

Duckweed Wastewater Treatment and Reuse for Fodder (West Bank)

Project title: Duckweed Wastewater Treatment and Reuse for Fodder (West Bank, Palestine)

Research area: Wastewater Treatment and Reuse

Research institution: Water and Environmental Development Organization (WEDO)

Total cost: 208 100 CAD

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Abstract The Occupied Territories are facing a grave water crisis. Current access to fresh water only barely meets the domestic, industrial and agricultural demand. If industry is to be developed, or agricultural output is to be maintained, recycled water will have to be used. But currently, only 20% of the West Bank is part of a sewer system: all rural and suburban areas rely on onsite cesspits. Cesspits themselves constitute a threat to freshwater: if they overflow, as frequently happens, they contaminate the soil and groundwater with raw sewage. If they are pumped out, the sewage is usually dumped into the nearest body of water. So not only is freshwater declining due to population growth, it is also under threat from pollution. This project aims to protect the environment and improve food security by pilot-testing the use of duckweed, a floating plant, to treat wastewater in small decentralized communities in the Jordan Valley, West Bank. In the past 5 years, there has been growing recognition of the effectiveness of this tiny aquatic plant to treat wastewater at much lower cost than mechanical treatment plants. Because duckweed is 40% protein by weight and grows so quickly, it can serve as an excellent feed supplement for poultry, livestock and fish, and can even be served in salads. An integrated system can both treat wastewater and provide income and employment opportunities for local residents who sell the produce raised on duckweed. In addition to reducing biological oxygen demand (BOD) and Total Suspended Solids (TSS) levels, duckweed efficiently reduces nitrogen and phosphorous levels in wastewater. But the operation of duckweed systems is still an art rather than a science, and while plants flourish in some locations, it is

difficult even to grow them in others. This project is optimizing various operating parameters for an integrated duckweed wastewater treatment system in the Middle East.

General objective

To promote a viable sanitation control for Palestine that increases environmental public health, food security and consistently recovers its operation and maintenance costs through optimal production of aquatic plants (duckweed fodder) and terrestrial fruit and vegetables.

Specific objectives

- To pilot-test a low-cost, sustainable, ecological, waste treatment system, which enhances food security through urban agriculture, and generates income.
- To optimize the design and operating parameters of a duck-weed based cropping system for wastewater treatment over a range of seasonal variations and changing parameters of wastewater influent quality (biological, physical, chemical).
- To pilot-test the use of duckweed as supplemental fodder on a number of animals such as chicken, cattle and sheep.
- To enhance WEDO's research capacity to undertake research and extension activities on duckweed based systems.
- To study the socio-economic aspects of such a waste treatment reuse system.
- To carry out a benefit-cost analysis of the duckweed system and to compare it to other potential waste treatment systems.
- To disseminate the results of the research project in order to promote the replication of duckweed-based wastewater treatment and reuse projects in semi-arid areas.

Project findings

This project is on-going, but it has been delayed due to the political situation in Palestine. Nevertheless, there are some preliminary findings:

- Duckweed thrives around 30 degrees Celsius; in temperatures much higher or lower than this the plant will not grow to cover the ponds, and will therefore not act as a water filter.
- Salinity tolerance of duckweed has been defined.
- Duckweed is being harvested twice a week, and the feed produced is currently being tested on chickens and sheep.

- There will be a survey done to assess the acceptance of duckweed by farmers as an animal feed, although there is already much initial local interest.
- Average weight of chickens fed by duckweed is 17% higher than other chickens.
- Duckweed-fed chickens have whiter meat, increasing their marketability.
- Fodder cost savings of approximately 15%.
- Demonstrates that when wastewater treatment leads to income generation, beneficiaries are willing to contribute to its costs.
- Research capacity of the team has been enhanced.
- There has been much public interest in the project from the Palestinian Ministry of Agriculture, the National Agriculture Centre, the Palestinian Agricultural Relief Committee (PARC), and local farmers.

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