Crop cultivation in Nakuru town, Kenya: practice and potential

Foeken, D.W.J.; Owuor, S.; Klaver, W.

African Studies Centre
Leiden, The Netherlands

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Dick Foeken, Samuel O. Owuor
& Wijnand Klaver

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African Studies Centre
P.O. Box 9555
2300 RB Leiden
The Netherlands

Telephone +31-71-5273372
Fax +31-71-5273344
E-mail asc@fsw.leidenuniv.nl
Website http://asc.fsw.leidenuniv.nl

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Foreword

The underlying paper is based on surveys carried out in the context of the Nakuru Urban Agriculture Project (NUAP). NUAP is a research project on farming by urban dwellers in Nakuru town, Kenya, and is a joint undertaking by the University of Nairobi (Department of Geography, Department of Urban and Regional Planning, Centre for Urban Research) and the African Studies Centre, Leiden, The Netherlands. The bulk of the contents of the paper is based on the data obtained during a general survey among almost 600 households in June-July 1999. Additional information collected during a second (in-depth) survey in October-November 2000 is also used. The present paper is a deepening of the chapter on crop cultivation in an earlier report written by the same authors and that is entitled *Urban farmers in Nakuru, Kenya* (2000).

Many people were, directly or indirectly, involved in the 1999 survey. We would like to thank first of all the representatives of the local officers who were, in one way or the other, helpful with the realisation of the work, in particular Mr. S.C. Kiarie (Public Health Officer), Mr. Paul G. Chege (Town Planner), Mr. N. Githire (Municipal Architect), Mr. J. Michoma (Director of Housing and Social Services), Mr. J.T. Muchoki (District Agricultural Officer), and Mr. H. Musoga (Provincial Physical Planning Officer). Our special gratitude goes to Ms. Miriam Muthoni Ngotho (SENVINET: Schools Environmental Network) and Mr. William N. Keyah (Catholic Diocese of Nakuru, Agricultural & Rural Development Programme) who were very helpful with designing the questionnaire and providing assistants while the former played a crucial role as co-supervisor during the 1999 survey. Half of the assistants were provided by the Provincial Statistical Officer, Ms. Pamela Audi, for which we are very grateful.

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Finally, we want to express our gratitude to Ann Reeves for the English correction.

Abstract

Urban poverty is increasing dramatically in Kenya. In Nakuru town, two out of each five households were living in conditions of absolute poverty in 1997. Farming in town is one of the ways people employ to cope with this problem. Based on survey held in 1999 among a representative sample of almost 600 households, it is estimated that about 30% 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 8 million kilograms of crops, which covered about 30% of their energy requirements.

Although over 40 different types of crops were established, maize, kale and beans were by far the most common ones, indicating that crop cultivation is mainly done for self-consumption. What types of crops are cultivated is to some extent related to the location of the plot: on plots further away from the house, mainly maize, beans and Irish potatoes were grown. Hence, 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.

A wide range of inputs were used, including chemical inputs, organic inputs like manure and crop residues, and irrigation. Chemical inputs were used more on plots located *outside* people's compounds, somewhat further away and relatively large in size. There is a marked difference between men and women as far as the use of certain inputs is concerned: men were more inclined to use chemical inputs than women, while women irrigated more often. Female heads of household showed by far the most 'input-poor' type of cultivation. This applied particularly to chemical inputs, which is related to the low welfare level of these households.

Yields are relatively low: on average 0.3 kg per square metre. However, yields vary enormously with plot size: the smaller the plot the higher the productivity. This is to some extent related to the use of inputs and to the amount of labour used. In households where a man is responsible for the crop cultivation, higher yields were realised than in households with a woman being in charge.

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. However, some conditions have to be fulfilled then. 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.

