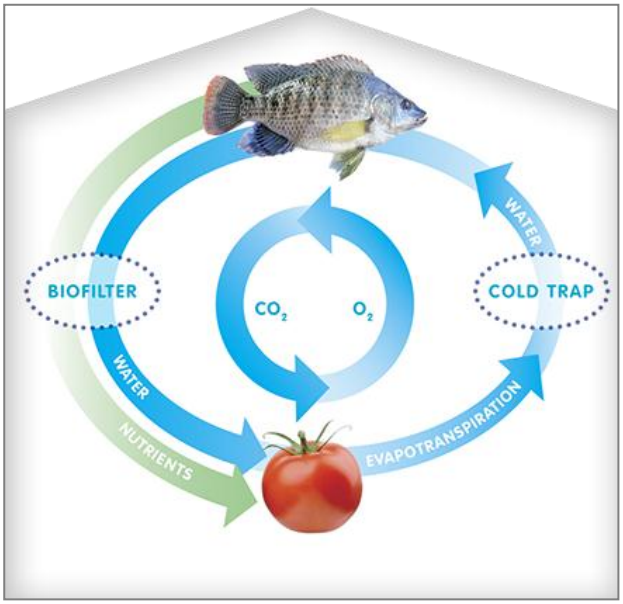
REVIVING AN ANCIENT FARMING TECHNIQUE

TOMATO-FISH SUSTAINABLE AQUAPONIC SYSTEM PRESENTED IN THE GERMAN PAVILION

By Xi Fang

In the German Pavilion at Expo 2015 titled *Fields of Ideas*, an innovation that combines fish breeding and tomato cultivation under one roof, is being promoted. The innovation reviving the ancient farming technique, has been developed and promoted by the Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB) in the context of the Aquaponic System for emission-free Tomato and Fish Production Project funded by the German Federal Ministry of Education and Research (BMBF).



This kind of technique coupling plant cultivation in water (hydroponics) and fish farming (aquaculture) has a specific term: *aquaponics*. It is a system that has very remote roots in various ancient civilizations from Aztec to South China and Southeast Asia who planted crops on floating river islands and utilized the waste of wild, local fish to fertilize them. The fish waste fertilizes the plants, and the plant roots, in turn, clean and filter the water. This symbiosis is an ideal example of the type of closed-loop, waste-free sustainability. Little has to be done to keep the system going, so it is still used in many parts of the world and regarded as a possible future of agriculture.

First modern attempts to combine fish and vegetable farming were carried out in the 1980s. The use of modern technology allows for the use of water, nutrients, energy and land in a more resource-friendly way that is also lower in emissions.

The Leibniz-Institute of Freshwater Ecology and Inland Fisheries has been researching this procedure for about ten years. With this Tomatofish Project, actually, IGB researchers try to examine whether this could be a model for food production of the future. The potential applications of this breeding method are diverse. Neither fertile soils nor large amounts of water are needed. Therefore, aquaponics could make a greater contribution to food supply, for example in regions with difficult climatic conditions.

In this technology, tilapia fish and tomatoes, which have similar environmental needs for growth (preference for warmth, etc.), thrive together in an interconnected aquaculture and hydroponics facility of around 170 m^2 in a greenhouse at the IGB. The nutrient-rich fish waste is used to fertilize the tomatoes, while the water vapor released by the plants is fed back into the fish circuit. In

this way, there is no need for the disposal of wastewater. The dirty water from the fish tanks runs through plastic pipes, then purified in a biofilter. In this process, aerobic bacteria convert the ammonium eliminated by the fish through the gills into nitrite, which is used as a fertilizer in agriculture. On demand, the filtered water is then channeled through a one-way valve to the plants, which thrive directly in the nutrient mixture. The roots of the tomatoes absorb the nitrates among other things, thus purifying the liquid. The pH value, the oxygen supply and the addition of nutrients are regulated individually.

Thanks to its special design, the IGB system is especially kind to the resources involved. It can be reproduced with dimensions to fit anything from a water butt to a large farm, making it suitable for use in both urban and rural locations.

The Tomatofish principle can actually help saving resources on a much larger scale. Closed-loop systems like Tomatofish can be used in areas that are too dry for conventional agriculture, with the necessary heat provided by the local climate. Waste heat from biogas or cogeneration plants can be used in aquaponics. In this way, thermal energy that might otherwise be wasted is put to good use in heating the water and plant cycle.

The Tomatofish innovation, consequently, can be regarded to be response to recent water, energy and nutrient management solutions in rural and urban agriculture to cope with global demands and to exploit all available opportunities of resource efficiency.

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