Farmers' perceptions and handling of livestock manure in urban/peri-urban areas of Kampala, Uganda

by Karin Alvåsen

Swedish University of Agricultural Sciences
Department of Animal Nutrition and Management

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Supervisors: Prof. I. Ledin, Department of Animal Nutrition and Management, SLU
Prof. E.N. Sabiiti, Faculty of Agricultural Sciences, Makerere University

Examiner: Associate Prof. J. Bertilsson, Department of Animal Nutrition and Management, SLU

Abstract

The global population is increasing every day, especially in developing countries. Due to the inadequate distribution methods of the world's resources a lot of people have problems accessing the food they need. Urban migration is causing a high demand of food in towns and farming activities in cities are necessary in different parts of the world. This study was conducted in Kampala, the capital city of Uganda, with the aim to investigate farmers handling of livestock manure in the city. The information was gathered through interviews with 125 farmers in two different divisions of Kampala and manure from three types of livestock was analyzed for chemical composition.

Most of the farmers kept poultry (61.6%) followed by dairy cattle (45.6%), pigs (27.2%), goats (22.4%) and sheep (3.2%). 72% of the respondents were women and the majority of the respondents were owners of livestock. Livestock was an important part of the respondents' lives and contributed with 25-50% to the household economy in the majority of the households. Livestock was used both for home consumption and for selling products.

For all types of livestock it was most common to use the manure as fertilizer for food production. The second common thing was to heap the manure in one place and dispose it later. Pig and poultry manure was experienced to have stronger smell and was harder to remove compared to manure from cattle and goats/sheep. Many farmers had conflicts with neighbours complaining about free ranging animals and noises. Most of the farmers did not consider the manure/urine produced as a problem, but needed tools like gloves, spades and wheelbarrows to facilitate the handling of manure.

Pig manure had the highest content of organic carbon (40.7%) and nitrogen (3.5%). Dairy cattle had the lowest value of nitrogen (1.0%) and the highest C:N ratio (31.8). Goat manure had lowest value of organic carbon (28%). Due to the C:N ratio, goat and pig manure is more suitable for biogas production. The manure, from all types of livestock, is appropriate to use to cope with the declining soil fertility.

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Introduction

Global perspectives on population growth and food supply

The global population reached 6 billions in 1999 (Leisinger *et al.*, 2002), and 97% of this population growth took place in developing countries (FAO, 1992). Asia contributes most with a population growth of 50 million people each year while the population in Africa is growing with 17 million people every year. However, the growth rate is still highest in Africa (Leisinger *et al.*, 2002). Africa is one of the continents with the largest food resources but it has lagged behind in the development of livestock revolution (FAO, 2006). In Sub-Saharan Africa, 45% of the population is below the age of 15 and it is the only region in the world where poverty, hunger, and child malnutrition has increased, and the quality of life has declined during the last decades. Globally, there has been a doubling of the grain harvest and a tripling of livestock production since the early sixties resulting in 2800 calories available per person per day. Yet more than 800 million people are food insecure due to the inequitable sharing of resources occurring world wide (Leisinger *et al.*, 2002).

General facts about Uganda

Uganda is a developing country in East Africa and borders to Democratic Republic of Congo, Sudan, Kenya, Tanzania and Rwanda (Figure 1). Uganda has a population of 28.9 million people (Sida, 2008), 35% of them are below the poverty line[1] (CIA, 2007) and 6.7% of the population in the age between 15 and 49 years are living with HIV/AIDS. Foreign aid is important for the budget of Uganda since 13.7% of the GDP[2] consists of aid (Sida, 2008). The capital city is Kampala which has 1.4 million inhabitants (National Encyclopedia, 2008).

Uganda has an area of 236 000 km^2 (Sida, 2008) and has a tropical climate with regular rainfall, but in the northeast of the country the climate is semiarid. There are two dry seasons: December to January and June to August. Uganda has fertile soils and mineral deposits of copper and cobalt. Agriculture is the most important sector of the economy, employing over 80% of the work force. The major crops and products produced are coffee, tea, cotton, tobacco, cassava, potatoes, corn, millet, pulses, cut flowers, beef meat, milk, goat meat and poultry meat (CIA, 2007).

Uganda is a low-income agricultural economy with livestock contributing over 9% of the total GDP. The sum of areas under arable land, permanent crops and permanent pastures is about 52% of the total land area. Over the last two decades livestock production has been increasing, but has not kept pace with the population growth and the productivity per animal has not increased to the same degree as the population. Mixed farming small holders and pastoralists own over 90% of the cattle and almost 100% of goats, sheep and poultry (FAO, 2005b). In 2005/2006, the numbers of livestock in Uganda were around

[1] Less than 1 US$ per person and day

[2] GDP = Gross Domestic Product. The total final output of goods and services produced by the country's economy

8.1 millions goats, 7.5 million cattle, 1.7 million pigs, 1.2 million sheep and 23.5 million chickens. At the same period of time 78.8% of all households in the country were estimated to be agricultural households (Ministry of Agriculture Uganda, 2005/2006).