Of particular importance is the environmental aspect of urban crop cultivation. In some areas of Nakuru town crops grow on very polluted sites, while in other areas untreated sewage water is widely used for irrigation. The use of chemical inputs should be discouraged, if only to protect the fragile ecosystem of Lake Nakuru National Park. The active propagation of environment-friendly (i.e. organic) farming may also help to change the

rather negative attitudes among *non*-farming Nakurians as well as officials towards farming in town.

Urban farming is a fact of life in Nakuru. Hence, the best policy of the local authorities is one of legalising it, be it within clearly defined legal conditions. In other words, urban farming should be integrated into urban planning exercises. In Nakuru, the *Legalising Agenda 21* programme forms the ideal framework for doing so. The next step is to actively promote organic farming within this legal framework, so that not only the people directly involved but also other economic sectors — and hence the town as a whole — can benefit.

Introduction

Travelling from Nairobi along the New Nairobi Road the visitor hardly notices that he has crossed the Nakuru town municipal boundary. The landscape is largely rural on both sides, with the exception of the Kenya Pipeline Oil Depot on the left-hand side of the road and Stem's Hotel on the right. After crossing the railway line, however, the landscape soon changes and becomes more urban as one nears the town centre. A long avenue, fringed with jacaranda trees, runs parallel with the railway line on the left. But during the growing season in years with sufficient rainfall, the railway is barely visible because of the maize growing on the *shambas*[1] between the road and the railway. Going from the town centre to the residential areas, be it in the low-income areas in the south or the high-income areas in the north, maize can be seen rising above the fences around people's compounds or in open spaces that seemingly belong to nobody. And if the visitor goes into one of these compounds, he will see a wide range of crops being cultivated, mostly meant for home consumption although some may be sold as well.

Urban poverty is increasing dramatically in Kenya. In the four years from 1994 to 1997, the percentage of people living in absolute poverty[2] 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 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

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[1] *Shamba* is the Swahili word for agricultural plot.

[2] 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.

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.

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 find an answer to 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, some methodological considerations and a short presentation of the characteristics of the plots on which the crops are cultivated.[3]

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,[4] and in Kenya,[5] and from these, the following picture arises.

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'), the owner being either the government or a private person.

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[3] This paper deals solely with crop cultivation. For livestock keeping in Nakuru town, see Foeken & Owuor 2000a and 2000b.

[4] 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).

[5] See 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.

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. 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 towns 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 for farming in town, 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 plot 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 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 the road sides 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.

