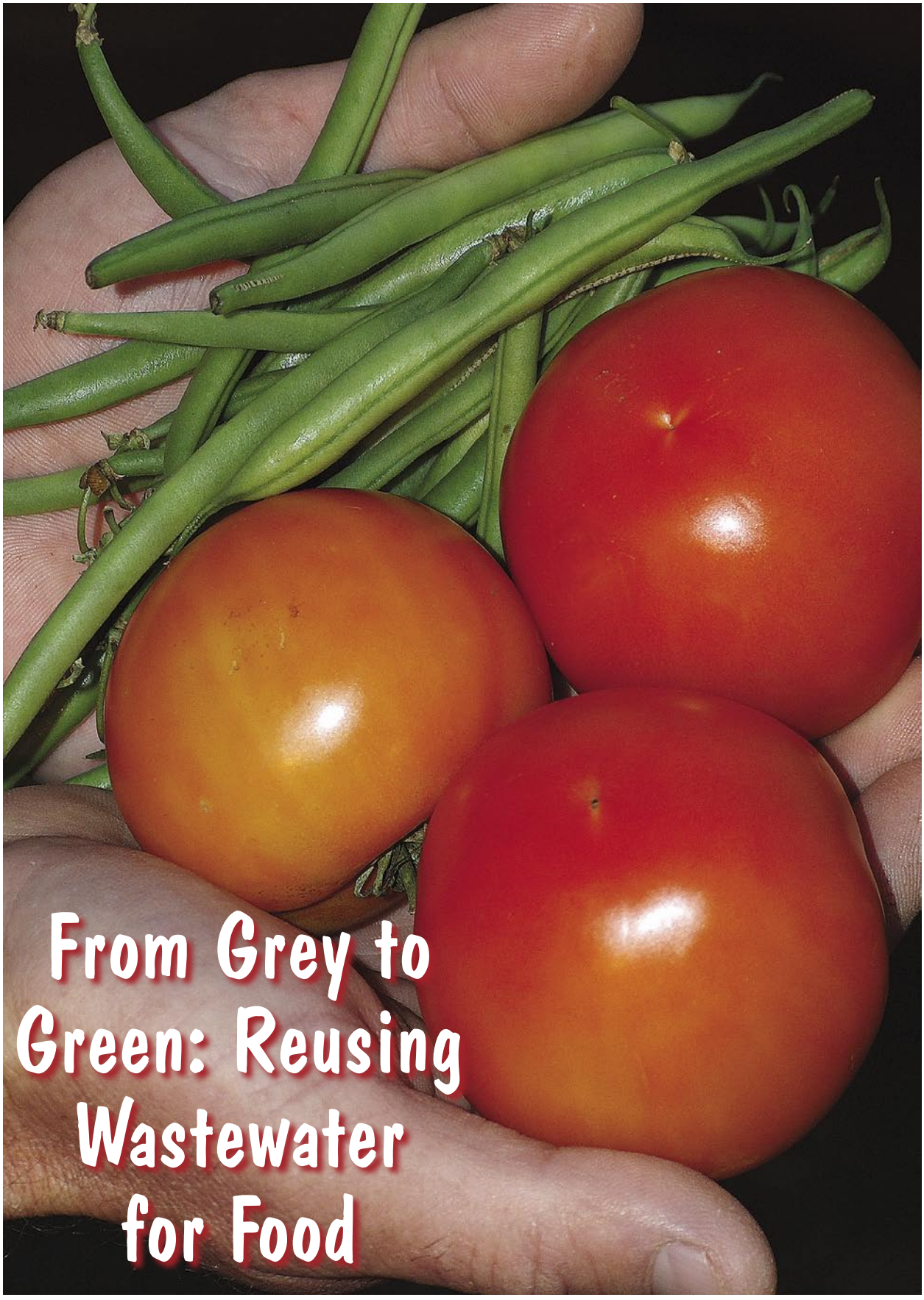

From Grey to Green: Reusing Wastewater for Food

The answer to enhanced food security might lie in your dirty dish water. Research indicates that the reuse of so-called 'greywater' – all household wastewater except toilet waste – has huge potential to grow food for peri-urban and rural families. Lani Holtzhausen reports.

All households produce greywater of some kind. This wastewater can include water from showering, bathing and washing dishes and clothes. The amount of greywater varies enormously between households. Consumption in poor areas can be as low as 15 to 20 ℓ per person per day, while in rich urban areas people may generate more than ten times as much.

Depending on the household the water can contain soap, shampoo, toothpaste, washing powder, disinfectants, shaving cream, bleach and household cleaning chemicals. The water can also contain cooking oil, hair, fat and fibres from fabrics. Greywater is unlikely to contain disease organisms (such as *E. coli*) anywhere in the same magnitude as those found in toilet wastes (unless laundry tubs or basins are used to rinse soiled clothing and babies' nappies).

