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TOWARDS THE MILLENNIUM DEVELOPMENT GOALS

Environmental sanitation and urban agriculture in Ghana

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FORTY FOUR PERCENT of the 19 million Ghanaian population currently live in urban areas, with some cities having growth rates as high as 4.4%. The rapid rate of urbanization does not match available urban infrastructure. In particular, the few sanitation facilities have been over-stretched, waste are also discharged indiscriminately in open drains. Moreover, the migration of people from rural areas to the cities in search of 'greener pastures' has increased urban food demands as well as the numbers of urban poor who cannot afford basic amenities of life. In response to this situation, an increasing number of city dwellers have resorted to all kinds of income-generating activities in the urban informal sector. Among this is the intensive irrigated urban and peri urban agriculture which takes advantage of urban demand for perishable crops and water sources (runoff/wastewater) for all-year or dry-season production. This practice, which has been on the increase during the last decades, links environmental sanitation to urban food supply.

Introduction

The current state of environmental sanitation in major cities of Ghana is derived from the increasing amount of waste generated and the inadequacy of waste disposal and treatment facilities. The use of public toilets and open defecation is pronounced, as only 5% of the population are served with a sewerage network while 20% have no toilets at all. It is a common feature to find open gutters, which were meant for storm water drainage now filled with domestic and industrial wastewater and often choked with solid materials and sediments. This is further aggravated by inadequate drainage systems to manage the large amount of runoff. All these eventually flow into streams and rivers causing severe pollution in the city and downstream (Keraita *et al*., 2002). This affects significantly different sections of urban dwellers who use city water bodies for various purposes. One of these groups are urban and peri-urban farmers.

Urban agriculture (UA) refers to the growing of plants and raising of animals for food within and on the fringe of a town. In Ghana, urban agriculture is a common phenomenon. It takes place in backyards as well as open land spaces, especially in inland valleys. While backyard farming serves subsistence needs and reduces household expenditures on food, open-space production is a labour intensive business taking advantage of market proximity. It is facilitated by ready supply of water in form of urban runoff, storm or wastewater and shallow aquifers that allows off-season production also of highly perishable vegetables.

The study carried out by the International Water Management Institute (IWMI) in Ghana between 2000 and 2003 revealed that almost two-thirds of households in the main urban centres practice backyard farming. Besides that, intensive, all-year-round vegetable irrigated farming is done on virtually every empty space close to water sources engaging up to about 2,000 farmers in and around Ghana's three main cities of Accra, Kumasi and Tamale. These are mainly men while most women are involved in marketing the produce. The importance of this kind of farming especially to urban food security and livelihood of the urban poor is remarkable; for instance, as much as 90% of lettuce and spring onions eaten in Kumasi and Accra are grown in and around the urban areas. The demand for fresh, perishable vegetables is particularly high, therefore urban agriculture complements rural agriculture by increasing the efficiency of the national food system. Studies conducted by IWMI and collaborators in the three cities revealed that between 40 and 80% of urban farmers in Accra, Kumasi and Tamale, consider urban farming as their main income generating activity. Furthermore, urban and peri-urban vegetable farmers generate at least twice the income of their rural colleagues, which is an important contribution to poverty alleviation and better livelihoods (Danso *et al*., 2002). Therefore the contribution of this type of urban and peri-agriculture (UPA) to employment, income generation and better livelihood is unquestionable. Similar cases were observed in Ouagaudougou in Burkina Faso, Dakar in Senegal, Lome in Togo and Cotonou in Benin. (Table 1).

The Challenge

Although many benefits are derived from UA, the related irrigated production is usually associated with health risks. Most of the vegetables produced are contaminated with pathogens through the use of polluted stream, groundwater and drains for irrigation as well as from poultry manure and pesticides application. Analysis of sampled vegetables carried out by IWMI (Unpublished), Mensah (2001), and Armar-Klemesu (2000), show levels of faecal bacteria contamination in lettuce and cabbage leaves varying from 1000 to over 30,000 in number. Although post-harvest contamination occurs, the majority takes place on farms, in part through poultry manure application but more

Table 1. Occurrence of urban farming in selected cities and monthly net income from mixed vegetable farming			
Selected Cities	**Percentage of household involved in urban farming (mostly backyards)**	**Number of open-space vegetable farmers in the city or its direct fringes vegetable farming (max. in brackets)**	**Net income in USD per month and farmer through open-space**
Lome	n.d.	1500	13 – 25 (300)
Cotonou	n.d.	570	50 – 70 (110)
Ouagadougou	n.d.	1100	25 – 70 (100)
Accra	46	1000	40 - 50
Kumasi	57	200	30 - 65
Tamale	26	150	n.d.
Bamako	n.d.	1980	20 – (200)
Dakar	n.d.	1100	40 – 66 (250)
n.d = no data			

significantly through the use of polluted water. Besides e.coli, epidemiological problems are related to nematode eggs which have been detected in sampled water bodies including hand-dug wells (Cornish *et al.*, 1999). The dilemma is that urban agriculture is a source of livelihood for many whilst being an attendant threat to public health, both farmers and consumers. This puts the issue in the vacuum of semi-official recognition, but with limited active support from city authorities. Relevant policies and bylaws on the use of polluted irrigation water do exist, but as they are vague and hardly practicable in this context, farmers never follow them. For most farmers, it is a 'do or die situation' as this is their only source of livelihood.