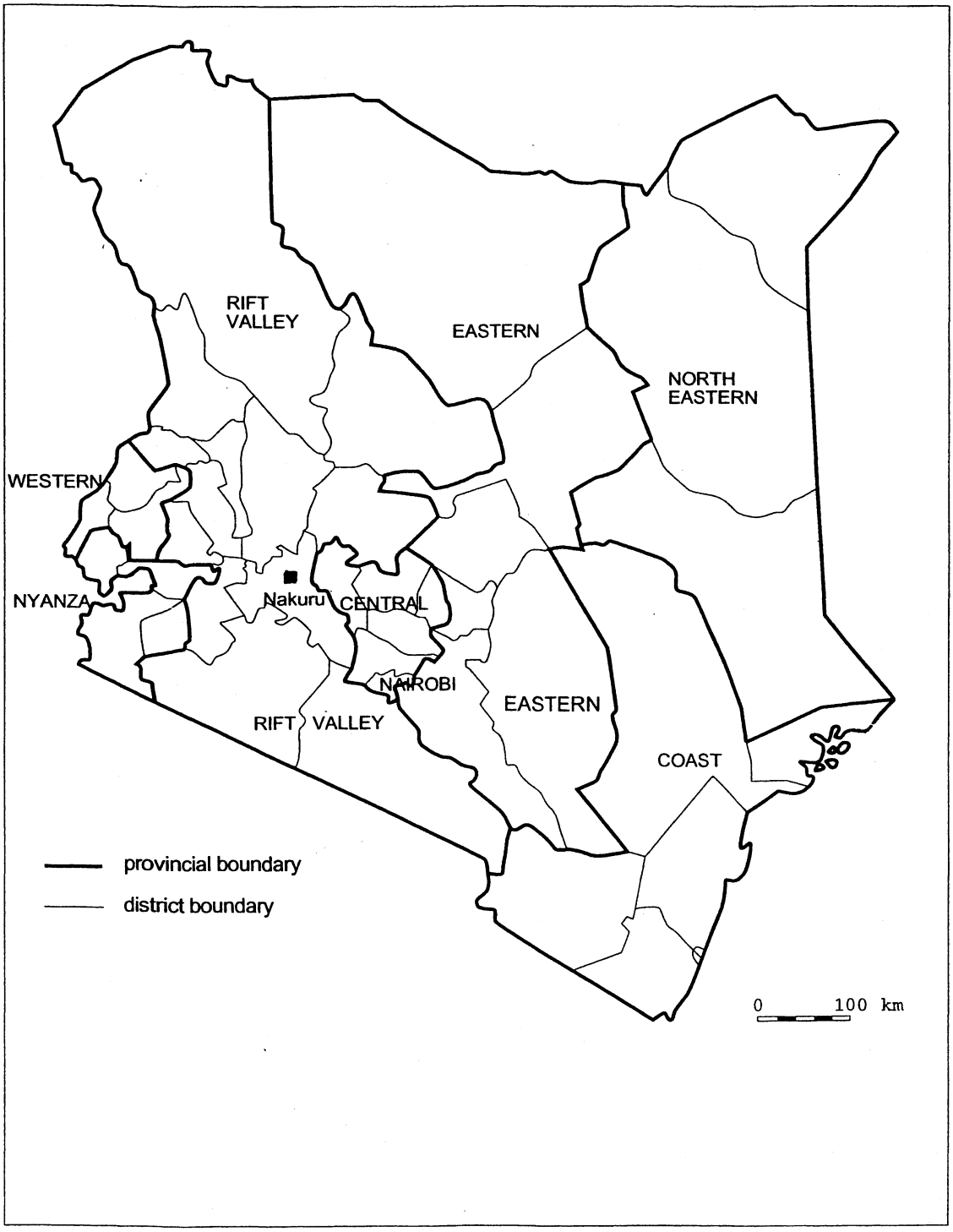
Urban agriculture is attributed a potentially beneficial role in terms of the urban economy, urban food supply and urban development in general (Smit *et al.* 1996). Although largely an informal economic activity, urban farming provides employment as well as an income for those involved. This income 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 O_2-CO_2 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 undertaken 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

Map 1 Kenya and location of Nakuru town



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.

Nakuru came into existence in 1904 as a railway station on the great East African Railway (or Uganda Railway) between the Indian Ocean (Mombasa) and Lake Victoria. Being located in the so-called 'White Highlands' (the area of large farms owned by European settlers), Nakuru soon developed into an important regional trading and market centre and became the capital of a district with the same name and of Kenya's largest province, Rift Valley Province.

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. There are over 100 agro-industrial establishments in town ranging from food processing to farm machinery assembly plants (MCN 1999).

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 (i.e. the areas between the built-up area and the town boundaries), 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 the paper deals with.

