

Aquaculture + hydroponics = aquaponics

Aquaculture is the farming of aquatic organisms, e.g. fish, and hydroponics is growing plants in a soilless medium. Aquaponics couples both systems. The nutrient-rich water from the fish unit is used as fertiliser for the hydroponically grown crops, therefore significantly reducing the sewage of the fish component.

However, larger aquaponic systems are not yet sufficiently established, often due to lack of system stability or economic profitability. The collaborative project **INAPRO** "Innovative Aquaponics for Professional Application" intends to change this and features a new water-saving combination principle of aquaculture and hydroponics which provides optimal production conditions both for the fish and the plants.



Prof. Werner Kloas from IGB (Forschungsverbund Berlin e.V. - Leibniz- Institute of Freshwater Ecology and Inland Fisheries – Germany), project coordinator said "The INAPRO system responds to

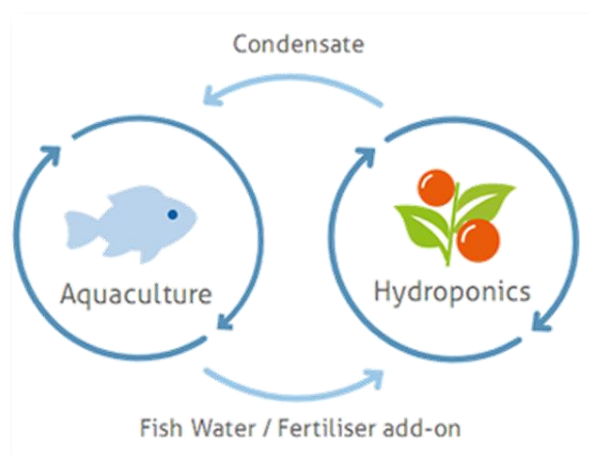
the global challenge of food security by producing local, healthy and sustainable food with a low water and carbon footprint alongside with a drastic reduction of nitrogen and phosphorus emissions". INAPRO is linked to the EIP Water Action group 'Water & Irrigated agriculture Resilient Europe' and therefore supports the European Innovation Union.

A complete cycle

The water cycle starts in the recirculation aquaculture systems (RAS). In this fish unit, the water passes through a multistage system: a mechanical filter removing solid particles is followed by an efficient biofilter with specific bacteria that converts the metabolism end products of the fish into nitrate. In conventional RAS the nitrate and phosphate rich waste water has to be disposed as waste water, but in INAPRO aquaponics this nutrient rich water can be transferred from the fish to the hydroponic greenhouse section to plants as fertiliser. Furthermore the CO₂ exhaled by the fish is also absorbed by the plants – thus increasing the crop productivity.

To complete the cycle, the water that is evaporated by the plants in the greenhouse is regained via cooling traps and returned into the fish tanks in order to minimise the demand for freshwater.

INAPRO aquaponics enhances conventional aquaponic systems (where the fish and the plants share exactly the same water) by separating the water recirculation between the RAS and the plant unit. The double recirculation system provides optimised conditions for the fish/RAS and plant part independently from each other in order to increase the productivity of both.



Saving water and reducing environmental impact

In order to support and advise the farm manager in operating the complex aquaponic farm, an INAPRO management and execution system (MES) has been developed. The MES consists of a collection of hardware/software components that enable the farm manager to control the overall fish and crop production. The system collects data and converts it into information that can be used in real-time, providing information on factors such as efficiency, waste and energy usage.

INAPRO system allows a nearly zero-emission, sustainable food production and contributes to solving the issue of water security. Prof. Kloas said that "it saves resources by introducing value added chains for the use of water, energy, and nutrients including CO₂, and reduces sewage and the amount of fertiliser for the plants". The system is adaptable to local conditions.

INAPRO project is and EU funded research project, demonstration facilities are being built in Spain, Germany, Belgium and China.

Interesting links

http://www.inapro-project.eu/page/project-overview_p116/

Earlier stages of the concept: [Der Tomatenfisch / the tomato fish – Homepage](#) (German), [tomato-fish brochure](#) (English)

Video: <https://www.youtube.com/watch?v=W2CLzfnCOd8>

EIP Water Action group

EIP Water Action group 'Water & Irrigated agriculture Resilient Europe' (WIRE) helps customise existing or upcoming innovation to the farmers' and growers' needs, and to facilitate innovation uptake in the complex, multi-faceted irrigated agriculture reality and market: <http://www.eip-water.eu/WIRE>

Images: INAPRO