

Abstract

One way to evaluate the sustainability of agricultural systems is to analyze the energy and emergy inputs and outputs of the system. This study aimed to analyze the sustainability of two watermelon production systems using energy, emergy and economic analysis in Faryab region of Kerman. In both systems, diesel fuel and nitrogen fertilizer accounted for the highest amount of energy consumed, respectively. The average share of renewable and non-renewable energies in total input energy in both systems was 10% and 90%, respectively, indicating that in both systems the effect of non-renewable energies on yield increase was greater than that of renewable energies. In the emergy analysis section, the input emergy structure, production efficiency, environmental impact and sustainability of the two production systems were considered. The emergy indices calculated in this study included transformity, renewability, emergy yield ratio, emergy investment ratio, environmental loading ratio and environmental sustainability index. The total amount of supporting emergy for commercial and traditional watermelon cultivation systems was $1.65E+13$ and $1.85E+16$ sej ha⁻¹, respectively. Non-free resources accounted for 63.01% and 33.76% of total input energy for commercial and traditional watermelon production systems, respectively. The large share of non-free inputs that usually comes from outside the system indicates that both systems studied are open systems that are heavily influenced by inputs purchased from the economy. The energy inputs purchased for the two commercial and traditional watermelon cultivation systems were largely similar. The environmental loading ratio of commercial watermelon cultivation was slightly lower than traditional, so its environmental sustainability index was higher than commercial watermelon systems. As a general conclusion, these analyze show that better environmental performance of a production system is associated with worse economic performance. The results showed that current production of watermelon in Faryab city, although economically acceptable, is unstable in terms of energy consumption because it relies heavily on non-renewable energy sources, environmental pollution and instability.

Keywords: Environmental sustainability, System analysis, Renewable energy, Energy efficiency, Environmental load.



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The Thesis Submitted for the Degree of M.Sc in the field of
Horticultural Science- Medicinal Plant

Title:
**Sustainability Assessment of Two Watermelon Production
Systems Using Energy Analysis and Economic Evaluation
in Faryab Region of Kerman**

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September 2019