Method

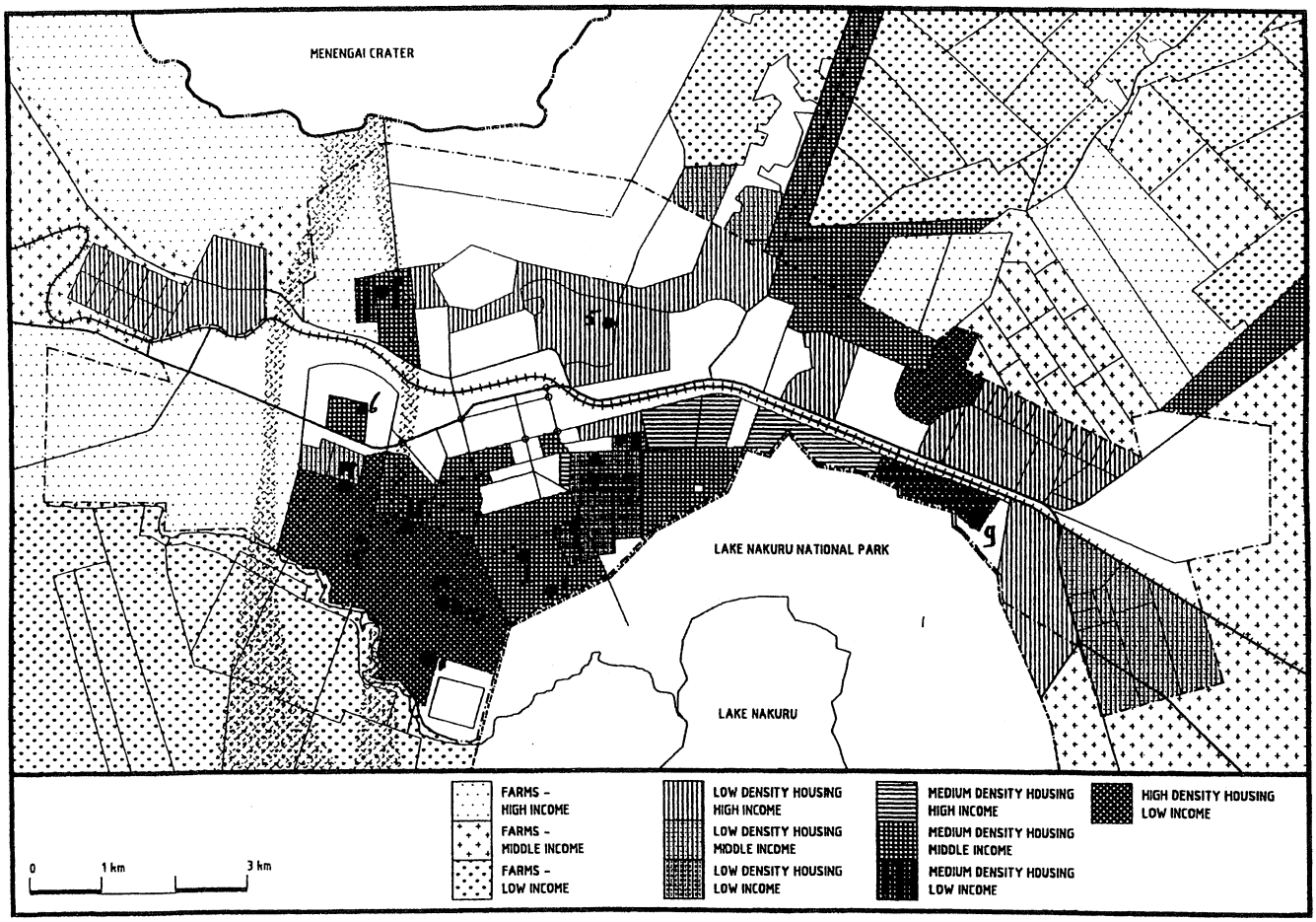
In June-July 1999, a survey among 594 households in the built-up areas of Nakuru town was carried out. To obtain a representative sample, the 15 clusters of the Kenyan Central Bureau of Statistics were used (see Map 2). Together, the clusters counted about 1,400 households; hence, from each cluster a 43% random sample was drawn. 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.