Figure 1. Map of Uganda (CIA, 2008)

Urban and peri-urban agriculture

Uganda's economy was damaged during the "war of economic independence" of the regime of Amin[3] (1971-1979) that was initiated with the expulsion of the Indian minority and gave rise to a black market economy. In the early to mid 1980s a guerrilla war was running on the outskirts of Kampala and this had a devastating impact of the urban economy and reduced the wages in the city. This also forced the city residents to find new sources of income, and the practice of urban agriculture increased. Another factor increasing urban agriculture is the population increment in developing countries and the arduous situation in the rural areas, which are encouraging people to urban migration. This is causing a great deal of challenges in the cities (Maxwell, 1995) and the waste management is becoming an acute problem due to the lack of advanced abatement methods (Richardson and Whitney, 1995). Poverty rates in many cities are rising and ever-larger numbers of city residents face difficulties accessing the food they need. The focus of agricultural development in Uganda has been on rural areas with the view that improved food production in rural areas can supply the expanding urban population. The rural food production has not been able to meet the demand from the city, and due to this worsening urban poverty, urban agriculture is widely practiced within the boundaries and the peri-urban areas of Kampala.

The population growth in the urban areas will have major effects on patterns of food production, marketing and consumption (Jabbar *et al.*, 1995). The Brundtland Commission (1987) noted that "urban agriculture could become an important component

[3] Idi Amin a Ugandan soldier, president and dictator who was overthrown 1979, migrated from the country and eventually died 2003 in Saudi Arabia.

of urban development and make food available to the urban poor" (Maxwell, 1995). Urban and peri-urban agriculture can reduce shortage of food in different ways: growing food at home or via a cooperative reduces the cost burden of acquiring food for the poor, puts more food within their reach, and reduces seasonal gaps in fresh produce (FAO, 2005a). Sales of surplus produce can generate income that can be used to buy more food or meet other household needs. By increasing the diversity of food consumed, the quality of urban diets can be significantly improved (Personal communication). Globally, around 200 million dwellers practice urban farming and provide food and income for around 700 million people (Egziabher *et al.,* 1994).

In Uganda, urban agriculture is an essential source of livelihood for many, especially the vulnerable groups such as female-headed households, widows, the elderly and those living with HIV/AIDS. They engage in agricultural activities not only to benefit them economically, but to also contribute substantially to their food security (Personal communication). Crop cultivation, livestock rearing and fish farming are the main activities characterizing urban agriculture in Kampala (Atukunda *et al.,* 2003). Land availability is increasingly constraining the productivity and the small land area available in urban and peri-urban areas is often used to its maximum. The farmers are not able to let the land be in fallow and this eventually results in soil degradation (Snapp, 1998). There is not enough land to grow animal fodder and the livestock keepers lack the financial means to buy commercial feeds. They can not produce enough household wastes which they would otherwise use to feed their animals. Urban livestock keepers are making the best of whatever is available to them. They are relying on roadside forages (which they cut and carry home), household wastes from adjacent neighbourhoods as well as crop wastes (generated during the marketing of food crops) from the different markets within Kampala (Personal communication).

Disposing of manure

Declining soil fertility in sub-Saharan Africa is a threat to future crop and livestock productivity (Faerge & Magid, 2004; Dechsel *et al.,* 2004). Losses of nutrients is occurring continuously through harvesting of grains, grazed feed, animal products, volatilization or manure removal for other purposes. In an ecosystem, when natural resources are managed, nutrient recycling is an essential part of any strategy for sustainable agriculture (Jabbar *et al.,* 1995). Livestock have a significant role in stabilizing farming systems by providing manure (Mohamed Saleem, 1998) which is a valuable resource and can be used as a supplement, to replace inorganic fertilizers or for energy production. Inorganic fertilizers are expensive and applied mainly to high yielding varieties especially in irrigated conditions (Faerge & Magid, 2004).

The large increase in the livestock population is causing environmental concerns due to limited land areas for efficient disposal of animal excreta. When many animals are kept in small areas it is difficult to return their excreta and sewage at rates which the agricultural land can absorb (Cooke and Williams, 1973). Wrong handling of the manure, like improper storage or faulty spreading on agricultural land can cause environmental pollution problems (air pollution and water pollution) and may also give problems with flies and odors.

Biogas

In many parts of the world lack of energy, e.g. for cooking, is a problem. Especially women and children need to spend a lot of time collecting fire wood. Many households need to use manure as fuel instead of using it as a fertilizer, and the nutrients get lost. A suitable way to deal with these problems is to convert manure, or other organic wastes, to biogas through anaerobic digestion in a biodigester. The result of the digestion is biogas, a mixture of methane and carbon dioxide, an odourless and colourless gas that burns with a blue flame (San Thy, 2003).

Animal manure has a good nutrient balance and is easily made into slurry, but manure from different livestock is more or less suitable for biogas production. Cattle manure is easy to use as it contains a lot of rumen bacteria which are the type of bacteria needed for the fermentative process. Pig and poultry manure produce more biogas per unit weight and at higher rates because of lower carbon to nitrogen (C:N) ratio. Goat and sheep manure are rich in nutrients but they need to be broken up mechanically before placing them in the biodigester. Animal manure is relatively biodegradable (from 28 to 70%) due to the diet consumed of the animal. The effluent from the biodigester is a source of nutrients and can later be used as inputs for crop production (San Thy, 2003).

