

Increasing Water Efficiency through Agricultural Drainage Water Reuse

Summary

The Egyptian Government has developed a national climate change adaptation strategy. One of the most expedient measures is the reuse of agricultural drainage water. Farmers in the Beheira Governorate in the northern part of the Nile Delta (Fig. 1) suffer from a lack of irrigation water.

A pilot measure by the GIZ regional programme “Adaptation to Climate Change in the Water Sector in the MENA Region (ACCWaM*)”, implemented in the northern Nile Delta, focuses on increasing water efficiency through agricultural drainage water reuse. The main aim is to improve irrigation water availability, particularly during the summer, by mixing fresh irrigation water with drainage water under controlled conditions.

The process is operated by the Ministry of Water Resources and Irrigation (WRI) in partnership with the local water community. Special attention is given to the needs of women farmers. The pilot measure demonstrates an innovative option for **climate change adaptation**.

Challenge

Egypt faces the challenge of meeting an increasing demand for water due to high population growth with a limited volume of freshwater. The population, which is estimated to be 89 million in 2015, is expected to increase to 105 million in 2030 – a further 16 million people in 15 years who need to be supplied with water

* ACCWaM = Adaptation to climate change in the water sector in the MENA region

and food – and jobs. The country relies on the Nile River as its main and almost exclusive source of fresh water (Fig. 2). The Nile valley and the Nile Delta are the most important agricultural production areas and as such, population density is extremely high, estimated at 1,540 inhabitants per km² (2015). Farmers try to boost their production, but irrigation water is in short supply, mainly during the summer season. Climate change exacerbates the vulnerability that results from water scarcity. To overcome this problem, farmers often pump (polluted and lower quality) water directly from the agricultural drainage canals to irrigate their lands, unaware of potential harms.

Setup

In its National Climate Change Adaptation Strategy, Egypt identified the reuse of agricultural drainage water as one of its most promising options. The GIZ pilot measure “Increasing Water Efficiency through Agricultural Drainage Water Reuse” aims to improve the availability of its irrigation water, particularly during the summer, by mixing fresh irrigation water with drainage water under controlled conditions. The pilot measure, located in the Mahmoudia District of Beheira Governorate, was implemented via the delivery of a mobile pumping unit in July 2013.

Impacts are being monitored according to an agreement signed between GIZ-ACCWaM and the Ministry of Water Resources and Irrigation (MWRI). It stipulates that between May and September every year the pump shall be used exclusively in the pilot area for the purpose of **alleviating water shortage and mitigating climate change-related impacts**.



Fig. 1 (l): Location of the project site in the northwest corner of the Nile Delta

Fig. 2 (r): El-Menshaweya Canal transfers Nile water into the GIZ pilot area in Damanhour in Beheira Governorate



Fig. 3 (l): Mobile pump unit under operation

Fig. 4 (r): Rice nursery in Damanhour in Beheira governorate

While GIZ provided the pumping unit, MWRI's role is to ensure its functioning, the allocation of the mobile pumping unit, and regular water quality monitoring. MWRI, ACCWaM and the Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) cooperate in the evaluation, monitoring and documentation of the project and the dissemination of lessons learned.

Opportunities

The main objective of this pilot measure is the reuse of agricultural drainage water through the purchase and use of a mobile pumping unit to help the local community by mixing it with irrigation water during the period of high water demand [May – September (Fig. 3 and 5)]. Fortunately, in the pilot area available drainage water is not polluted by village or industrial effluents. The main crops are rice (Fig. 4), wheat, maize, clover and vegetables.

Socio-economic features: The pilot covers an area of about 6,000 feddan¹, cultivated by 3,000 farmers and organised in three Water User Associations (WUAs). 30% of WUA members are women (Fig. 6). In the Pilot Measure area, the farmers are constrained by a shortage of irrigation water, and, in response, drainage water is pumped for irrigation privately by local farmers. This implies water quality problems (e.g. salinisation) and high energy consumption.

The increasing involvement of WUAs and local MWRI staff and the use of technical and socio-economic studies is expected to ensure the sustainability of the project.

The controlled mixing of drainage water with fresh irrigation water through the pilot's single mobile pump saves much energy and reduces the cost to farmers that do not have to operate

1 1 feddan = 0.42 hectares; 6,000 feddan = 2,520 hectares.

many individually-owned smaller and often inefficient pumps. In addition, regular water quality monitoring eases concerns over food safety.

Increasing the discharge in the irrigation canals through reuse **reduces farmers' vulnerabilities** and contributes to **allocative equity**. A mobile pumping unit has the advantage that it can serve those fields that suffer the most from irrigation water scarcity (e.g. at the tail end of a canal). On the other hand, the economical use of a mobile pump unit requires the proximity of a feeder and drainage canal.

The **technical preconditions** for the successful operation of the unit are (a) a regular monitoring of the water quality; (b) protection of the drainage water from domestic and other pollution (including garbage disposal); (c) regular maintenance and uninterrupted energy supply of the pump; and (d) demand-driven operation and a steady, reliable water availability. The **risks involved** are the slow and gradual salinisation of the irrigated lands, an accumulation of hazardous chemical substances (if drainwater is polluted) and hygienic problems (if drainwater is contaminated with human excreta).

Stakeholder involvement in the pilot area for decision making and the operation and maintenance of the mobile pumping unit is intensifying. One important element is the fruitful and constructive partnership **between MWRI** and GIZ/ACCWaM through operational planning workshops. The experiences, benefits and impacts of the pilot measure are shared with water user associations, irrigators and focal groups.

The selection of the programme counterpart at central level (Cairo) and at local level (governorate and district) do have a direct impact on the success of the project activities. Guidelines for the further upscaling of agricultural drainage water reuse based on monitoring and additional studies have been developed.



Fig. 5 (l): Mobile pump at feeder canal

Fig. 6 (r): Women play a major role in agriculture and irrigation



Fig. 7: Farmers and Dr. Ihab Jnad (ACSAD) in discussion

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Outlook

Lessons learned: As an arid country, Egypt faces the challenge of meeting an increasing demand for water resources with a limited availability of freshwater. Climate change, with its higher temperatures and corresponding higher evapotranspiration, aggravates this problem. The controlled mixing of agricultural drainage and fresh water by a mobile pumping unit can reduce the pressure and hence contribute to climate change adaptation. The achievements of the pilot measure in the Nile Delta are:

- increasing the water supply;
- safeguarding the required level of water quality;
- improving water use efficiency and
- reducing energy consumption.

The reuse of agricultural drainage water will become more widespread in future, and, therefore, guidelines have to be developed and complied with.

Preconditions for the safe application using a mobile pumping unit are:

- existing legal framework and a strong partnership with the country's water ministry;
- close partnership between national and local-level water authorities, the beneficiaries and the funding agency for the implementation, operation and maintenance of the system;
- an acceptable quality of drainage water plus an ample quantity of irrigation water;
- regular monitoring of water and soil quality, which demands adequate laboratory facilities and
- training of farmers and pump operators.



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