Reuse of treated wastewater in the Jordan Valley
An added value outweigh risks

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Introduction

The history of treated wastewater use dates back to early 1980's after the construction of Kherbit As-Samra treatment plant which treats significant amounts of Amman and Zaraqa wastewater.
The use of treated wastewater in Jordan for agricultural purposes acquired more importance over time with the increase in Jordan' population and the aggravation of water scarcity as a result of vagaries in precipitation cycles.
Over the last five years water shortages peaked and conflict of interest started to be an issue with regard to priority of water allocation for drinking purposes. This breakthrough obliged the decision makers to consider treated wastewater use a present and future strategy.

Impact of treated wastewater use

1. Negative Aspects

- **Health of farmers and consumers**

It goes without saying that use of treated wastewater for agricultural purposes poses a risk of biological contamination. However this risk can be managed effectively if efficient risk monitoring and management system is developed. In Jordan the existing barriers are relatively effective in eliminating the risks of biological contamination. Treatment plant, storage facilities (reservoirs), drip irrigation systems, natural die-off of pathogen (as a result of high temperature and abundant sunshine), and finally the relatively high level of hygiene practices of Jordan population are barriers that should not be looked over when we discuss the biological contamination problems associated with reuse of treated wastewater.

- **Environmental risks**

Both soil and groundwater are subject to risks of heavy metal accumulation and nitrate pollution respectively if no risk management is in place. As for risk of heavy metal accumulation in soil, report showed it is very minimal because heavy metal content in the generated treated wastewater in Jordan is within the acceptable levels. Ground water contamination with nitrate exists but it is attributed to general agricultural activities (use of fertilizers) and not due to treated wastewater use.

2. Positive Aspects

Nutrients in treated wastewater

The fact that treated wastewater contain significant amounts of nutrients that contributes in crops requirement requires thorough evaluation to asses its role in reducing dependence on chemical fertilizers which in its turn reduce cost of fertilization and mitigate soil salinization process.

- **Farm level**

Impact of nutrients contents on fertilization cost cut was assessed by the project through practical demonstration trials with farmers. The obtained results revealed that on average farmers can save up to 60% of fertilization cost bill. In monetary terms, each farmer in the Jordan Valley can save up to JD 1000 per farm unit (3 hectares) which tantamount 20% of his yearly net profit

The following table gives details on fertilization saving

Area Irrigated with RW (du)	152000
% of cultivation	80
Average fertilizer consumption (kg/du)	80
Average Size of Farm unit (du)	37
Total fertilizers consumption (ton)	9728
Total consumption per farm unit(ton)	2.368
Saving in fertilization (%/du)	60
Total saving (ton)	5836.8
Total saving per farm unit (ton)	1.4208
Average profit per farm unit (JD)	5000
Average price of I ton of fertilizer	700
Average saving per farm unit (JD)	994
Saving as % from the net profit	19.9

- **National Level**

More than 80% of fertilizers used in Jordan are imported; therefore any saving in fertilizers means reduction in foreign currency transmittance to the exporting countries. As such making use of nutrients in treated wastewater save Jordan about JD 4.0 million per year.

- **Environmental Level**

Beside reuse of treated wastewater in agricultural is productive approach, its positive impact on the environment is multi-perspectives. Salinity, energy consumption and CO_2 emissions are among the multi-perspective issues.

1. **Salinity mitigation**

Fertilizers are important nutrient sources for crops, however the irrational use of fertilizers pose the risks of both ground water contamination and acceleration of soil salinization. Bearing in mind this fact, each extra Kilogram of fertilizer applied to the soil increases the risk of salinization and vice versa.

2. Energy reduction

Fertilizers are known as indirect energy consumer. Energy consumption associated with fertilizers accomplished away from the farms in the production, packaging and transport processes.

Energy Requirement (World Average) KJ/Kg

Element	kJ/kg
N (nitrogen)	78230
P (phosphorous)	17500
K (Potash)	13800

Source: UNISCO- EOLSS

Based on the ratio of fertilizers consumption in Jordan (60% N, 20% P and 20% K) and the figures in the table we can derive the average energy requirement for 1 kg of fertilizer as 53198 KJ/kg. As it is shown in table1, considering nutrient in treated wastewater lead to 5838.8 ton per year reduction in the consumption of fertilizers. This amount is equivalent to 86 gigawatt-hr per year (about 1% of the current Jordan electricity consumption)

3. CO_2 emission reduction

Another important aspect of fertilizers use reduction is the reduction of greenhouse (GHG) generated during fertilizers production. Kongshaug (1998) estimates that fertilizers production consumes 1.2% of the world's energy and is responsible for 1,2 % of total GHG emissions

Gas emissions (CO_2) per one kg of different types of fertilizers

	g CO_2 /kg			
Fertilizer	Country	Production	Transport	Total
MAP	Europe	703	238	941
Urea	Europe	1848.7	-	1848.7
AN	Europe	2460	14.2	2474.2
DAP	Europe	866.2	211.3	1077.5
NPK	Sweden	2064	32.1	2096.1
Average				1700

Source: IEA bio-energy 2004

Based on the average gas emission per production 1 kg of fertilizers (1700 g), Reduction in fertilizers use in Jordan Valley would lead to reduction 11 million kg of CO_2 emission.