Five examples

• David and Susan came from Migori to Nakuru in 1982 when David was 30 years old. They started to grow crops in town in 1998 on a 1/4-acre plot given to them by David's employer. They tried maize and potatoes for self-consumption but the crops failed. In 1999 they tried again, this time maize, beans and sweet potatoes, again for self-consumption only. Despite the drought that year, they managed to harvest one bag (90 kg) of maize and four 2-kg tins of beans because they were able to use tap water for irrigation. They also used chemical fertiliser, and pesticides against stalk borers. The fertilisers and pesticides were bought in a shop for Ksh 750 (about US$10) and Ksh 50 respectively. The farming activities were carried out by David and sometimes Susan, and they also received some assistance from a friend. Susan spent part of the year in their 'home area', on the farm of his family, from where they also got food. They did not sell any of their urban crop but did give some of it away and the crop residues were given to someone with livestock. Farming is important for them as it provides food for six months of the year (December to June). If they had a higher income from their non-farming activities, they would not stop cultivating crops in town. On the contrary, they would cultivate more in order to raise their income.

Map 2 Distribution of the research clusters
(Map from MCN 1999, Fig. 3.6, p. 37)



They feel that using more chemical inputs could increase their yields, but lack of cash is a major constraint.

• Samuel and Pauline came from Bomet to Nakuru in 1987 and settled in Rhonda Kaptembwa, where they still live today. They have always cultivated crops and keep cows in the compound on a plot about 200x100 feet. In 1999 they grew maize and beans solely for self-consumption, as well as Napier grass for their cows. They weeded twice and used chemical pesticides. Due to the drought and because they did not irrigate, their harvest was modest: some maize cobs were picked raw and roasted, while only two 2-kg tins of beans were harvested. The dried maize stalks were fed to the cows. Napier grass is cut whenever it reaches a certain height. They did not sell anything but gave away some of their crops to friends. Pauline is responsible for the crops and at peak times she works on the *shamba* all day, with some assistance from a nephew. One day she also hired a local person for weeding, which cost her Ksh 300. The crop residues were used as fodder for the cows and the animal dung as manure for the crops. Farming activities are important for her because "it subsidises". She would not stop cultivating even if the household had sufficient income for a decent standard of living. Pauline is convinced that she could produce more crops if she was able to irrigate. The local government could assist by providing a water supply.

• Margaret came to Nakuru in 1974 because she was transferred there as a teacher. She has always cultivated crops in her compound located in Kabachia. It started as a hobby but nowadays it is important for her own food supply as well as for providing some extra income. In 1999 she cultivated kale, onions, spinach and tomatoes. She successfully used a pesticide on the tomatoes to avoid rust and blight and she irrigated the crops with tap water. She harvested about 35 kg of tomatoes when they were ripe, but was not able to estimate the amounts harvested of the other crops. Her son assisted her in the *shamba*. Part of the crop was sold, as it was too much for her to consume and some was also given away. She left the crop residues to rot as fertiliser.

• John and Mary came to Nakuru in 1971 and settled in Lakeview, where they still live today. They have always cultivated maize and beans for home consumption in town on a plot measuring 100x50 feet. In 1999, they had some kale and arrowroot as well. They used no chemicals and did not irrigate the crops. There was little harvest in 1999, partly because of the drought and partly because baboons from the adjacent national park came over the fence from the park (where it was also very dry) and ate part of the crop. She dug up some arrowroot each month. She did not sell anything but gave away a few cobs of maize to her children. Mary is the one responsible for farming and does it all on her own, spending on average two hours per day on the *shamba* all year round. The main impact of the drought was that she had to spend more money on the purchase of food than in normal years. Cultivating crops in town is important for her because "it helps in feeding my family". It has become more important for her over the years because "now food is expensive but I'm

able to cater for that with what I harvest". She gets something from it throughout the whole year. So she would never stop with the activity as "it helps in my budget". In general, she is satisfied with the yields she realises and does not know how they could be further improved.

