Institute.
- LEE-SMITH, D. & P.A. MEMON (1994), Urban agriculture in Kenya. In: A.G. Egziabher *et al.*, *Cities feeding people: An examination of urban agriculture in East Africa*, pp. 67-84. Nairobi/Ottawa: IDRC.
- LOURENÇO-LINDELL, I. (1996), How do the urban stay alive? Food production in a squatter settlement of Bissau. *African Urban Quarterly* 11(2-5): 163-168.
- MAXWELL, D. (1994), The household logic of urban farming in Kampala. In: A.G. Egziabher *et al.*, *Cities feeding people: An examination of urban agriculture in East Africa*, pp. 47-65. Nairobi/Ottawa: IDRC.
- MAXWELL, D. (1995), Alternative food security strategy: A household analysis of urban agriculture in Kampala. *World Development* 23(10): 1669-1681.
- MBIBA, B. (1995), *Urban agriculture in Zimbabwe: Implications for urban management and poverty*. Aldershot: Avebury.
- MCN (1999), *Strategic Nakuru Structure Plan. Action plan for sustainable urban development of Nakuru town and its environs*. Nakuru: Municipal Council of Nakuru (Final draft).
- MEMON, P.A. & D. LEE-SMITH (1993), Urban agriculture in Kenya. *Canadian Journal of African Studies* 27(1): 25-42.
- MIANDA, G. (1996), Women and garden produce of Kinshasa: The difficult quest for autonomy. In: Parvin Gharayshi & Claire Belanger, eds., *Women, work and gender relations in developing countries*. Westport, Conn.: Greenwood Press.
- MLOZI, M.R.S. (1996), Urban agriculture in Dar es Salaam: Its contribution to solving the economic crisis and the damage to its environment. *Development Southern Africa* 13(1): 47-65.
- MLOZI, M.R.S., I.J. LUPANGA & Z.S.K. MVENA (1992), Urban agriculture as a survival strategy in Tanzania. In: J. Baker & P.O. Pedersen, eds., *The rural-urban interface in Africa: Expansion and adaptation*, pp. 284-294. Uppsala: The Scandinavian Institute of African Studies.
- MOSHA, A.C. (1991), Urban farming practices in Tanzania. *Review of Rural and Urban Planning in Southern and Eastern Africa* 1: 83-92.
- MOUGEOT, L. (1994), *Urban food production: Evolution, official support and significance*. Ottawa: IDRC, Cities Feeding People Series, Report 8.

- MWANGI, A.M. (1995), *The role of urban agriculture in food security in low-income areas in Nairobi, Kenya*. Leiden: African Studies Centre.
- MWANGI, A.M. & D. FOEKEN (1996), Urban agriculture, food security and nutrition in low-income areas in Nairobi, Kenya. *African Urban Quarterly* 11(2-3): 170-179.
- NUGENT, R. (2000), The impact of urban agriculture on the household and local economies. In: N. Bakker *et al.*, eds., *Growing cities, growing food. Urban agriculture on the policy agenda*, pp. 67-98. Feldafing (Germany): Deutsche Stiftung für internationale Entwicklung (DSE).
- NYANDWARO, E.O. forthcoming, *Environmental impact of urban farming: A case study of Nakuru town. Kenya*. Nairobi: Kenyatta University of Nairobi, MSc thesis.
- OBOSU-MENSAH, K. (1999), *Food production in urban areas. A study of urban agriculture in Accra, Ghana*. Aldershot: Ashgate.
- OBUDHO, R.A. & D. FOEKEN (1999), *Urban agriculture in Africa. A bibliographical survey*. Leiden/Nairobi: African Studies Centre/Centre for Urban Research, ASC Research Report 58.
- RAKODI, C. (1988), Urban agriculture: Research questions and the Zambian experience. *Journal of Modern African Studies* 26(3): 495-515.
- ROGERSON, C.M. (1994), Urban agriculture in South Africa: Scope, issues and potential. *GeoJournal* 30: 21-28.
- SANYAL, B. (1985), Urban agriculture: Who cultivates and why? A case study of Lusaka, Zambia. *Food and Nutrition Bulletin* 7(3): 15-24.
- SAWIO, C. (1993), *Feeding the urban masses? Towards an understanding of the dynamics of urban agriculture and land use change in Dar es Salaam*. Worcester: Clark University, unpublished PhD thesis.
- SAWIO, C. (1994), Who are the farmers of Dar es Salaam? In: Axumite G. Egziabher *et al.*, *Cities feeding people: An examination of urban agriculture in East Africa*, pp. 25-46. Nairobi/Ottawa: IDRC.
- SCHILTER, C. (1991), L'agriculture urbaine: Une activité creative d'emplois en économie de survie. Le cas de Lomé. *Cahiers des Sciences Humaines* 27(2): 159-168.
- SHELDON, K. (1991), *Farming in the city: Urban women in agricultural work in Mozambique*. Los Angeles: University of California.
- SMIT, J., A. RATTA & J. NASR (1996), *Urban agriculture: Food, jobs and sustainable cities*. New York: United Nations Development Programme (UNDP).
- TRICAUD, P.M. (1987), *Urban agriculture in Ibadan and Freetown*. Tokyo: United Nations University, Food Energy Nexus Programme.
- VENNETIER, P. (1961), La vie agricole urbaine à Pointe Noire (Congo). *Cahiers d'Outre-Mer* 14(55): 60-84.
- VILLIEN, F. (1988), L'agriculture dans la ville: L'exemple de Bangui. *Cahiers d'Outre-Mer* 41(163): 163-180.