

Growing better Cities

URBAN AGRICULTURE FOR SUSTAINABLE DEVELOPMENT

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Dealing With the Water Deficit in Jordan

Recycling household water to irrigate home gardens makes good environmental and financial sense

Water is a precious commodity in much of the Middle East and North Africa, too valuable to pour down the drain. So researchers in Jordan found a way to reuse household wastewater for use in urban gardens. Saving water and increasing the food output from home gardens has proved to be a winning combination that is fast being adopted throughout the region.

In a rapidly urbanizing world, municipal governments are learning to accept, and even encourage, the practice of urban agriculture as a way for the poor, and even the not-so-poor, to help feed their families and earn a little extra income. For most of these urban farmers the limiting factor is space, but in the arid regions of the Middle East and North Africa, more often the critical issue is not land but the availability and cost of water to irrigate even a small garden.

Take the case of Jordan, one of the 10 most water-scarce countries in the world. Wedged in between Israel, Syria, Iraq, and Saudi Arabia, this small country has a population of about 5.7 million people, swelled in recent decades by successive waves of returnees. In Jordan the shortage of water creates a double threat for the poor — both food and water insecurity.

Almost three-quarters of Jordan's population lives in cities and towns, and in these urban centres there is barely enough water to drink, let alone enough for agriculture. The Ministry of Water and Irrigation estimates that the amount of water available to each individual is less than 200 cubic metres per year. The World Health Organization (WHO) estimates that below 1 000 cubic metres per person, water scarcity can impede economic development and harm human health.



IDRC: Jan Kassay

A simple, easy-to-maintain greywater treatment system allows Jordanian farmers to recycle valuable wastewater, grow more food, and save money.

Despite this, a survey by the Jordanian Department of Statistics, with support from the International Development Research Centre (IDRC), estimated that some 50 000 households in the capital city of Amman — or about one in six — practice urban agriculture. City gardeners grow olives, fruit, vegetables, and herbs or keep live-stock on plots that average about nine square metres. City gardens totaled 648 hectares, even though only 25% of available space was under cultivation.

The Department estimated the annual total value of the food grown at US\$3.5 million, or about \$70 per household — not an insignificant amount in a country where the average monthly income is about US\$130, and much less than that for the poorest families. However, most of these gardens were irrigated with fresh water from the public distribution system. This at the same time nearly one-third of all households suffered from water scarcity, and many complained of the high price of water. Some households, however, were already using water-saving practices such as collecting rainwater or applying greywater directly to their gardens.

Changing attitudes

Greywater is water that has been used for household purposes such as bathing, laundry, or the preparation of food. The potential to reuse this water for agriculture was the objective of a series of projects jointly funded by IDRC and the Inter-Islamic Network on Water Resources Development and Management (INWRDAM) in Amman, from 1998 to 2003. The projects took a new approach to food insecurity and water scarcity in the region, exploring water management techniques, simple technological innovations, and creative agricultural practices.

Because the water issue has reached a crisis situation in Jordan, attitudes toward water management have undergone a radical shift. Water was once viewed as a free public good, but it is now widely accepted that it has an economic value. Water is no longer free — or plentiful. Potable water is available only once or twice a week, and it must be paid for. When there are shortages the price tends to go up, meaning the poor go thirsty. Not surprisingly, the scarcity and high price of water have become major issues in Jordan.

Jordan's population is growing at a rate of 2.7% a year, and is increasingly urbanized. The United Nations Development Programme (UNDP) expects the percentage of Jordanians living in urban areas to reach 80% by 2015. Urbanization diverts water away from agriculture into built-up areas for drinking water supply and domestic uses.

A country is said to have a water deficit when it is using more water than can be replenished by rainfall and other natural sources. Jordan has a water deficit, and the Water Ministry has projected that it will continue for at least the next 25 years. Water engineer Fayez Bataineh is less optimistic: "We will be in deficit forever unless we implement a number of measures," he says. Those measures include conservation, which is a top priority for the government, and to this end the country is spending millions to repair or replace leaky distribution systems. Another priority, however, is the treatment and reuse of wastewater. The need to conserve and reuse water becomes increasingly urgent.

This land is now dry

Even 30 years ago a well drilled just 10 metres deep could supply enough water to irrigate the small farm where Murad Jabay Bino grew up. Today Bino is executive director of INWRDAM and he headed the IDRC-supported project. He says the water table on that farmland today has dropped to 150 metres. "This land is now dry and used for urban development," he adds.

It is that experience, perhaps, that has led Bino to dedicate much of his career to finding ways to conserve and reuse water. With degrees in both mechanical engineering and chemical engineering, he is well qualified for the job. Conservation, combined with wastewater treatment and reuse are now priorities for the government — and for Bino, who says he hopes the outcome of his life's work will benefit the most vulnerable in society.