• Charles and Rose came to Nakuru in 1965 and have cultivated crops ever since on a half-acre plot in Lanet. They started with kale, but nowadays they cultivate tomatoes, *dhania* (parsley), beans, spinach and kale. They plant twice a year, use chemicals for weeding and irrigate with tap water. The tomatoes and the *dhania* are mainly sold to local middlemen. When the tomatoes are ripe, they harvest about eight crates per week. The *dhania* gave them an income of about Ksh 18,000 in 1999. Moreover, six bags of beans can be harvested each year, of which four are sold. Some of the crops are given away. The remaining beans, as well as the spinach and the kale, are mainly for home consumption. The income from sales is being used to build a house. Charles and Rose are jointly responsible for their farming activities but have to hire labour for planting and picking. The crop residues are used as fodder for the livestock they keep in the same compound (cows, goats, sheep and rabbits, partly for milk, partly for income and partly as an insurance in case they need money) and the animal dung fertilises the *shamba*. Their farming activities are beneficial throughout the year as they can sell crops and milk all year round. Over the years, urban farming has become increasingly important to them, so they would never stop it. On the contrary, they would like to expand.

The five households described above cultivated crops in 1999 and were among the households interviewed in the more detailed survey. They should be considered as examples and not as a cross-section of all the crop cultivators in Nakuru town. Nevertheless, they do represent many of the features characteristic of the crop cultivators in the town in general.

Urban plots

The 160 crop cultivators cultivated 180 plots or 1.1 plots per household, but the plots were not equally distributed over town (Table 1). 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. Theoretically, it is possible for households in high-density areas to practise crop cultivation on plots in other, less densely inhabited areas. This could not be deduced from the data, however.

Table 2 presents information on various characteristics of the urban plots. Most of the 180 plots used for crop cultivation 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'): on the respondent's estate (17%), along a railway (8%),

Table 1 Geographical distribution of plots (%)

housing density	households in sample (N=594)	plots (N=180)
high	39.7	19.4
medium	58.9	76.7
low	1.3	3.9
Total	100	100

Source: 1999 survey

on another estate (6%), along a road (4%) or in various other locations (5%) such as along a river, under a power line, in a school compound or next to a cemetery, a park or a sewage outlet. 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.

Table 2 Characteristics of urban plots (%)

location		*plot size (m^2)*	
in own compound	60.6	<10	13.4
within own estate	16.6	10-99	26.2
elsewhere	23.8	100-999	28.5
Total	100	1000+	31.8
		Total	100
distance to plot			
<10 minutes on foot	70.0	*ownership of plot*	
10-30 minutes on foot	12.2	own land	33.0
>30 minutes on foot	17.8	landlord	45.8
Total	100	government	14.0
		other	7.3
cultivated plot since		Total	100
before 1990	23.3		
1990-1994	25.6		
1995-1998	51.1		
Total	100		

Source: 1999 survey

The ten plots of the households in one of the medium-density areas (Ziwani) were all located outside the estate itself because the landlord (the railway company) did not allow farming inside the estate, despite there being space to do so. The plots are located along the railway to Nairobi, a zone to which the residents of the railway estate have easier access than others. Because the estate is located some distance south of the railway itself, Ziwani

is also the only area where the majority of the plots were located at a distance of more than half-an-hour's walk from the house. In most other areas, the majority of the plots were within ten minutes walking (Table 2), except for the medium-density Flamingo I where one third of the plots were located at a distance of more than an hour's walk. This has to do with the back-to-back construction of the houses and the resulting absence of backyards.

Crop cultivation in Nakuru on the present scale seems to be quite a recent phenomenon. About half of the plots have been put under cultivation since 1995 (Table 2). Only 13 of the 180 plots (7%) were being cultivated before 1980. This suggests a general decrease of the purchasing power of the population during the last decade.