"Greywater can be a significant water resource, contributing to a community's well-being rather than adding to pollution."

Generally in urban areas, greywater is washed away along with other wastewater (sewage) and treated at wastewater treatment plants. In peri-urban and rural areas, however, where people are generally served with dry toilets, such as ventilated improved pit (VIP) latrines and standpipes, there is usually no infrastructure to transport the greywater away and treat it.

As a result, greywater is usually disposed of to the ground in the vicinity of the dwelling, leading to pooling of this wastewater. In turn, this leads to unpleasant odours, pollution of groundwater and surface runoff, soil erosion, health hazards and mosquito breeding.

POTENTIAL REUSE

It is believed that greywater can be a significant water resource, contributing to a community's well-being rather than adding to pollution. One possibility is the reuse of greywater for the irrigation of community gardens. As Odette Beukes of the Agricultural Research Council (ARC) points out: "Malnutrition is an enormous problem in rural communities. While food gardens can alleviate the problem, the water supply is often very limited. Greywater reuse is one possible answer."

Globally, there remains doubt about the suitability of greywater for irrigation. It is thought that water that contains high levels of sodium, phosphate and chloride can lead to a build-up of these elements in the soil, with a negative effect on sensitive plants. Questions also arise around the effects that the consumption of crops grown with greywater can have on people's health.

To investigate this, researchers at ARC Infruitec-Nietvoorbij, in the Western Cape, initiated a project to determine the effect of greywater irrigation on the quality and yield of tomatoes and beans. The project, partially funded by the European Union, also focused on the effect of greywater on infiltration tempo, permeability and element content of three types of soil, sand, loam and clay.

SURPRISING RESULTS

The greywater used was obtained from the shower, hand basin, kitchen sink and washing machine of a household of an ARC employee, and was not filtered before application. The water was added to potted crops using conventional watering cans.

In its greywater reuse project at Nietvoorbij, the Agricultural Research Council obtained higher production of tomatoes by using greywater.

In the trials conducted by the University of KwaZulu-Natal, the vegetables fed with greywater (left) have shown considerable more growth than the vegetables fed with municipal tap water (right).

Beukes reports that the results were rather surprising. "Water and soil samples were taken during the course of the trials and analysed for chemical composition. Results indicated that the use of greywater had no detrimental effect on the production of the tomatoes or beans. In fact, higher productions were obtained with the greywater applications compared to the municipal water applications."

Moreover, no negative effects of greywater application on the infiltration rates were observed. Chemical analysis of the tomatoes and beans did show an increase in sodium levels and phosphorus levels, with the macro nutrient levels of the plants grown in sandy soil types consistently the lowest compared to those grown in other soil types.

FROM TOMATOES TO SPINACH

The University of KwaZulu-Natal's School of Biological and Conservation Sciences, in collaboration with eThekwini Municipality's Water and Sanitation Unit, has been conducting its own trials into the reuse of greywater. Greywater from eight households of the nearby Cato Crest peri-urban settlement was used to irrigate spinach, green pepper, potatoes and madumbes. Drip irrigation was used to water the plants with municipal water, greywater or a commercially available nutrient solution to compare the results.

Plant growth was measured weekly, and harvested crops were analysed for microbiological contaminants, including *E. coli*, total coliforms and *Staphylococcus*. According to project leader Dr Nicola Rodda, there was a consistent increase in plant height and yield when the crops were irrigated with the greywater, as compared with municipal water, although the nutrient solution yielded the best plants.

Analysis showed that contamination of the crops with bacteria was minimal to negligible, indicating that irrigating with greywater did not produce consistent increases in bacterial levels on the final crops. This is despite a 'worst case' scenario being evaluated, with no waiting period between irrigation with greywater and harvesting, and no allowance made for inactivation of bacteria during food preparation, such as cooking.

These studies certainly indicate that greywater represents a potentially important resource for food production in poor peri-urban and rural communities with minimal additional risk to health association with consumption of the irrigated produce.

A CAUTIONARY APPROACH

However, despite initially positive results, Dr Rodda and Beukes maintain that the reuse of greywater to irrigate food crops should be approached with caution at this stage. "Before the use of greywater for urban agriculture can be widely promoted, the effect on plant growth, sustainability of greywater irrigation (in terms of medium- to long-term effects on soil quality), community acceptance of the practice and associated health risk during irrigation and as a result of crop consumption needs to be investigated further." These studies are currently in progress at the University of KwaZulu-Natal.

If people have no choice but to use greywater on food crops they suggest that some form of drip irrigation be used, and that users should rather avoid below-ground crops. A resting period, if possible, one month between last irrigation and harvest, is also recommended. Importantly, users should take sound hygienic precautions when handling the greywater, and wash (and preferably cook) produce before consumption.

Greywater reuse shows much potential. It is hoped that further research will answer the remaining questions to turn this pollutant into an important resource.