Simple Solutions to Reduce Health Risks from the Use of Wastewater in Urban and Peri-Urban Agriculture

Urban and peri-urban agriculture (UPA) is becoming an important means of attaining balanced diets and urban food security. Vegetables produced close to consumers will be fresher, with nutrients more intact than those stored and transported for long periods of time. This is especially important in sub-Saharan Africa, where refrigerated transport and storage are scarce. UPA also creates jobs for the poor, especially women, and is an effective way to overcome poverty (Cofie *et al.* 2003). Use of wastewater in UPA lessens the pressure on water resources and increases water productivity through the re-use of water and nutrients. However, the use of untreated wastewater raises public health concerns. The two interlinked CGIAR Challenge Program on Water and Food (CPWF) projects: "Safeguarding Public Health Concerns, Livelihoods and Productivity in Wastewater Irrigated Urban and Peri-Urban Vegetable Farming" and "The Impact of Wastewater Irrigation on Human Health and Food Safety Among Urban Communities in the Volta Basin – Opportunities and Risks" and their partners sought to balance livelihood concerns with

safeguarding public health. The projects also aimed at contributing to the revision of the World Health Organization's (WHO) guidelines on wastewater irrigation, issued in 1989, especially where compliance with norms is not possible. In addition, they considered postharvest measures to reduce the health risks of diverse wastewater-irrigated crop production systems. The generic framework was robust in handling conditions ranging from extensive grazing systems to intensive mixed crop-livestock systems at local, watershed and basin scales.

Risks mount in UPA with untreated wastewater

- Untreated wastewater has high levels of pathogenic organisms. Thus, its use may adversely affect the health of consumers, farmers and the environment.
- Effective wastewater treatment can reduce pathogen levels, but, in most developing countries, it is too expensive (Keraita *et al.* 2002). Furthermore, the payback period for investing in wasterwater treatment exceeds the infrastructure's economic lifetime (Bos *et al.* 2004).
- Banning the use of polluted water in UPA threatens many livelihoods and the urban vegetable supply, which contradicts strategies to alleviate poverty.
- Inspite of its significant contributions to urban food supply, poverty alleviation, empowerment of women, and improved human nutrition,

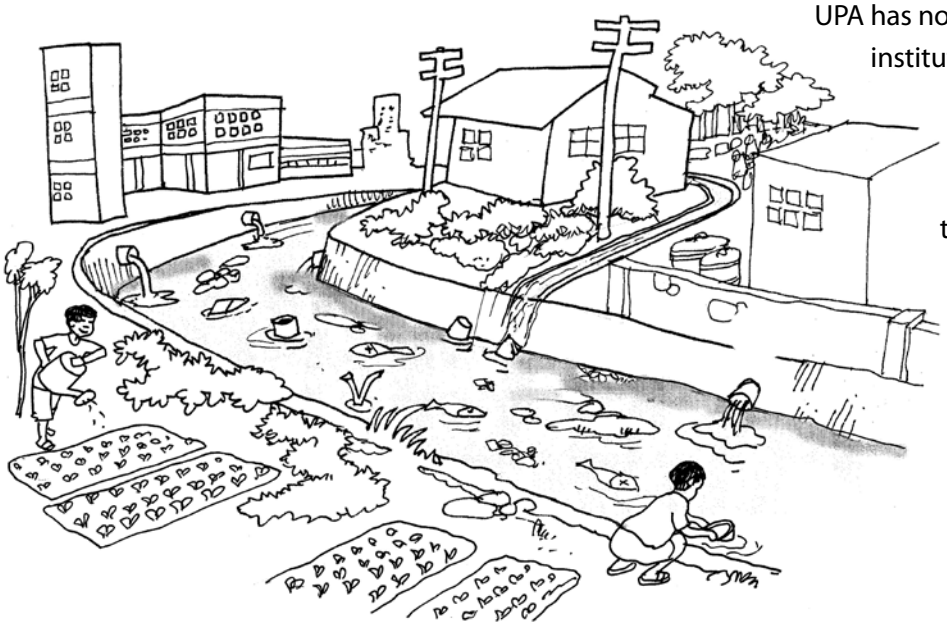
How important is peri-urban agriculture?

Urban and peri-urban agriculture (UPA) contributes about 30% of the world's food supply (UNDP 1996).

In several African cities, between 50 and 90% of the vegetables consumed are produced within or close to the cities (Cofie *et al.* 2003)

In many African countries, 65% of the people involved in UPA as farmers or traders are women.

