



## **BIO- AND NANO-TECHNOLOGIES APPLIED TO AQUAPONIC SYSTEMS: SUSTAINABLE AGRICULTURE AND HIGH-QUALITY FOOD**

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Aquaponics represent the fusion of aquaculture and soilless hydroponic methods, referring to a technology able to integrate the two approaches in a unique system in which water, rich in nutrients, is used to fertilize cultivated plants; microorganisms, bacteria above all, are the third component required in waste conversion. This innovative production system could be one of the tools to counteract with 21<sup>st</sup> century's problems connected to overpopulation, water availability, food quality and safeness. The main stimuli of aquaponics concern the possibility of cultivating plant food sources with low environmental impact (eco-sustainability), characterized by a high quality of their components and by beneficial effects on human health. Aquaponics systems' characteristics able them to be freed from sources of pollution, seasonality, and climate changes.

This project will lead to: i) development of bio- and nano-technological systems for the realization of green fertilizers to be applied to an innovative and sustainable cultivation method (i.e. aquaponics); ii) implementation of the quantity and quality of agri-food products obtained through the application of the aquaponic system; iii) reduction of impact and contribution of supplements for plant growth in an aquaponic system; iv) evaluation of the effects of latest generation fertilizers belonging to two main categories, fertilizers of biological origin and fertilizers engineered and conveyed by carriers of inorganic particles; v) monitoring of nutritional and nutraceutical characteristics of food products obtained with the proposed technology, in relation to traditional agricultural products (i.e. soil cultivation) on human health; vi) qualitative properties of foods obtained with the proposed technologies during their postharvest and shelf-life by non-destructive techniques; vii) recovery of native agri-food species of interest. This project will be a cooperation with "Tuscia University", especially for the creation of a standardized monitoring system working both in-situ and online, and with "Agri Island", a company that works already in the aquaponic field.

Our model and cultivated plants will be *Lactuca sativa* L., *Solanum lycopersicum* L., and *Phaseolus vulgaris* L., whereas farmed fish will be tilapias (*Oreochromis niloticus* L.). All main parameters of the singular components (water, fish, plants, bacteria) will be controlled with a monitoring system and specific analyses. Our quality tests will be conducted with a metabolomic approach and a nutritional one. These analyses will include an effects' evaluation of the experimental trials. A well-known problem of aquaponics is the micronutrients depletion, iron above all. Sustainable fertilizers will be developed through a nano- and a bio-technological methodology, compensating for this lack of micronutrients, restoring normal levels in the recirculating water flow, and allowing plants to reach maximum growth and reproduction levels. This project aims to contribute to the sustainability and quality improvement of last generation agriculture.