When the project began, the concept of reusing household water for irrigation was a new area of research for urban agriculture. Bino and his team of researchers and technicians believe that the techniques for wastewater reuse developed in this project can substantially reduce the use of fresh water in gardens, and help to produce more food for the poor. But he warns that it is essential to ensure that reusing wastewater is both safe and socially acceptable.

The researchers met these requirements when they undertook a pilot project in Ain Al-Baida, Tafila, south of Amman. After evaluating a number of different low-cost technologies, they settled on a system using four 160-litre plastic barrels. Other components of the system were also readily available locally, and inexpensive. "We tried different ideas, and we were always considering the cost of the



IDRC: Jan Kassay

In water-scarce Jordan, government officials are examining the country's building code to ensure use of greywater systems in new housing construction.

system because we were dealing with poor people who have very limited financial resources,” explains Bino.

The system they developed was tested in two dozen households in Tafila. It was in essence a simple recycling system that allowed water from household uses, though not of course from toilets, to be reused safely in home gardens. This involved some minor modifications to household plumbing in order to divert water from kitchen and bathroom sinks through a filter instead of allowing it to go down the drain and into the septic system.

There was some initial resistance to the idea of using greywater, both among householders and local officials. Some were skeptical, unconvinced that the system would work, or afraid that it would be too expensive and hard to maintain. Others worried about odours and mosquitoes. But once the system was demonstrated the community quickly became enthusiastic.

Exceeded expectations

From the beginning the project exceeded expectations. The researchers installed water metres that showed that initial water savings were at least 15%. An unexpected cost-saving for users of the system was that it meant they had to have their septic tanks emptied less frequently. In Jordan more than 60% of homes are not connected to a municipal sewer system.

Households used the recycled water to irrigate crops such as eggplants, herbs, and of course, olives. In Jordan, Bino says, it is traditional to plant an olive tree with every house. And he claims that Jordanians consume as much as 20 litres of olive oil per capita each year! Results from this

first phase showed that the combination of a reduction in water bills and septic tank pumping fees, together with an increase in crop yields from irrigated gardens meant that the cost of the units could be recovered relatively quickly. Analysis of research data shows that the long-term benefits to the household of reusing greywater outweigh the costs by something like five to one.

In addition to the poor households, the researchers installed greywater systems at two other strategic locations in Tafila. One was at the local mosque, where water used by worshippers to wash before praying was diverted to the recycling system, then used to irrigate landscaping and trees surrounding the mosque. At first, says Bino, some were concerned that recycled water was somehow “unclean” but the Imam was able to convince them that this was not the case. So people saw the system, saw that it worked, and wanted to know more about it. “It was a very good demonstration for the community,” says Bino.

Another system was installed at the local girls’ school. The school has 500 students and 15 or 20 drinking water faucets from which the girls could drink on breaks between classes. It was a very wasteful system, says Bino. “We collected this water and gave it to the olive trees in the school garden. So the girls and everyone could see that this water was now being used. Now many other schools ask us to do this.”

A key to the success of the pilot project and subsequent expansion of greywater recycling was the involvement of nongovernment organizations (NGOs). The research team involved a local NGO as a major stakeholder in the pilot project. Members were given training in water conservation as well as techniques for separating and treating greywater. The NGOs helped put on workshops providing training in system maintenance and irrigation techniques. A manual on greywater treatment and reuse was produced, in Arabic, and made available at meetings and workshops.

Meets WHO standard

The Ministry of Water and Irrigation was impressed with the results of the projects — but cautious. Officials monitored the quality of the greywater used for irrigation for a year. The system passed the test. “Greywater from our treatment units met the WHO’s standard for restricted irrigation,” says Bino. “This means it is fit for irrigating trees and crops that must be cooked before they are eaten.”

The Ministry of Planning was so impressed with these results that it supported the construction of a further 700 systems in 90 communities across the country based on the INWRDAM model. As a bonus, the new technology has created a local business enterprise involving engineers, plumbers, and contractors. A local company is now producing an environmentally friendly detergent to replace the



IDRC: Andrés Vélez-Guerra

Treatment units developed by Dr Bino, pictured here, and his INWRDAM team meets WHO standards for restricted irrigation.

standard detergents available on the market. The Ministry of Social Development has become involved, offering training for the poor in plumbing and agricultural techniques, but also in finance, administration, and business management.

So far, the greywater systems are available only for single houses. The cost and complexity of installing such systems in apartment buildings is prohibitive. However, the government is now considering rewriting national building codes to ensure that all residential construction in future can make use of greywater reuse systems. There is also now a national committee preparing definitive greywater reuse guidelines.

Word of the success of the greywater recycling project has spread beyond Jordan to many of its equally thirsty neighbours, thanks in part to the Department of Statistics, which published the results of the initial projects on its Web site. Greywater reuse projects are now underway in Lebanon, Syria and West Bank and Gaza, and a number of other countries have indicated interest in the technology.

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