Objectives

- Swedish International Development Cooperation Agency/Department for Research Cooperation with Developing Countries (Sida/SAREC) has financed this study with the aim to investigate farmers' perceptions and handling of livestock manure in Kampala, Uganda. The goal was also to determine problems related to farming in urban and peri-urban areas and to see how this kind of farming can be used to reduce poverty and wastes in the city. The specific objectives were:

- To record livestock manure/urine handling practices in the urban and peri-urban areas of Kampala.

- To list the constraints that could hinder the recycling of livestock manure/urine.

- To understand the farmers' perceptions of environmental impacts of livestock manure/urine and how they are related with household socio-economic characteristics.

- To determine nitrogen (N), organic carbon (C), C:N ratio, phosphorus (P) and potassium (K) contents of livestock manure.

- To determine the popularity of using livestock manure/urine as an organic fertilizer for crop/fodder production.

Material and methods

This study was conducted during September and October 2007. It is part of a major study, dealing with recycling aspects in Kampala which encloses humans, animals, garbage, and soil issues. The animal part is performed by Constantine Katongole (PhD) who focuses on goat keeping and the use of market crop wastes as feed. Emma Selberg Nygren (student in Animal Science) did another MSF report concerning market wastes using information from the interviewed farmers.

Study area

Kampala City Council divides Kampala into four different farming styles: peri-urban, peri-urban to transition, urban new and urban old (Table 1). The farming styles are greatly based on how much land is available for agriculture, with the peri-urban area having the biggest area and the urban-old category having the least (Atukunda *et al.*, 2003).

Table 1. Description of Kampala City Council urban agriculture classification system (Atakunda)

Criteria	Urban, old	Urban, new	Peri-urban to urban transition	Peri-urban
Average population density (persons/km^2)	124	49	11	8
Prevalence of crop production	Low	Low	Medium	High
Prevalence of local livestock	Low	Low	Low	High
Prevalence of improved livestock	Medium	High	High	Low
Land availability	Limited	Limited	Moderate	Very good

Kampala consists of five different divisions and in this study Kawempe and Lubaga divisions are included (Figure 2). Each division is further divided into parishes[4]. Two parishes were selected from each farming-style and this resulted into a total sample size of 8 parishes. Between 14-17 interviews in each parish was carried out resulting in a total of 125 interviews.

[4] A parish refers to an administrative unit consisting of several villages. A village is the lowest administrative unit.

Figure 2. The different divisions of Kampala (McGill, 2004)

Sampling design

A list of all households with livestock in each selected parish was compiled with the help of local leaders. Preliminary visits in the different areas were accomplished to make the farmers aware of the subject and also to fix appointments for primary data collection (interviews). The visits were utilized to confirm willingness of the farmers to participate.

Data collection

Primary data was collected using a structured household questionnaire (appendix 1). The questionnaire focused on the following aspects: type of market wastes fed to livestock, feed treatments used, farmers' perception and their handling of animal manure/urine and different constraints faced. The survey addressed socio-economic factors and supply chain issues relating to the use of market crop wastes. One respondent from each household were interviewed, and interpreters familiar with the local language Luganda were participating during the interviews.

Data analysis

Descriptive statistics was generated for the questionnaire survey data using the Statistical Package for Social Sciences (SPSS) version 10.0. Means and standard deviations for livestock manure were generated using Excel.

Chemical analysis

Livestock manure from cow, pig and goat were collected from two participating households. The samples were oven dried at 60^{o}C for 48 hours and ground to pass through a 1-mm screen. The samples were analyzed for total nitrogen (N), total phosphorus (P), total potassium (K), organic carbon (C) and dry matter (DM) according to AOAC (1990).

Results

Data analysis

A total of 125 interviews were carried out in the two divisions. 64 of the interviews (51.2%) were conducted in Kawempe division (Komamboga, Kikaaya, Mpererwe and Kyebando parish) and the other 61 interviews (48.8%) in Lubaga division (Lubya, Nakulabye, Lubaga and Kabowa parish). The majority (72%) of the respondents were women and nearly all the respondents were the livestock owners. 61.6% of the interviewed households kept poultry, 45.6% dairy cattle, 27.2% pigs, 22.4% goats, 3.2% sheep and none of the households kept rabbits (Figure 3). In 53.6% of the households they only kept one species of animal (either dairy cattle or goats/sheep or pigs or poultry solely). Only 1.6% of the households held all four types of animals.

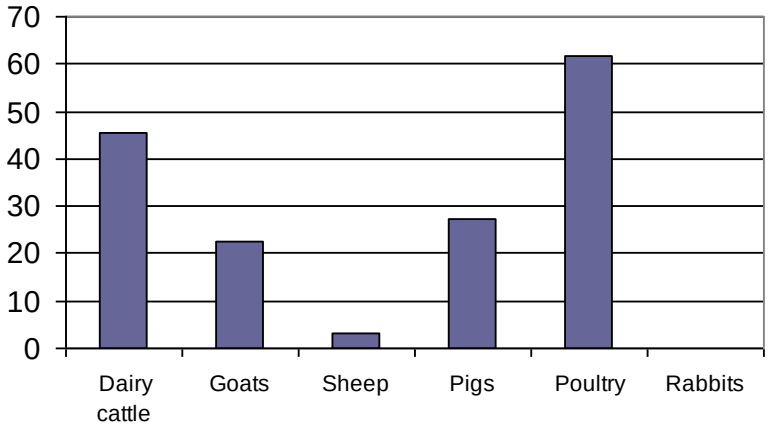

Figure 3. Percentage of total households keeping each type of livestock

The majority of the farmers said that the livestock gave financial contribution of 25-50% of the household's economy. 20% said that the contribution was negligible, and for 5.6% of the respondents' livestock keeping was their only way to get income and therefore it was contributing with 100% (Figure 4). Many of the elderly farmers said that rearing animals are the only thing they could manage to do.

