

Benefits and Risks of Using Treated Municipal Wastewater for Agricultural Production

Indicator	Quantity (MCM/Year)
Treated effluent	600
Reused effluent	352
Treated effluent lost	248

With the current population growth rates in the UAE, the estimated treated wastewater quantity is expected to reach 1,400 MCM by 2030. The safe utilization of this alternative resource can have considerable environmental and economic benefits.



Radishes grown at ICBA experimental farm using treated municipal wastewater under subsurface drip systems.

Thematic Area: Crop Productivity and Diversification

Purpose: Evaluate the impact of using treated municipal wastewater for irrigation on vegetables and other agricultural production systems

Geographic Scope: United Arab Emirates (UAE)

Timeline: 2013 - 2015

Partners:

- Ministry of Environment and Water (MoEW)
- Dubai Municipality (DM)

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Food and water security is a growing global challenge especially for marginal environments such as the Middle East and North Africa region that receives a mere 1.3% of the world's renewable freshwater but has the highest population growth rate in the world. These factors, along with the projected effects of climate change, have put enormous pressure on agriculture to reduce its share of freshwater use and to look for alternative sources to meet its requirements. Treated municipal wastewater could be a viable option for farm production systems as it contains organic matter and nutrients which are essential for plant growth. However, its use needs careful handling to mitigate harmful effects on soils, crops and human health.

In the United Arab Emirates (UAE), the yearly water supply from the treated municipal wastewater is about 600 MCM (million cubic meters). This constitutes about 12 percent of the total water supply per year and all of it is treated at the tertiary level. If the population continues to grow at the present rate, by 2030 the estimated yearly treated wastewater quantity in the country will reach around 1,400 MCM. Both the Government of the UAE and the International Center for Biosaline Agriculture (ICBA) consider treated wastewater an alternative water resource that needs to be managed and used properly. This prompted the launching of an initiative to evaluate the benefits of using treated wastewater for agricultural production and examine the possible risks of pathogens and heavy metals on soils and crops.

Activities and Outcomes

ICBA is receiving tertiary-level treated municipal wastewater from the Al Aweer Sewage Treatment Plant of Dubai Municipality to carry out experiments at the Center for growing different crops. Tertiary-level treatment does not completely screen out the presence of bacteria such as total *Coliforms* and *E. Coli* from the effluent nor does it address the concentration of heavy metals especially copper, iron, zinc and chromium which could pose a safety hazard if high.

Research activities and trials will aim to assess the level of concentration of heavy metals and/or pathogens in plant tissue, and in the soils (within the root-zone) and advise if these levels



Salvadora persica (miswak) seedlings were planted in November 2013 to evaluate the transportation of pathogens and heavy metals to the plant parts.

are within safe levels and what the short and long-term effects will be. Additionally, project activities will aim to identify suitable irrigation methods for avoiding environmental/health risks using treated wastewater and recommend the suitable treated wastewater quality for vegetables, landscaping, forages and date palm trees.

During 2013 and 2014, vegetables, namely carrots, lettuce, eggplant, tomato, radish, and spinach were grown at ICBA using two irrigation methods i.e. surface drip and subsurface drip for comparative evaluation. Additionally, experiments with buffel grass, forage, and *Salvadora* (a landscaping plant) also started in 2013 as well as testing of various Lulu variety Date Palm seedlings that were provided by UAE university. ICBA scientists monitored and analyzed results to assess any correlation with the use of treated wastewater.

The results of the field experiments during the initial two years of the project are very encouraging and demonstrate that treated wastewater, if used properly, can become an important alternative resource for the UAE. Results showed that the vegetables produced with treated wastewater were free from *E. Coli* 157 and *Salmonella*. Likewise, the concentration of *Coliform* bacteria was below the detection limit (<10 cfu/g). However, in the tomato plots, scientists detected higher concentrations of *Coliform* that exceeded 10 cfu/g in 50% of the samples, but that was due to insect induced infection on their skin. These findings will be confirmed during the on-going third year experiments before final determination can be made.

As for the concentration of heavy metals such as copper (Cu) and zinc (Zn), results showed that the concentrations were mostly similar in the plots irrigated with treated wastewater and the control plots irrigated

with fresh water. However, slightly higher amounts of iron (Fe) were observed in spinach and lettuce, and this is attributed mainly to the leafy nature of these plants. These preliminary results suggest that using tertiary level treated wastewater is suitable for irrigating most fruit bearing vegetables (above and below ground), but may not be appropriate for irrigating leafy vegetables.

Future Directions

ICBA will continue with its experiments to test the implications of using the tertiary-level treated wastewater for irrigating vegetables, landscaping plants, forage and date palms. Suitability for UAE conditions will be demonstrated and technological interventions will be suggested as needed in order to minimize the negative impacts.

Findings will be published in journals and/or conference papers. The potential impacts of these findings will assist the MoEW in creating policy and regulations for the safe use of treated waste water in landscaping and agriculture and taking measures to help protect the environment. The results of this project will ultimately have wider application in the whole Arab region as more and more countries are starting to use treated wastewater for agriculture.



Data from buffel grass selected for forage evaluation showed that 1011-cuttings can be achieved per year using treated wastewater for irrigation compared to only 34- cuttings from the control treatments where low-saline water (0.3 dS/m) was used.