Periurban **Irrigated Agriculture and Health Risks** in Ghana

In Africa, more than one-third of the population already lives in cities, and over the next 25 years, the rapid urbanisation of Africa could lead to decreasing food security in the cities. In Ghana, the urban population is growing at an estimated annual rate of 4.1% compared with the overall population growth of 3%. Among major urban problems are those related to unemployment and under-employment, as well as high food prices especially due to the high costs of marketing food products. The growing demand for fresh and perishable agricultural produce in the major cities is driving the development of (peri)urban agriculture. This demand is not seasonal, necessitating year-round production, heavily dependent on irrigation.

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It has been established that (peri)urban farm produce in Ghana is contaminated by microbial organisms at both the production and the distribution points. Three main sources of contamination have been identified:

- irrigation water, whether it be wastewater, normal surface water or pipe-borne water when stored in ground reservoirs;
- fertiliser inputs; and
- the handling and storing of produce at points of sale.

Many pathogenic bacteria such as *Escherichia coli* and *Salmonella*, among others, have been identified in addition to some gastrointestinal helminths and protozoa, indicating gross contamination most likely of faecal matter.

In spite of these risks, (peri)urban agriculture, driven by an increasing demand from a rapidly growing urban population will continue to expand within the limits of available land resources. Water quality and soil fertility will have to be managed in synergy with the cleaning up of the urban environment through the recycling of wastewater and solid waste.

ROLE OF IRRIGATION AROUND KUMASI AND ACCRA

Most vegetable farmers in the (peri)urban area of Kumasi consider irrigated horticulture to provide their primary source of revenue. They move from one site to another as dictated by water availability. Some 700 farmers are thus irrigating about 300 ha at 17 sites around and within Accra.

Currently, (peri)urban irrigation provides vegetables year-round and contributes to the improvement of the nutritional status of city inhabitants. The proximity to the markets allows for a large array of fresh products of good quality. However, water is a constraint because the cost of pipe-borne water makes it unaffordable to farmers. The use of untreated wastewater for irrigation has therefore become a widespread practice, with its attendant health hazards.

HEALTH HAZARDS AND IRRIGATION WATER QUALITY

A recent study of two sites in the Accra Metropolitan Area (Sonou M. et al, forthcoming) revealed that wastewater was the most frequently used water for irrigation purposes. As much as 60% of the farmers interviewed at Dzowulu Power Pool Station (67.7%) and at Castle Parks and Gardens (32.3%) confirmed the use of this type of water. Less than a quarter (23.3%) use pipe-borne water while approximately 17% use piped water stored in a ground reservoir.

Laboratory analysis of samples collected from twelve different sources in 1999 (Cornish et al, forthcoming) all proved to be contaminated with bacteria, beyond the limits of the 1989 WHO microbiological guidelines for wastewater use in agriculture. Two other studies (Owusu, 1998) and (Armar-Klemsu et al, 1998) also reveal that (peri)urban vegetable farmers around Accra and Kumasi have been using highly polluted water for their irrigation needs.

City authorities fear that the vegetables grown under these conditions are a threat to public health. Hence, the Accra Metropolitan Assembly of 4 August 1995 enacted a by-law for the "Growing and Safety of Crops," as follows: "No crops shall be watered or irrigated by the effluent from a drain from any premises or any surface water from a drain which is fed by water from a street drainage;" and furthermore, "A person who contravenes these by-laws commits an offence, and is liable on summary conviction to a fine not exceeding ¢100,000, or in default o f the payment of the fine, to a term of imprisonment not exceeding three months, or both." (Local Government Bulletin 1, 1995: 190). These by-laws are not enforced (Armar-Klemsu M et al, 1998).

Ms. Inés Beernaerts

Carrying water from the drain to the field (Marine Drive)

The Ghana Tourist Board, the Hotel Catering and International Management Association (HICIMA) and the Vegetable Exporter and Producer Association of Ghana have all expressed serious concerns about

the hygienic cultivation of vegetables in Ghana. They have launched a campaign called "Save Ghana Vegetables" and requested FAO technical assistance to formulate a project for the development of safe and environmentally sound (peri) urban irrigated agriculture (Westcot, 1997).