Irrigation water quality

In Kumasi, rivers and streams are the main sources of water for farming by 69% of the farmers. There is extensive use of shallow dug wells (30%) in bottomlands in the urban area. Piped water is expensive, scarce and inaccessible to most farmers (only 1% uses it). More than 74% of the farmers use the source of water that is most accessible, available and reliable which in most cases is river/stream water (often with wastewater). Farmers don not pay for the water used from streams shallow dug wells in irrigation. Table 2 shows the values of selected chemical and biological parameters of water sources used by farmers in and around Kumasi, sampled at different points along the Rivers Sisa and Oda which pass through the city. The values are averages from a wide range of samples taken during both the dry and wet seasons. Heavy metals had already been shown by Cornish (1999) to be within tolerable limits in Kumasi. The high levels of FC however are an indicator of indiscriminate dumping of untreated faecal waste to water bodies in the sampled areas. The risk is not only to farmers but also to consumers. The recommended FC levels for irrigation water for vegetables is = $1*10^3$/100ml (WHO 1989) but levels as high as $3.4*10^{10}$/100ml are recorded for site A, which is the site closest to the city being only 4 km downstream. The faecal sludge treatment plant around this site has an evident negative influence on water quality though the levels decrease downstream.

The nutrient content of irrigation water (wastewater) is of benefit for the farmers, although the main reason for using the water is the reliability of the water source and lack of other alternatives. However, in comparison with common poultry manure and mineral fertilizer application rates, the nutrient value of the wastewater is still of little significance (Table 3).

In Accra, 138 urban farmers were interviewed and almost 50% of the respondents use only effluent from drain for growing vegetables with majority (78%) working without any protective clothing. Though financial constraint is the main reason given by farmers for not using protective clothing, others indicated that the use of boots for instance retards work progress and causes foot rots. About 20% of the 138 farmers use pipe borne water but the Water Company is discouraging this due to the increasing demand of pipe borne water for domestic and industrial uses. Thus, the company has started to cut off farms that have connection to pipe water supply. Nearly 12% of farmers use surface water (often polluted with wastewater) and 6% use hand-dug wells. The rest use partly treated wastewater or a combination of two of the already mentioned sources. Average values of coliforms of irrigation water bodies

Table 2: Quality of water used for irrigation						
Sampling site	**Distance from city center (km)**	**EC *µs/cm***	**N (NH_3 + NO_3) *mg/l***	**PO_4-P *mg/l***	**K *mg/l***	**FC x 10^6 MPN/100ml**
A	4	1203	104.5	11.3	47.9	3595
B	9	1336	118.9	20.4	51.7	433
C	18	931	78.6	9.0	75.4	1
D	32	849	78.1	11.2	57.7	35

Table 3. Approximate amount of nutrient applied through fertilizer, poultry manure (PM) and irrigation water in and around Kumasi

Nutrient source	Farming type	Nutrient type	Amount of nutrient applied (kg/ha yr-1)	Comments
NPK fertilizer	UA	N, P, and K	135*	• *Refers to amount of each nutrient in a 15–15–15 fertilizer.
PM	UA	N	770	• All applications on cabbage of three croppings per year.
		P	350	• P and K are expressed in terms of P_2O_5 and K_2O respectively
		K	420	
Irrigation water	*Water application rate varies from 640-1600mm/yr but calculation based on 1000mm/yr. P and K are expressed in terms of P_2O_5 and K_2O respectively*			
	UPA	N	10–15	This is for upstream. Value varies from 100–150 kg N downstream Kumasi
		P	7–11	This refers to normal range but could be as high as 700kg in few
		K	50-80	weeks after onset of rains

sampled in Accra show a faecal coliform range of $4.8x10^3$-$2.8x10^6$/100ml for drains and $3.9x10^2$-$3.5x10^5$/100ml for streams (Mensah, 2001). Two-thirds of the farmers who were using effluent from drain were satisfied with such water because of its availability and the benefits they derive from it.

In Tamale, vegetable gardeners use any kind of water that comes their way because Tamale is located in the relatively water scarce northern savannah with limited supplies of pipe borne water and low groundwater potential. Majority of the urban farmers use wastewater and surface water polluted with faecal matter. At one farm site (Kamina), farmers use wastewater directly from a broken down sewage treatment plant. Microbiological analysis carried out during 2000/2001 dry season at six vegetable gardening sites within the Tamale metropolis shows faecal coliform levels higher than $2x10^6$ for all sites (Abdul-Ghaniyu. 2002). Physiochemical parameters, on the other hand, were found to be within tolerable limits for irrigation. Some farmers make use of the limited hand dug wells available in the area and pipe borne water. In general wells are low yielding and pipe borne water is scarce and expensive.

Conclusions: The Way Forward

- Urban agriculture, enhanced by the availability of urban runoff, wastewater and polluted water, contributes to food supply, employment, income generation and better livelihood of many people in and around the cities.
- In Ghana, both the municipal as well as governmental food and health authorities are designated to respectively advise farmers and enforce bye-laws that have been enacted to ensure production of hygienic food products in the cities. However, the laws are often too vague and the institutional set-up too weak to implement them. There is need for institutional strengthening, funding sanitary improvements and enacting of practical byelaws that can enhance urban safe vegetable production.
- As a long-term solution, comprehensive improvements to sanitation infrastructure is a possibility but lack of resources makes it unlikely in the near future. With expanding urban populations and food needs, it is likely that use of polluted water for food crops may prevail. Guidelines for risk reduction should therefore go beyond calls for improved water treatment.
- Awareness creation can be attempted at various points, targeting households, farmers, vegetable sellers, consumers and the local authorities. A comprehensive understanding of the situation which includes farmers' level of awareness, technical know-how, livelihood patterns, perception, social constraints, land and water rights etc. are all vital to laying the foundation for practical policy and guideline formulation.
- Quantification of actual and potential benefits and negative effects associated with use of polluted water for urban agriculture is needed to allow for informed decision making.

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