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Life Cycle Assessment of Conventionally and Organically Grown Pineapple in Gampaha District

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Abstract

Pineapple is one of the major commercial fruits grown in Gampaha and Kurunegala districts of Sri Lanka. Most cultivations are under conventional practices which generate significant environmental impacts while there are few organic cultivations (~1%). There is lack of published on the environmental impacts related to cultivation of pineapple in Sri Lanka. This study therefore aimed to quantify and compare environmental impacts of conventionally and organically grown pineapple in Gampaha District. Environmental impacts were compared using Life Cycle Assessment (LCA) tool which evaluates the potential environmental impacts throughout the life cycle of a product or a process. According to ISO 14040:2006 and ISO 14044:2006 guidelines, LCA methodology has four main phases such as goal and scope definition, life cycle inventory analysis (LCI), life cycle impact assessment (LCIA), and life cycle interpretation. The system boundary for the study was from cradle to farm gate. All the environmental impacts were estimated for a functional unit of one tonne of pineapple. Primary data for the LCA was gathered using a pre-tested structured questionnaire conducted among twenty conventional- and six organic farms. Input and output inventories were prepared during LCI phase. Under LCIA phase, impact categories such as global warming potential (GWP), eutrophication, human toxicity, terrestrial ecotoxicity, and freshwater ecotoxicity were considered. Results indicated that conventional cultivation system has significantly higher impacts compared to the organic cultivation system. Global warming potential of conventionally cultivated one tonne of pineapple was 182.23 kg CO₂ eq. It was 26.72 kg CO₂ eq for organic cultivation indicating 7 times lower impact. Eutrophication potential was 6.63 kg PO₄³⁻ eq for conventional cultivation while that for organic cultivation was 0.81 kg PO₄³⁻ eq (8 times lower). Pesticide use has resulted in 2,279.12 kg 1,4 DB eq of human toxicity, 18,331.71 kg 1,4 DB eq of freshwater ecotoxicity and 1,624,494.37 kg 1,4 DB eq terrestrial ecotoxicity for conventional cultivation while organic cultivations have resulted in no toxicity. The results highlight significant contribution of synthetic fertilizers and pesticides towards all five impact categories of the LCA. The results could provide implications for promoting organic cultivation in order to reduce the impacts on the environment in the long run.

Keywords: Life cycle assessment, Pineapple, Conventional cultivation, Organic cultivation, Environmental impacts