Environmental Assessment of an Organic Integrated Greenhouse Tomato Crop Grown Under Northern Conditions Compared to a Conventional Crop.

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***Background*:**
The environmental burdens associated with fossil energy use, in addition to water and fertilization management continue to be major concerns for Northern greenhouse production systems. To reduce the environmental impacts of greenhouse farming under Northern climate conditions, the use of renewable energy sources and suitable nutrient and waste management are becoming essential. From this perspective, a closed-loop organic production system that increases the efficiency of water and nutrient use on-farms and utilization of waste biomass was tested in the province of Quebec.

Project Overview:
The goal of this study was to assess the environmental impacts of this integrated system compared to a conventional system in order to use its environmental profile as a starting point for improving the sustainability of existing systems. The environmental analysis was conducted with LCA methodology as defined by ISO 14040 and 14044, the ILCD handbook (2010) and SimaPro v.7.3.2 software. The functional unit was 1 ha but results were also expressed in kg of tomatoes (yield of conventional and organic growing systems were 50 kg/m^2 and 48 kg/m^2, respective). The system boundary was from raw materials extraction to the farm gate. The life cycle stages considered were the infrastructure, auxiliary equipment, climate control system, farm operation, fertilizers, pesticides, waste management and packaging. One energy flow indicator (cumulative energy demand) and five impact categories, defined by the CML2001 method v. 2.05 (Guinée, 2002), were selected for the environmental assessment.

Conclusions: From the environmental assessment indicated, as expected, that high energy demand had the major contributions to all impact categories (Figure 1). When organic farming using wood biomass as renewable energy was used, the CO_2 footprint of one kg of tomatoes was reduced from 5.788 to 0.849 kg CO_2 eq/ kg compared to the conventional growing system. After packaging, greenhouse structure made the third highest contributions to environmental impact categories. The fertilizer assessment of the organic crop had a lower environmental impact on abiotic depletion (by 12 times), acidification (by 6 times), eutrophication (by 136 times) and global warming (by 10 times) compared to the conventional fertilizer assessment (data not shown).

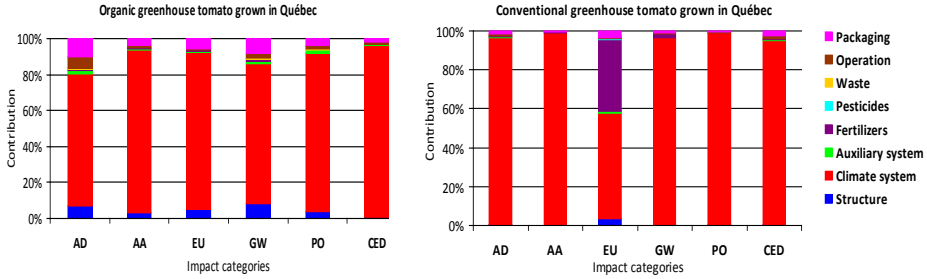

Figure 1 Stages contributions to impact categories for organic and conventional greenhouse growing systems: AD, abiotic depletion; AA, air acidification; EU, eutrophication; GW, global warming; PO, photochemical oxidation; CED cumulative energy demand.

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