

<https://doi.org/10.7250/CONNECT.2024.029>

# VERTICAL HALOPONICS: SUSTAINABLE AND RESILIENT PRODUCTIONS USING BRACKISH WATER

Salvatore CURCIO<sup>1</sup>, Arianna TIRALTI<sup>2</sup>, Lucia ROCCHI<sup>3\*</sup>

<sup>1-3</sup> *Dept. of Agricultural, Food and Environmental Sciences, University of Perugia, Borgo XX Giugno 74, Perugia Italy*

\* **Corresponding author.** Email address: [luca.rocchi@unipg.it](mailto:luca.rocchi@unipg.it)

**Abstract** – While the rapidly growing global population will require a significant increase in food production in the next years, the current climate, sanitary and geopolitical crises highlight the weaknesses of the actual food production systems, excessively dependent on external inputs and involving extremely complex nested scales and non-linear processes. Thus, appears the need of accelerating the transition toward agricultural solutions and food systems based on the principles of the ‘Green Deal’, encompassing ecological resilience, environmental sustainability, local production, and universal access to healthy foods. Aquaponics (AP) can provide short and eco-friendly food supply chains with increased resource-use efficiency, high environmental sustainability, and food resilience. The sustainability of AP systems could be further increased by exploiting water resources that are not suitable for other purposes (brackish and salt water – haloponics), applying the vertical farming technology for both aquatic and vegetable species, reducing the use of fish meal in aquafeeds, valorising the system residues (sludge) for agronomic purposes. The VERTICALPONICS project aims to develop an innovative food production system by implementing an interdisciplinary approach. Since aquaponics combines recirculation aquaculture and hydroponics, within a close loop, it is considered environment friendly. However, given the different technical approaches, it is necessary to evaluate the differences in impacts and specially to assess whether the vertical system is really resource-efficient and economically viable for farmers, in comparison to the business-as-usual. The environmental and economic sustainability of the system is measured by the mean of a combined LCA and the LCC analysis (EN ISO 14040-44 and ISO 156865:2017 standards). The system expansion will be used to evaluate the beneficial effect of reducing the overall environmental burden from by-product recovery and utilization of side wastes, specifically the sludge produced. The methods applied are Recipe and IPCC 2013 Global Warming Potential 100a. Environmental impact indicators will be provided using both mid-point and end-point categories thanks to the Recipe Method, while the IPCC 2013 Global Warming Potential 100a will be applied to calculate the direct global warming potential of the system. Moreover, the inclusion of the agronomic valorisation of the sludge will be analysed to understand the potential in terms of avoided impacts.

**Keywords** – *Haloponics system; Life Cycle Assessment (LCA); Life Cycle Costing (LCC); Vertical Farming*

## ACKNOWLEDGEMENT

This work has been supported by the European Union – Next Generation EU, within the project “Vertical haloponics: exploiting brackish water resources for sustainable, resilient and high valuable aquaponics productions” PRIN 2022 PNR P202277Y78.