Around Kumasi, Ghana, more than 12,000 farmers are involved in vegetable farming during the dry season and urban farmers grow 90% of the main vegetables eaten in the city (Cornish *et al.* 2001).



UPA has no appropriate public or institutional support in Ghana or many other West African countries. This is mainly because of the health risks posed by UPA due to high levels of fecal contamination in irrigation water.

Realistic solutions from action research

Partners used an action research approach to systematically find solutions for safer wastewater irrigation (Figure 1).

Determine what has been done and what can be used. A literature review from related initiatives was done to find out what worked and could be adopted in the action research framework. For example, reports on low-cost farm measures and vegetable washing methods were used to develop risk reduction interventions.

Confirm and validate what is current and acceptable practice. Surveys and focus group discussions (FGDs) were done to identify current practices and situations. This was followed by interviews of individual farmers to determine the acceptability and feasibility of adopting practices to reduce health risks.

Establish the science, provide the proof. Soil, water and vegetable samples were analyzed for helminth eggs, fecal coliform bacteria, and traces of pesticides. The data from the analysis were used to assess health risks.

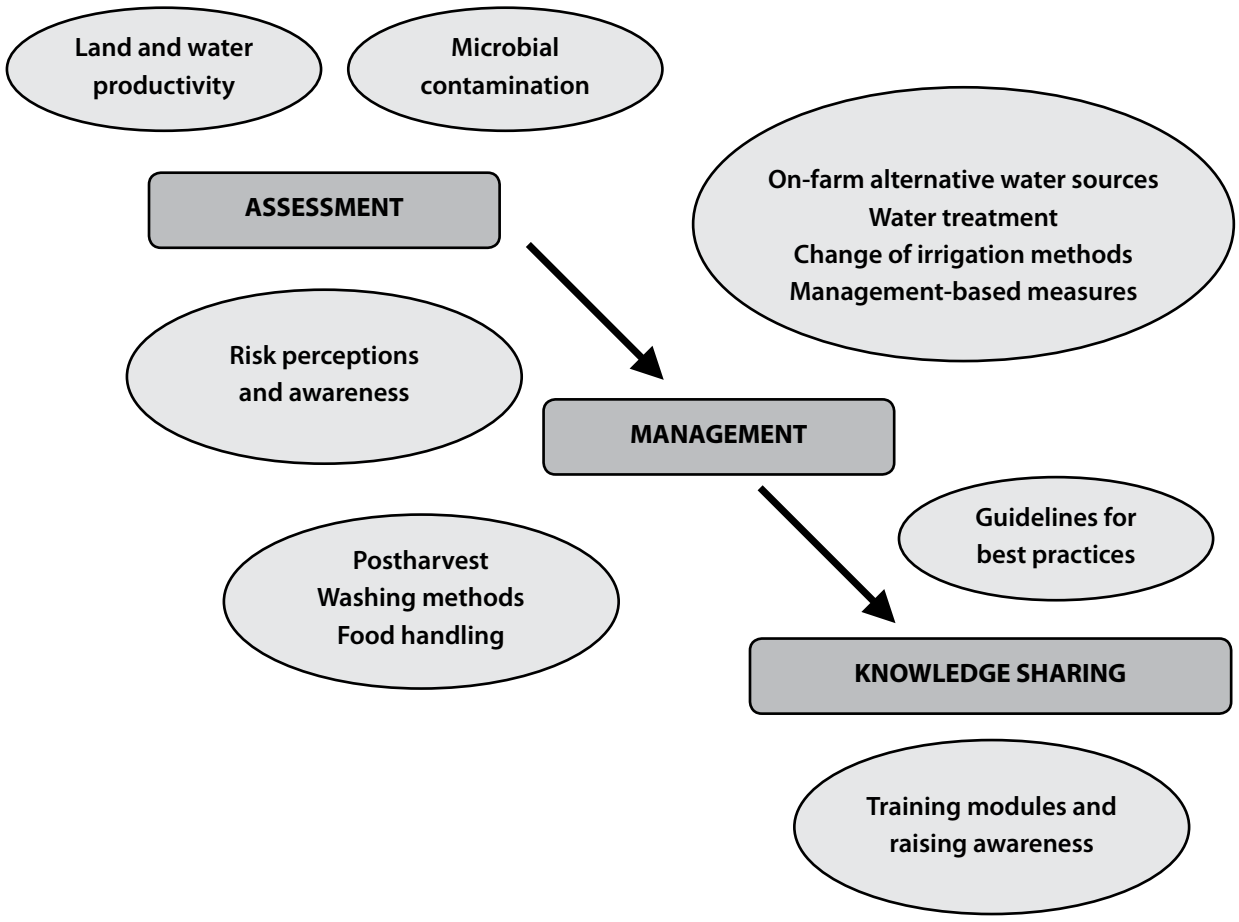


Figure 1. Action Research Approach

Confirm the effectiveness of the proposed interventions. Farmers identified and assessed the proposed interventions in their own fields (on-farm trials). Postharvest interventions, especially washing methods, were tested in the laboratory.