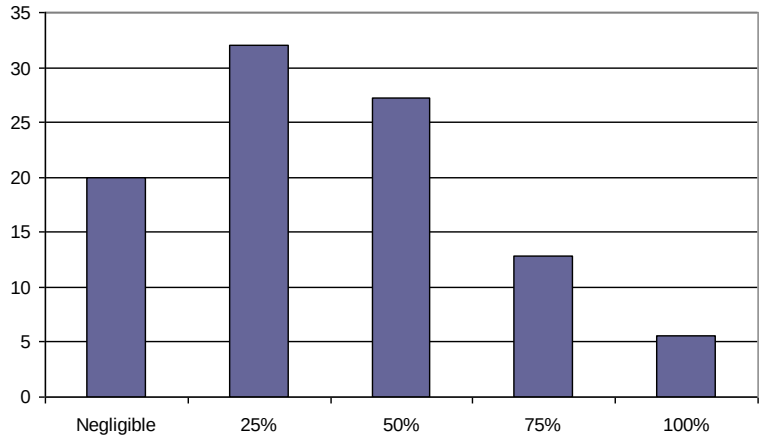

Figure 4. Financial contribution from livestock to the total household economy (%)

All respondents, except two, had some kind of formal education. More than half of the farmers had undergone livestock training, the majority in the form of a short course at the university, by an institution, a workshop or by a NGO[5].

The farmers often kept small groups of ruminants and bigger groups of poultry and pigs (Table 2). Many of the farmers kept poultry and pigs because these animals are able to eat several types of feed. They also have shorter generation interval and gets many offspring compared to ruminants. There is a high demand of pork in the town as it is very common to eat it as snacks. Farmers often had the poultry at free range in their yard. Around two thirds of the cows and goats were kept mainly to sell products. Sheep is uncommon in Uganda because of the tradition to eat goat meat instead of mutton. Cows was used for dual-purpose (meat and milk) while goats was only used for meat or hobby reasons.

Table 2. Number of livestock in the different households

	N	Min	Max	Mean	Total
Dairy cattle	57	1	11	2.6 (1.8)	148
Goats	28	1	20	5.6 (4.9)	156
Sheep	4	5	9	7.0 (2.3)	28
Pigs	34	2	47	10.6 (11.0)	360
Poultry	77	1	3000	240.9 (502.2)	18549

N=number of farmers

The most common way for all types of livestock was to use the manure/urine as fertilizer for food production (Figure 5) by spreading the manure over the soil (Figure 6) or by mixing it with the soil.

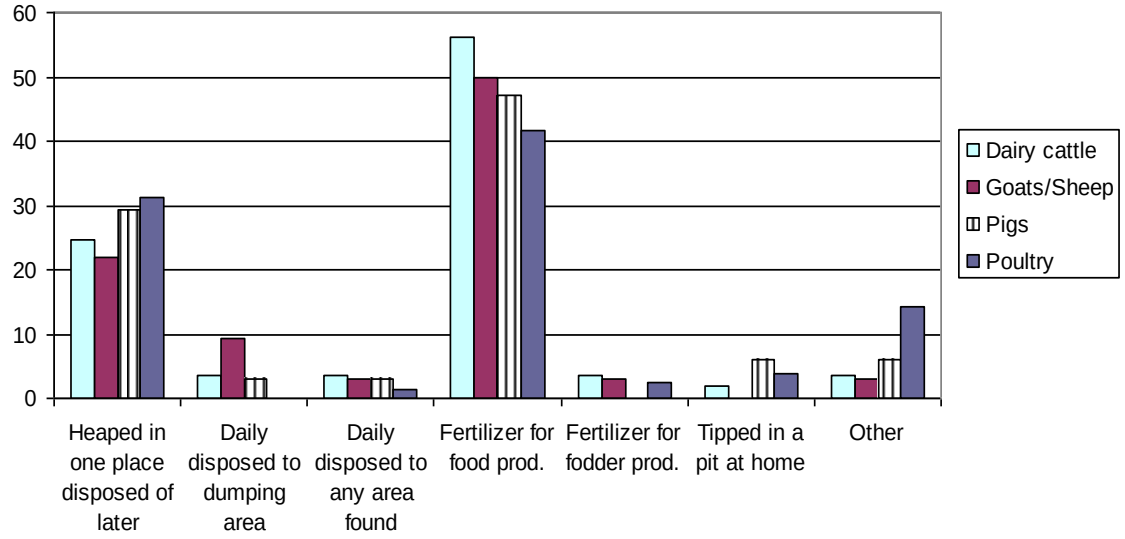

Figure 5. Where the farmers put the manure/urine produced from each type of livestock (%)

[5] NGO = non-Governmental Organization

There were a few households who tried to use the manure for biogas production but it did not really work properly for them. They felt that they needed more information about how to process the manure for biogas production.