The average plot measured 964 square metres.[6] 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 (Table 2). The smallest plots encountered were one square metre while the largest was a plot in Lanet measuring 16,000 square metres (1.6 hectares). Plots in people's compounds were generally smaller than those located elsewhere. For instance, half of the plots in the compounds were smaller than 100 square metres against less than a quarter of those located elsewhere. One would expect plots to be bigger where housing density is lower. However, the percentage of small plots (less than 100 square metres) in the medium-density areas was much higher (45%) than in the high-density areas (23%). Since the percentage of plots within the compounds is only slightly higher in the medium-density areas, there is no obvious explanation for this.

One third of the plots used for crop cultivation were owned by the cultivators themselves (Table 2), 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 owned by landlords were generally smaller (54% were smaller than 100 square metres) than those owned by the cultivators themselves (28%). Plots owned by the government were relatively large (54% were more than 1,000 square metres).

Crops

A wide range of crops was cultivated in Nakuru in 1998. Appendix 1 offers a full list of all the crops cultivated on the 180 plots. Both from Appendix 1 and from looking around in the field it is clear that mixed and inter-cropping was common, though the majority of the plots (58%) 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 is no relationship between plot size and the number of crops per plot. For instance, on about two-thirds of both the smallest plots (<10m^2) and the largest plots (1,000+m^2) one to three crops were being cultivated. The largest variety of crops was found on the plots measuring between 100 and 1,000 square metres.

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

The three crops that stood out as by far the most important in terms of the number of households cultivating them were kale (*sukuma wiki*), maize and beans. Kale and maize were grown by about two-thirds of the crop cultivators and beans by almost 60%. Onions, spinach, tomatoes and Irish potatoes were cultivated by 20 to 30% of the cultivators and cowpeas, bananas and spider plant (*saget*) by less than 20% (for exact figures, see Table 5).

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. Kale was grown on 80% of the compound plots and on 32% of the other plots. 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 elsewhere.

It is remarkable that even on the smallest plots (<10m^2) all ten of the major crops were represented, even the more bulky ones. For instance, maize was found on more than half of these tiny *shambas*. On the larger plots (1,000+m^2), maize and beans were more common (77% and 72% respectively), but most other crops were less extensively cultivated. Kale, for instance, was found on only 32% of these plots. This is related to the fact that these larger plots are often somewhat further away from the house: over half of the plots of 1,000 square metres or more were at least half an hour's walk away. On the 14 plots even further away (at least an hour's walk), maize, beans and Irish potatoes were over-represented while the other crops were either under-represented (kale and cowpeas) or not found there at all. In other words, 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,[7] while women, on the other hand, more often cultivated vegetables such as spinach, onions and *saget*.[8] In other words, 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.

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[7] Maize was cultivated by 73% of the male heads and 56% of the female heads and spouses. The figures for beans were 71% and 49% respectively.

[8] Spinach: 10% of the men, 23% of the women. Onions: 10% of the men, 30% of the women. *Saget*: 4% of the men, 12% of the women.

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. However, in the case of Nakuru town 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.

Appendix 1
Crops cultivated in Nakuru town, 1998

Table A1 Crops cultivated in Nakuru (% of plots; N=180)

1	maize	61.7	22	black night shade (*managu)*	2.8
2	kale	61.1	23	cucumber	2.8
3	beans	56.1	24	parsley (*dhania)*	2.8
4	onions	25.0	25	oranges	2.2
5	spinach	20.0	26	sweet potatoes	2.2
6	tomatoes	19.4	27	arrowroot	1.7
7	Irish potatoes	17.8	28	egg plant (*mbiriganya*)	1.7
8	bananas	15.6	29	*mavaki* (local vegetable)	1.7
9	cowpeas	15.6	30	millet	1.7
10	spider plant (*saget)*	11.1	31	passion fruit	1.7
11	pepper	7.2	32	American herb	1.1
12	sugarcane	7.2	33	mango	1.1
13	cabbage	6.1	34	capsicum	0.6
14	carrots	6.1	35	guava	0.6
15	pawpaw	6.1	36	lettuce	0.6
16	pumpkins	5.6	37	loquats	0.6
17	green peas	5.0	38	mushrooms	0.6
18	avocado	3.9	39	pineapple	0.6
19	Napier grass	3.9	40	strawberries	0.6
20	cassava	3.3	41	water melon	0.6
21	amaranth (*terere)*	3.3			

Appendix 2
Crops: Calculation of 'percentage self-consumed'

The amounts self-consumed (%) were calculated by translating the qualitative values of the amounts self-consumed as indicated in Table A2 below into percentages as follows:

all: 100%	about half: 50%	small portion: 10%
most: 75%	less than half: 30%	none: 0%

The percentages are at best only indications.