Develop local capacity. Relevant stakeholders participated in workshops to develop guidelines and awareness materials. They also participated in assessing the suitability of materials such as videos, flip charts and policy briefs.

Need for simple and low-cost interventions

Farmers felt that some of the risk reduction measures, including wastewater treatment as suggested in the international guidelines (WHO, 2006), were not suited to their farming practices. Farmers in Ghana preferred simple and low-cost interventions, which they could easily adopt. The projects introduced major on-farm interventions to improve water quality and reduce contamination and health risks. Sedimentation ponds and filtration techniques were assessed to improve water quality and reduce contamination of crops. Changes in water application techniques (i.e., irrigation methods and cessation of watering before harvesting) were tested. In general, there was a significant reduction in contamination using these low-cost measures. Most helminth eggs were reduced using pond and filtration systems, while bacteria loads were reduced mostly by water application techniques. For example, most helminth egg densities were reduced to less than 1 egg per liter in 3 days by ponds, while drip irrigation reduced fecal coliforms by 4 log units. Careful combination of these measures could reduce both helminth eggs and bacteria.

Farmers prefer risk reduction measures that

- **show potential for risk reduction but can achieve more when used in combination; and**
- **require little capital investment, few changes in farming practices and behavior, but need higher labor input.**

Postharvest

Washing was the main practice employed for postharvest risk reduction. Best practices varied between Ghana and its francophone neighbor countries. In the latter, the most common food disinfectants used in the middle-and upper-class homes and restaurants are bleach and potassium permanganate. These disinfectants are not commonly used in Ghana. In lower-class households in francophone countries, plain water or water with salt, soap or lemon juice is used. This is similar to Ghana, where various salt and vinegar solutions, plain water or a combination of these three are used. At both sites, however, there are no guidelines available on how to use any of the disinfectants. Respondents were unaware of international recommendations and used their own judgment on dosages and contact times.

Translating research into widespread practice

These two interlinked CPWF-funded projects significantly increased the knowledge of urban vegetable farmers and sellers regarding health risks and risk reduction measures. The projects reached out to about 60% of all vegetable

farmers and sellers in the study sites—about 60 lead vegetable sellers and more than 300 street food vendors and caterers.

An increasing number of farmers have begun using sedimentation ponds and safer water application techniques; sellers are practicing safer handling practices; and food vendors are also making changes in their vegetable washing techniques.

Based on the outcomes of these projects, various kinds of awareness-raising and training materials aimed at different stakeholders were produced. The projects helped to establish strong working relationships between farmers' organizations and networks of farmers and food sellers. This led to the founding of the Ghana Environmental Health Platform, which continues the work started by local universities and CPWF partners. Project researchers were also asked to provide inputs to the WHO guidelines for wastewater use in agriculture. In close collaboration with the Resource Centre on Urban Agriculture and Food Safety (RUAF), researchers assisted in the revision of the Accra by-laws banning the use of wastewater. In 2008, a first draft of a new by-law stated that, with certain precautions, the re-use of wastewater could be beneficial. Now, Accra's urban vegetable farmers can continue to make a living, while helping to ensure the city's food security.

Conclusion

Farm-based and postharvest risk reduction interventions provide practical low-cost solutions to the health challenges in wastewater-irrigated urban and peri-urban agriculture. Though individual risk reduction measures alone may not be sufficient, they can be used in combination to lower the risks to acceptable levels.

Much headway has been made in ensuring the safety of wastewater-irrigated vegetable crops. Tested and developed in the major cities of Ghana, these measures have considerable potential to be adapted and further improved for their use in other locations. Two things remain to be done: 1) ensure the widespread application of well-tested risk reduction measures by national stakeholders, and 2) transpose them into legally enforceable national standards that can be monitored and verified.

Contact Person

Robert Abaidoo (r.abaidoo@cgiar.org)

Partner Organizations

Centre Regional pour l'Eau Potable, Burkina Faso
Faculty of Health Science, University of Copenhagen, Denmark
Kwame Nkrumah University of Science and Technology, Ghana
International Water Management Institute
University for Development Studies – Tamale, Ghana
Water Research Institute – Council for Scientific and Industrial Research, Ghana

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