

ENVIRONMENTAL ASSESSMENT OF AQUAPONICS: THE LETTUCE POINT OF VIEW

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Aquaponics System (AS) claims to be one of the solution for a more sustainable fish and vegetable production system. AS is an integrated system coupling a Recirculating Aquaculture System (RAS) to a Hydroponics System (HS) in which wastewater from RAS is the source of nutrient for HS. Thus, the aim of this study was to assess AS performance in the use of nutrient released from common carp (*Cyprinus carpio*) by lettuce production, compared to the similar lettuce production under HS condition, using a Life Cycle Assessment (LCA). The data were collected on the Ratho (Brindas, France) facilities, where both systems (AS and HS), designed at a commercial scale, are running under the same greenhouse.

LCA was carried out according to the standardized method (ISO 14040 and 14044). The only functional unit considered was 1 kg growth gain of lettuce produced. For AS, feed was the only source of nutrient for carp. Carp production was the only source of fertilizer for lettuce. Therefore, environmental impacts were allocated between carps and lettuce according to the fate of phosphorus from feed recovered by lettuce and carps. According to the midpoint CML baseline method, the impact indicators considered were acidification (AC), eutrophication (EU), climate change (CC), total cumulative energy demand (CED), net primary production use (NPPU), water dependence (WD) and land competition (LC).

For 1 kg of lettuce produced in AS, on farm energy use was the main contributor to WD (83%), CED (78%), GWP100 (70%) and AC (60%), whereas carp production was the main contributor to EU (50%) and NPPU (100%). According to LCA (Fig. 1), compared to HS using only chemical fertilizers, production of lettuce in the AS induced less impact in AC, EU, GWP100, LC and CED, but a direct benefit on water saving was not observed. Furthermore, if use of nutrient from formulated feed was of benefit to reduce impacts on climate change, it was not in regard of the NPPU (a part of fish meal and oil is now used to produce lettuce).

The results of this study seem to indicate that AS is able to decrease fish farming nutrient emissions, while decreasing most of the environmental impacts of HS lettuce production.

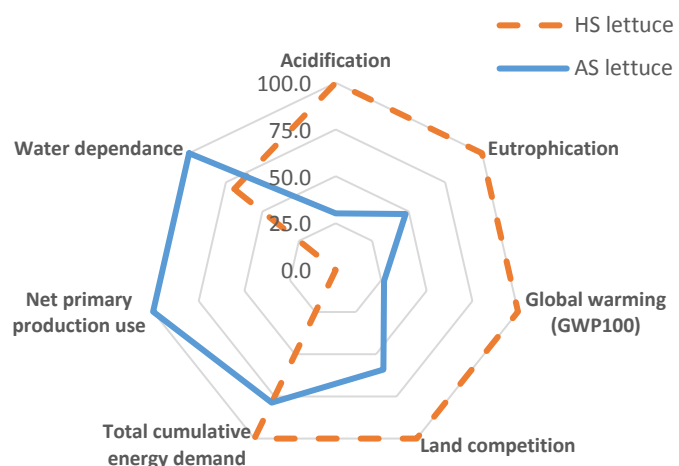


Figure 1: radial graph of comparative environmental assessment comparing lettuce production in aquaponics system (AS) with lettuce production in hydroponics system (HS), for 1 kg of lettuce produced. Values are expressed in percentage of the largest impact in each category and points closer to the center have less environmental impact.