Figure 6. Farmer shows how she uses manure as fertilizer for her food production

Many of the farmers did heap the manure for a period of time for later disposal (Figure 5). The tendency of heaping seems, in most cases, to be for a longer period than 1 month or heaping it in less than 7 days (Figure 7). Some of the farmers poured the manure/urine into a water stream and said that it was a good way to minimize the handling and work with the manure.

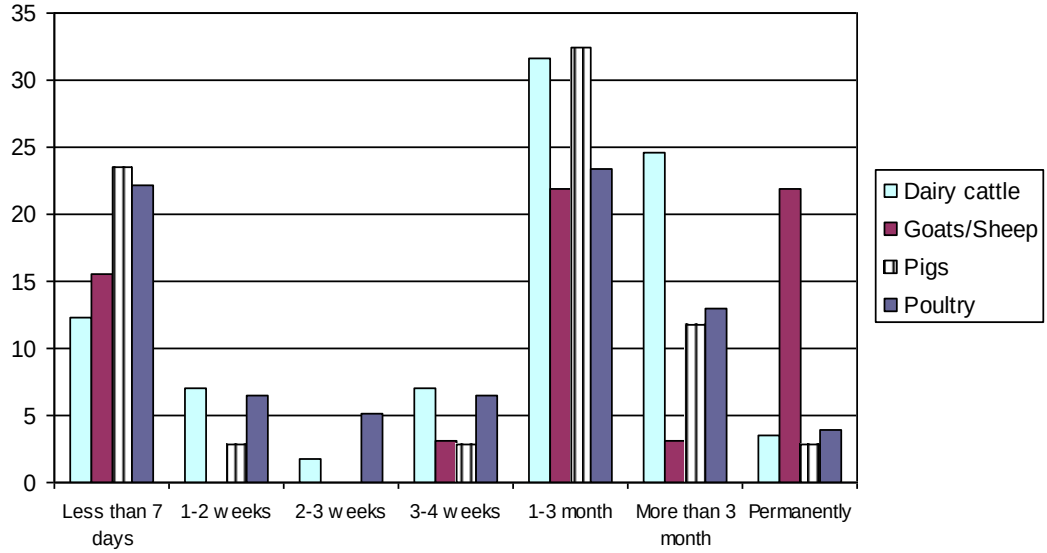

Figure 7. How long time the manure/urine was heaped at one place before disposal (% of farmers)

The majority of the farmers did not think the manure/urine produced was any problem. However, manure produced from pigs and poultry was experienced to have a stronger smell and was harder to remove compared to manure from cattle and goats/sheep. The most common way to remove manure or clean animal houses was with bare hands. A coherent opinion among the farmers for all types of livestock was the lack of tools. It was also reported that many of the farmers' neighbours felt that livestock was an inconvenience for them. They had problem with noises and when free ranging animals destroyed things in their way. Flies was not considered to be any problem and most of the farmers thought that proper and regular cleaning was the best way to control the nuisance of smells and flies. The most frequent way of dealing with the smells and flies among all types of livestock was to do nothing specific (Figure 8). Some of the farmers keeping pigs and poultry thought that the animals were a health risk for humans and they also had problems with attacking banana weevils'.

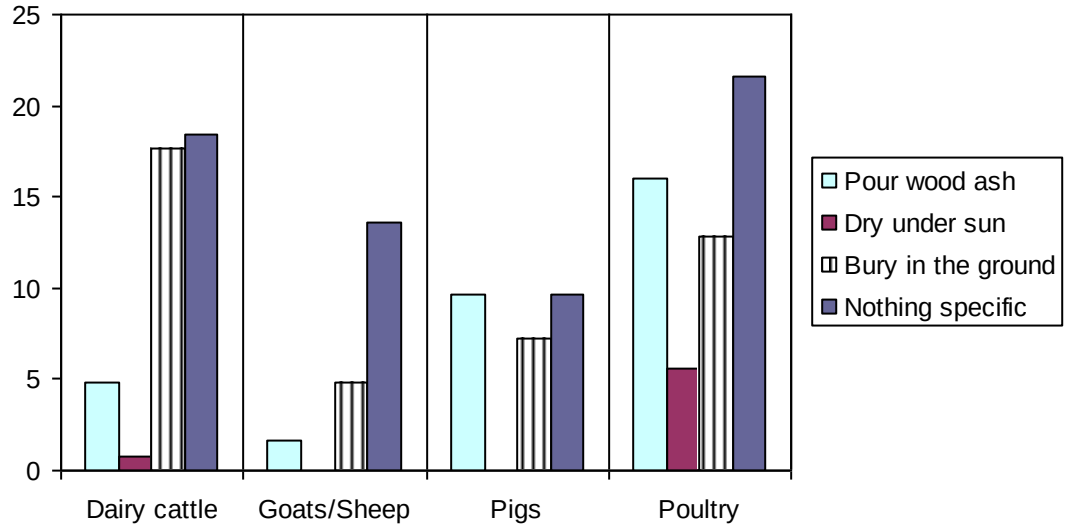

Figure 8. Methods used to avoid smells and flies among the farmers (%)

Chemical analysis of the manure

Pig manure hade highest content of organic carbon and nitrogen, and lowest C:N ratio. Dairy cattle manure had the highest C:N ratio and lowest value of nitrogen (Table 3).