HEALTH HAZARDS ASSOCIATED WITH MARKET HANDLING AND STORAGE OF PRODUCE

Another main source of microbiological contamination at the market level is poor handling and storing practices of vegetables by market women. During an interview conducted recently (Sonou et al, forthcoming), 100% of women claimed they wash the vegetables in water before selling them. Personal observation of the storage conditions has, however, revealed that the vegetables are generally exposed and are frequently visited by houseflies and other insects including cockroaches. Table 1 shows the bacteria counts obtained from vegetables at two different market places. The common micro-organisms isolated from vegetable samples include *E. coli*, *Pseudomonas, Enterobacter cloacae, Salmonella arizonae* (Table 2). Other organisms (helminths and protozoans) identified on vegetables collected from the field and market include free-living soil nematodes, flagellates and *Balantidium coli.*

It appears that vegetables produced with tap water are contaminated with health threatening micro-organisms. The source of such contamination can be ascribed to non-hygienic produce handling at farm level or at market place. It may also be caused by improper solid waste recycling for soil fertility management.

HEALTH HAZARDS ASSOCIATED WITH SOIL FERTILITY MANAGEMENT

A third source of potential contamination is found in the manure used by farmers in the management of soil fertility. Poultry manure, which represents 75% of the organic fertiliser used, generally contains Faecal Coliforms ($1.30.10^6$/g) and Faecal Streptococci ($3.4.10^6$/g) (Westcot, 1997). This is evident even in situations where pipe-borne water was used for irrigation. Vegetables cultivated with manure are highly infected by bacteria, indicating contamination from a faecal source (Sonou et al, forthcoming).

Recycling solid waste and wastewater into (peri)urban horticultural production contributes to cleaning the environment. However, this is associated with potential health risks which call *inter alia* for (i) careful agronomic practices including water quality and soil fertility management; (ii) integrated pest management (IPM); and (iii) health sensitisation and education programmes.

Table 1: Bacteria counts obtained from vegetables from the two different markets

Vegetable type	Mokola (CFU/ml)			Agbogbloshie (CFU/ml)		
	TBC	*TC*	*TFC*	*TBC*	*TC*	*TFC*
Cucumber	7.6×10^5	1.9×10^5	7.1×10^4	1.6×10^5	2.9×10^4	6.9×10^4
Carrot	7.3×10^4	7×10^3	3.8×10^4	1.15×10^4	1.6×10^4	9.0×10^3

Amoussou-Gohoungo in Sonou et al.(2000)

Table 2: The common micro-organisms isolated from vegetable samples

Vegetable type	Source of water	Organisms isolated
Spring onion	*Tap water*	Pseudomonas spp; *Proteus mirabilis*
Spring onion	*Drain*	
Lettuce	*Tap water*	E. lermannii; Citrobacter freundii
Lettuce	*Drain*	Salmonella arizonae; Pseudomonas spp
White radish	*Tap water stored underground*	E. coli; Klebsiella spp
Green pepper	*Tap water stored underground*	E. coli *(from S-F)*
Green pepper	*Drain*	Pesudomonas spp
Cucumber	*Not known*	Citrobacter freundii
Carrot	*Not known*	Salmonella arizonae

Amoussou-Gohoungo in Sonou et al.(2000)

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CONCLUSIONS AND RECOMMENDATIONS

The following recommendations could contribute to the development of a safe and environmentally sound (peri)urban irrigated agriculture (Sonou, 2000):

- training in the management of water quality, soil fertility and Integrated Pest Management;
- sensitisation and education campaigns targeting (peri)urban farmers and market women through the most accessible media, and extension services;
- implementation of appropriate health protection measures to accompany the use of low quality water in irrigation;
- development of technologies that promote environmental sanitation and the treatment of wastewater before re-use in (peri)urban agriculture;
- promotion of irrigation techniques and technologies that (i) reduce the frequency and duration of human/irrigation-water contact (at times when the level of contamination is assumed to exceed WHO standards); (ii) prevent direct contact between the product and the contaminated irrigation water, as the case may be for drip irrigation;
- design of a practical method to identify the geographical extent of contamination and to define the priority for action to regulate the use of contaminated water in (peri)urban irrigation; and
- design and implementation of a water-quality certification programme based on the level of contamination and aimed at protecting consumers. This may be linked to a national strategy to control and reduce the contamination of water used in agriculture.