Table A2 Crops: Amounts self-consumed by crop type (N)

amount self-consumed:		all	most	about half	less than half	small portion	none	total	calculation (%)
1	kale	48	34	10	8	6	3	109	75
2	maize	45	35	11	2	4	4	101	77
3	beans	51	22	7	3	2	3	94	77
4	onions	22	15	2	2	2	2	45	78
5	spinach	11	12	2	3	5	3	36	62
6	tomatoes	20	8	2	1	-	4	35	78
7	Irish potatoes	19	9	1	-	1	2	32	82
8	cowpeas	16	3	2	-	3	4	28	70
9	bananas	13	3	3	-	-	8	27	62
10	*saget*	8	5	1	2	1	2	19	68

Appendix 3
Calculation of energy from urban crop production

Table A3 Calculation of energy from urban crop production

		no. of h'holds[a]	kg. harv-ested[a]	aggregate kgs	kcal/kg as purchased[b]	aggregate kcal.
1	kale	109	84	9,156	384	3,515,904
2	maize	101	224	22,624	3,630	82,125,120[c]
3	beans	94	75	7,050	3,390	23,899,500
4	onions	45	26	1,170	187.2	219,024
5	spinach	69	92	6,348	384	2,437,632
6	tomatoes	35	15	525	196	102,900
7	Irish potatoes	32	88	2,816	637.5	1,795,200
8	cowpeas	28	67	1,876	3,400	6,378,400
9	bananas	27	4	108	777.2	83,916
10	saget	19	33	627	224	140,448
11	other crops	[d]	32.7	4,184	2,308	9,656,672
12	total energy produced (1+2+...11)	160				130,354,716
13	daily energy requirement per capita					2,200
14	annual energy requirement per capita (13x365 days)					803,000
15	annual energy requirements per household (14x3.4 persons/h'hold)[e]					2,730,200
16	annual energy requirements 160 households (15x160 households)					436,832,000
17	annual energy requirements 594 households (15x594 households)					1,621,738,800
18	contribution of urban crop production to energy req'ments 160 h'holds (12/16x100%)					29.8%
19	contribution of urban crop production to energy req'ments 594 h'holds (12/17x100%)					8.0%

Notes:
a. From Table 3
b. See Platt 1962
c. Assuming that weight figures refer to dry mature kernels (100% edible).
d. From Appendix 1. As other crops include 31 items, the aggregate number of households is not meaningful.
e. Based on an estimated total number of households in Nakuru Municipality of 70,000 in 1999, 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.

Appendix 4
Problems with crop cultivation in town

Table A4 Problems with crop cultivation in town (%; N=160)

	mentioned as a problem	mentioned as the main problem
theft of crops	36.6	24.4
inadequate rainfall	35.0	24.4
destruction by animals	23.8	10.0
pests/insects	22.5	8.8
lack of water for irrigation	12.5	9.4
disease	9.4	2.5
lack of inputs/capital	6.9	1.9
harassment	2.5	-.-
poor quality seeds	1.9	-.-
poor soil	1.3	-.-
lack of space/land	1.3	1.3
lack of labour	0.6	0.6
weeds	0.6	0.6
too much rainfall	0.6	-.-
poor seasonal timing	0.6	-.-
burst sewage pipes	0.6	-.-
no problem	16.3	16.3
Total		100

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