Table 3. Organic carbon, total nitrogen content and C:N ratio in the manure (% of DM)[1]

	Organic carbon	Nitrogen	C:N ratio
Goat	28.0 (2.7)	2.3 (0.06)	12.1
Dairy cattle	30.5 (0.7)	1.0 (0.37)	31.8
Pig	40.7 (2.3)	3.5 (0.07)	11.8

N=3 for all livestock; [1]Means and standard deviation

The machine analysing phosphorus and potassium were not working so the chemical results are not yet available.

Discussion

Data analysis

For the majority of the farmers in Kampala farming activities are an essential source of income. At the same time it is a natural part of their lives and Egziabher *et al.,* (1994) noted that if people in Kampala were offered jobs which gave the same amount of money as the farming, they would not stop farming anyway. They like keeping animals and even though many of the respondents complain about the lack of land and scarce feed resources, they are willing to keep on struggling. However, goats, sheep, poultry and rabbits especially from backyard production systems, are an important source of part-time work, particularly for landless women and children (FAO, 1992). In this study the majority of the farmers were women and Maxwell (1995) confirms that urban farmers in Kampala are mainly women. The farmers in this study are dependent on livestock both for home consumption and also for selling products to be able to pay e.g. school fees.

The positive opinions about urban farming brought out in the interviews were that it is a higher demand for livestock products in town compared with rural areas, the prices are therefore higher and there is always a market available. Many farmers forget that it is more expensive with feed in the town and that makes the input costs higher.

Goats are more common in Kampala than dairy cattle, but in this study the number of dairy cattle is higher. Goats are easy to feed and manage, and not as expensive as dairy cattle to buy. Many people let the goats stray around by them self to search feed and this gives the goats a bad reputation as they often can be seen on roads and in gardens.

Due to the continuous loss of nutrients in the soil, forages are inadequate to meet the livestock mineral requirements. Farmers generally do not supplement livestock with minerals, and therefore mineral deficiencies are common. In Uganda major deficiencies of Calcium, Magnesium, Phosphorus, Potassium, Sodium, Sulfur, Cobalt, Manganese, Selenium and Zinc are being forthcoming in the soil (Mohamed Saleem, 1998). Most farmers did already recycle the manure to provide the soil with nutrients. Kabi and Bareeba (2007) showed that cattle manure, especially when buried, improved the yields of elephant grass significantly. This was possibly due to reduced nitrogen volatilization when the manure was covered in soil. If the manure is heaped for a period of time and exposed to rain, there is a high risk that the rain carries off some of the nutrients.

The lack of tools did hinder the recycling activities of manure in different ways. Without tools it takes a lot longer time to clean up in the animal houses and makes the transport of the manure more difficult. Some of the farmers poured the manure into a water stream and this can give rise of diseases and destroyed water sources for people downstream. All households needed tools like wheelbarrows and spades to make the handling of manure easier and this would facilitate the recycling activities a lot. There is also need of workshops or meetings where the farmers can get ideas and knowledge to improve their farming.

Chemical analysis

Sidibe-Anago (2008) have examined dairy cattle manure in tropical areas and presents values of 28.4% organic carbon and 0.67 to 0.68% total nitrogen, which makes a C:N ratio of 42. Kausar (1983) have similar values except a higher value for total nitrogen (1.47%). The values reported in this study are corresponding well with the earlier studies except the C:N ratio which is lower in this study due to higher total nitrogen value. With a high C:N ratio nitrogen is immobilised by the microbial population and this is making it temporarily unavailable to crops (Njarui *et al.*, 2003).

In pig manure Velthof *et al*, (2005) have found organic carbon values ranging from 14.3 to 47.2% and total nitrogen values from 4.4 to 7.0. Kausar (1983) shows lower total nitrogen value, 3.1%. The value of total nitrogen in this study (3.5%) is in this range. The C:N ratio for pigs is between 2.9 to 8.3 according to Velthof *et al.* (2005) and the manure analyzed in this study reached a higher value (11.8).

According to Moral *et al.* (2005) goat manure has a content of 26.4 to 38.1% organic carbon and 1.4 to 2.3% total nitrogen. Kausar (1983) shows values of 1.99% total nitrogen and this conforms to the results in this study.

Unfortunately there is no analysis of the feed consumed before the samples were taken. This, and the fact that the samples were taken only once, from each type of livestock makes it hard to draw any representative conclusions out of the results. The values of potassium and phosphorus are still not analyzed but according to Kausar (1983) the manure in tropical areas normally contains 1.4% potassium and 0.5% phosphorus for dairy cattle, 1.2% potassium and 1.1% phosphorus for pigs, and goat manure contains 2.4% potassium and 0.6% phosphorus as a percent of total solids.

As the chemical results showed manure has a high potential as a fertilizer and the soil needs available nutrients. Manure from dairy cattle had a high C:N ratio and is not as suitable as pig and goat manure when it comes to biogas production. To use the manure for biogas production and then dispose the wastes would be one way to take advantage of all the properties of the manure.

