Introduction

Farmers, due to increasing groundwater salinity, use small-scale RO plants to produce desalinated water for crops irrigation. However, good management practices are lacking, since the brine waste is discharged in the soil contaminating the fresh groundwater, leading to a vicious circle.

Challenge

The safe disposal of the produced brine remains a key environmental issue. The conventional disposal systems are expensive and unproductive. The project addresses this challenge by transforming this common waste into a resource through IAAS with benefits for the environment and farmers.

Materials and Methods

A land-based IAAS supported by a RO-unit was established at ICBA in 2013 to demonstrate how less productive farms can be transformed into productive farms. The project addresses the following challenge by transforming this common waste into a resource through IAAS with benefits for the environment and farmers.

Key Results and Discussion

1. All available water resources in the field (desalinated, RO-brine and aqua-brine) were successfully used to irrigate high value crops, halophytic species and grow fish.

2. High value crops produced good yield, however, optimisation of the management practices is needed in order to enhance the agronomic performance of the plants and increase the production further.

3. The fish species Sparidentex hasta (sobaity seabream) was successfully grown in the inland aquaculture system. Over a period of nine months, fish weight gain, length and width increased by 74%, 89% and 46% respectively.

4. Water analyses showed that the concentration of total nitrogen was higher in the aquaculture brine (1.23 mg/l), due to ammonia and nitrate produced from fish activities, compared to ground water (0.50 mg/l), desalinated (0.73 mg/l) and RO-brine (0.62 mg/l). Desalinated water was characterized as poor in nutrients, so extra fertilization was added to sustain vegetables good growth and yield.

5. Soil salinity was very low in plots where vegetables and other high value crops were irrigated with desalinated water and ranged from 0.4 to 3.1 g/l in all soil depths (0-25, 25-50, 50-100 and 100-150 cm). Higher salinity values were measured for soil samples collected from the plots where brine treatments were applied and varied between 1.4 and 15.9 g/l.

6. Aquatic plants cultivated in full strength brine are salt tolerant and can produce biomass in high yield. The aquaculture system produces brine that is rich in nutrients and can be used for irrigation. The fish species Sparidentex hasta (sobaity seabream) was successfully grown in the inland aquaculture system. Over a period of nine months, fish weight gain, length and width increased by 74%, 89% and 46% respectively.

7. Results showed that the revenues increased making the assumption that farmers receive government subsidy for RO-units installation.

8. Results also suggested that the profitability of the desalinated part could increase, by cultivating high value crops of shorter growth cycle that could be cultivated more than once throughout the growing season such as leafy vegetables.

9. A SWOT analysis was developed to identify the strengths, weaknesses, opportunities and threats of IAAS implementation in arid regions (Figure 3).

Conclusions

Our three year experience has shown so far that such integrated systems can create a wealth of ecological and economic advantages in marginal environments dealing with salinity issues. The benefits range from sustaining environment quality through productive use of brine and dissolved and particulate nutrients discharge to generate value-added by-products. In this way, the sustainability of the existing RO infrastructures in the region is enhanced.

Key references


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