Use of Brackish Groundwater in Aquaculture and Agriculture

The UN and other agencies dealing with water sector have indicated that one third of the world population already faces water scarcity, and warned that "radical actions" are required in order to continue to feed the world's population over the next 50 years. One of the proposed major actions is to reduce the use of freshwater for crop production by as much as 50%. This reduction should result from higher water use efficiency, the re-use of wastewater, and also by the use of so-called marginal waters, including brackish surface water and brackish groundwater. Dr. Samia El-Guindy, Vice Pres. ICID, and Member of the ICID Working Group on Use of Poor Quality Water for Irrigation (WG-PQW) explains as how the brackish water can effectively be used in aquaculture and agriculture.

Why Use Brackish Water?

Brackish water has a level of salinity between freshwater and sea water (0.5 – 30 grams of salt per liter). International interest in the use of brackish water for production of food and other goods is indeed increasing. The reasons are diverse:

- In large dry land areas all water resources need to be exploited in order to cope with the growing water requirements. This is the case in the Middle East, but also in large areas of India, Australia and the USA;
- In old irrigated areas without sufficient drainage, the acquired salinity of soils and shallow groundwater often prevents continued growth of traditional crops; more salinity-resistant crops or crop varieties are required. Such examples can be seen in southern Pakistan, in parts of China, and in the north-east of Thailand; and
- In coastal areas, increased seepage of seawater partly accelerated by sea level rise, results in brackish groundwater and soils. This is the case in the Netherlands, Spain, Japan and some other low-lying countries.

Notwithstanding, in all situations there is a need for the development of new crops or crop varieties/cultivars in order to keep the areas in active crop production.

The available brackish groundwater resources are not being exploited as yet. The salinity levels of brackish waters are too high for irrigation of conventional crops. However, many of the barren lands could be made productive if suitable salt-tolerant crops or special cultivable techniques could be adopted to use the brackish water. Appropriate large-scale production systems using this water have not been developed so far. Small-scale experiments, however, as well as developments elsewhere in the Middle East, do indicate that suitable opportunities exist to use the brackish water.

In principle, there are two possible ways of using brackish waters:

- Desalinization of brackish and salty waters. At present this is not feasible for large-scale use in agriculture or aquaculture because of high energy demands, but it is already cost-effective for more luxury water use, such as in hotels and resorts. Along the Red Sea coast desalination is common in such ventures. In some other Middle East countries desalination for drinking water is already being practiced; and
- Development of production systems that can make use of available brackish water without (major) treatment.

Integrated Agri-aqua Culture Farming System

A pilot farm based on the multi-use of the water unit in different activities was established in Egypt. First of all, groundwater is pumped from deep wells to lined tanks for intensive production of tilapia. The effluent from the tilapia tanks is discharged for re-use in catfish tanks, while the effluent from the catfish tanks, containing important nutrients, is used again to irrigate berseem and other crops. The berseem is subsequently grazed by sheep, goats and cattle. Finally, the livestock manure and plant residues/offal are used for production of biogas (Figures 1 and 2). The farm covers some 500 feddan (210 ha), of which 1.5% area is used for aquaculture, 42% area for berseem and livestock, 34% area for horticulture, and the rest for hatcheries, godowns, houses, offices and other infrastructure. Annual yield of fish was reported to be high (37 g/m^3 and of export-quality, since pollution is absent), and the crop produce was also higher than that grown with commercial fertilizers. The fish waste improves desert soil qualities substantially, resulting in an increase of the value of the land.

The salinity of the well water was rather low (500–700 ppm), but in order to prevent building up of soil salinity, the

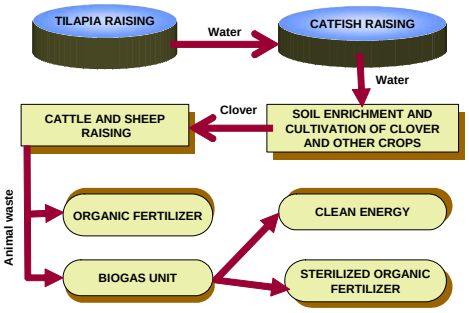

Figure 1

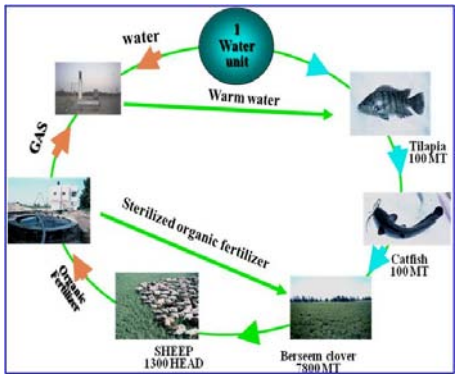

Figure 2

soil is leached with freshwater after the harvest of berseem. The aeration system for the fish tanks was demonstrated; the various systems are used only when absolutely required because of the high consumption of electricity.

The following table shows a comparison between the conventional and the proposed systems for an unit water quantity. It is seen that the proposed system has very high potential for water conservation. There are other uses of the proposed system, besides food production and water saving amplifying multiple uses of water.

Conventional System	Item	Proposed System
100 MT	Tilapia	100 MT
100 MT	Catfish	100 MT
4500 MT	Clover	7800 MT
1000	Sheep	1300
No	Warm Water	Yes
No	Organic Fertilizers	Yes
Variable	Waste	Nil
100	Irrigated Feddans	130
0%	Water Conservation	67%

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