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Appendix 1. QUESTIONNAIRE

A. HOUSEHOLD IDENTIFICATION

A1. **Questionnaire number** _____
A2. **Date of Interview** _____
A3. **Interviewer's name** _____
A4. **Location of the Household**
Division: _____
Parish: _____
LC1/Zone/Village: _____

B. HOUSEHOLD SOCIO-ECONOMIC AND DEMOGRAPHIC CHARACTERISTICS

B1. **Name** _____
B2. **Age** _____

B3. **Sex of the respondent** □Male □Female

B4. **For how long have you been residing at the current home?** _____

B5. **What is your marital status?**
□Single □Married □Divorced/separated □Widowed □Other

B6. **What is your position in the household?**
□Household head □Spouse □Son/daughter
□Other relative □Household worker □Other

B7. **What occupation takes the LARGEST PORTION of your time everyday?**
□Salaried employment □Casual labour engagements
□Business/Trading □Managing the livestock enterprises
□House keeping □Managing the crop enterprises
□Other

If respondent is NOT the household head:
B8. **What occupation takes the LARGEST PORTION of the Household Head's time everyday?)**
□Salaried employment □Casual labour engagements
□Business/Trading □Managing the livestock enterprises
□Managing the crop enterprises □House keeping
□Other

B9. **What is your stake in the livestock enterprises at the current homestead?**
□Enterprise owner □Daughter/son to enterprise owner
□Hired labour for enterprise owner □Spouse to enterprise owner
□Other relative to enterprise owner

B10. **What is your maximum level of education?**
□Lower Primary (Primary1-Primary4) □No formal education
□Upper Primary (Primary5-Primary7) or Junior1 □College
□Lower secondary school (S1-S4) or J2 □University
□Upper secondary school (S5-S6) or J3

B11. **Have you ever undergone any livestock training in your lifetime?** □yes □no

B12. **If yes, what?**

- Training by government or private extension worker
- Short-course at University/Institution/Workshop or NGO
- Junior certificate in agriculture or veterinary
- Diploma or degree in agriculture or veterinary

B13. **How many people stay permanently in the household for each age bracket?**

Children < 6 years ___
Children 6≤17 years ___
Adults 18-45 years ___
Adults 45-60 years ___
Elderly 60+ years ___

C. LIVESTOCK PRODUCTION SYSTEM

C1. **For how long has the household been keeping each type of livestock at the current location?**

Dairy cattle	___	Goats	___	Rabbits	___
Pigs	___	Sheep	___	Poultry	___

C2. **How many animals (including young ones) do you have (at the current location) in each category?**

Dairy cattle	___	Goats	___	Rabbits	___
Pigs	___	Sheep	___	Poultry	___

C3. **What is the main reason for keeping each type of livestock?** (**TICK** the appropriate box)

	Dairy cattle	Goats/ Sheep	Pigs	Poultry	Rabbits
Milk for sale					
Milk for home consumption					
Sale live animals to raise income					
Home consumption (Home slaughter)					
Hobby or cultural reasons					
Eggs for home consumption					
Eggs for sale					
Other					

C4. **Who is responsible (1st and 2nd) for the specified activities for each type of animal?**

1.Husband 2.Wife
3.Jointly by husband and wife 4.Jointly by all household members
5.Daughter/Son/Other relative 6.Hired labourer
7.Other

	Dairy cattle	Goats/ Sheep	Pigs	Poultry	Rabbits
Mobilising and collecting feed					
Processing feed (cooking, chopping, drying/wilting etc)					
Feeding the animals					
Cleaning the animal houses					
Repairing animal houses					
Contacting the Vet. when animals are sick					
Disposal of animal manure					
Finding buyers for products					
Negotiating with buyers the prices					
Handling cash from the sales					

C5. **Which type would you say is more financially rewarding? Give reasons!**

□ Dairy cattle _____
□ Goats _____
□ Sheep _____
□ Pigs _____
□ Poultry _____
□ Rabbits _____

C6. **What would you estimate to be the financial contribution from livestock to the total household expenses?** □Negligible □25% □50% □75% □100%

C7. **Indicate how frequently you give the following feed categories to your animals.**

	Reason to never	Rarely (1-2 times per month)	Sometimes (1–2 times per week)	Regularly (4 - 7 times per week)
Commercial concentrates				
Kitchen/Plate food wastes				
Market crop wastes				
Cut grass and fodder				
Food peelings				
Slaughter wastes				
Brewery wastes				
Other (Specify)				

C8. **Describe the availability of each feed type using a scale of 1 – 3: (1) poor, (2) fair and (3) good**

	Score	Reason for the score
Commercial concentrates		
Kitchen/Plate food wastes		
Market crop wastes		
Cut grass and fodder		
Food peelings		
Slaughter wastes		
Brewery wastes		
Other		

C9. **Indicate the type of animals (Dairy cattle, Goats, Sheep, Pigs, Poultry and Rabbits) you mostly give each of the following feed types?**

	1st choice	2nd choice
Commercial concentrates		
Kitchen/Plate food wastes		
Market crop wastes		
Cut grass and fodder		
Food peelings		
Slaughter wastes		
Brewery wastes		
Other (Specify)		

C10. **What is the reason you give market crop wastes to the chosen animals? _____**

D. UTILIZATION OF MARKET CROP WASTES FOR FEEDING ANIMALS

D1. **What is the contribution of market crop wastes to your feed requirements in a week?**
□Negligible □25% □50% □75% □100%
If negligible, go straight to D17

D2. **List the types of market crop wastes that you mostly collect for your animals and where you regularly get them from?**

Market crop waste	Source	Distance, km
1.		
2.		
3.		
4.		
5.		

D3. **Under which terms do you get each of the market crop wastes mentioned above?** (**TICK** the appropriate box)

Market crop waste	Given free	Cost is charged for specific unit	Token of appreciation given	Exchange for other services
1.				
2.				
3.				
4.				
5.				

D4. **For each of the market crop waste you collect please indicate (YES or NO) to describe the way you find it at the source.**

Market crop waste	Heaped	Sorted	Packed in sacks/any containers	Treated in any way (if **YES**, specify the treatment)
1.				
2.				
3.				
4.				
5.				

D5. **What is the exact location where you get the market crop wastes at the source, and in case you have to pay for them, who do you give the money?** (**TICK** the appropriate box)

	Exact source of wastes				**Who do you pay**			
Market crop waste	Waste heaps	Market vendors' stoles	Prior arrangements made	Middle men	Market vendors	Middle men	Market authorities	None
1.								
2.								
3.								
4.								
5.								

D6. **How much do you pay for the wastes?**

Market crop waste	**UNIT** measure of packing	**COST** per unit
1.		
2.		
3.		
4.		
5.		

D7. **Indicate the method and frequency of collection for each market crop waste**

Market crop waste	Average **NUMBER** of units collected per week	**METHOD** of transport	Transportation **COST** per week
1.			
2.			
3.			
4.			
5.			

D8. **How available are each of the market crop wastes?** (**TICK** the appropriate box)

Market crop waste	Always get what needed and leave a lot behind	Always get enough but leave behind little/nothing	Sometimes enough, sometimes very little or nothing	Have to be there first to out-compete others for it
1.				
2.				
3.				
4.				
5.				

D9. **Describe if its availability is stable throughout the 12 months of the year** (**TICK** the appropriate box)

Market crop waste	Availability stable throughout the year	
	Yes	No
1.		
2.		
3.		
4.		
5.		

D10. **Indicate which months of the year that each market crop waste is available at the source.**

Market crop waste	Months when MOST available	Months when LEAST available
1.		
2.		
3.		
4.		
5.		

D11. **What constraints do you face with the market crop wastes that you use?**

Market crop waste	1st	2nd
1.		
2.		
3.		
4.		
5.		

D12. **What treatments or processing do you carry out on each market crop waste?**

Market crop waste	Processing/treatment	Reasons for processing
1.		
2.		
3.		
4.		
5.		

D13. **How do you normally store the market crop wastes between collection and feeding?**

Market crop waste	Method of storage	Average days of storage
1.		
2.		
3.		
4.		
5.		

D14. **List if your animals have had any problems from the consumption of the different market crop waste types.**

Market crop waste	Observed problem	Type of animal
1.		
2.		
3.		
4.		
5.		

D15**. Even if you have not observed any, what problems would you fear for your animals due to the consumption of the different market crop wastes?**

Market crop waste	Fear (wellbeing or health)	Type of animal
1.		
2.		
3.		
4.		
5.		

D16. **If you were to stop using market crop wastes for feeding your animals, what is the MOST important reason you would do so? _____**

If you are NOT USING market crop wastes for feeding your animals:
D17. **What is the MOST important reason you are not doing so? _____**

E. MANAGEMENT OF MANURE/URINE

E1. **Where do you put the manure/urine produced by each type of animal?**
(**TICK** the appropriate box)

	Dairy cows	Goats/ Sheep	Pigs	Poultry	Rabbits
Heaped in one place and disposed of later					
Daily disposed of in a public dumping area or facility					
Daily disposed of in any area found					
Dried and burnt for fuel					
Added to land as fertilizer for food production					
Added to land as fertilizer for fodder production					
Tipped in a pit at home					

E2. **In the case of the manure left heaped for later disposal, how many days or weeks does it take before its disposal?** (**TICK** the appropriate box).

	Dairy cattle	Goats/ sheep	Pigs	Poultry	Rabbits
It stays there permanently					
Less than 7 days					
1-2 weeks					
2-3 weeks					
3-4 weeks					
1-3 months					
More than 3 months					

E3. **How would you RANK (1st, 2nd, 3rd and 4th) the intensity of nuisance smells and flies associated with manure/urine produced by the 5 types of animals?**

	Dairy cows	Goats/sheep	Pigs	Poultry	Rabbits
Score					

E4. **Have you ever slaughtered a goat at the current home stead?** □ yes □no

E5. **If yes, have you experienced contamination of the carcass by manure/urine smell?** □ yes □ no

E6. **If no, how did you avoid it?** _____

E7. **What techniques do you use to control nuisance smells and flies associated with the manure/urine from each type?** (**TICK** the appropriate box)

	Dairy cows	Goats	Pigs	Poultry	Rabbits
Do not do any thing specific					
Pour wood ash on the manure					
Put the manure under the sun					
Bury the manure in the ground					

E8. **Which other methods are you aware of that could help control the smell and flies from the manure/urine? _____**

E9. **Highlight any key problems you have experienced with respect to handling and disposing manure/urine from each type of animal?**

	Problems
Dairy cows	
Goats	
Pigs	
Poultry	
Rabbits	

E10. **What are your opinions (positive and negative) about urban livestock keeping?**

_____

_____