



University of Zabol

Graduate School

Department of Agronomy

The Thesis Submitted for the Degree of M.Sc

in Agroecology

Title

**Integrated energy and economic evaluation of cotton, soybean and rice
production system of Golestan Province**

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December 2022



Abstract

The application of emergy analysis to evaluate the efficiency and sustainability of crop systems results in improved crop system management. An evaluation of the efficiency and sustainability of rice, soybean, and cotton cropping systems in the counties of Aq Qala and Aliabad-e-Katul in Golestan province was conducted using emergy and economic indicators. The consumption and performance of cotton, soybeans, and rice were assessed in this study through the use of questionnaires and in-person interviews with farmers and farm managers. The total amount of emergy required to support rice, soybean, and cotton production systems in Aq Qala was $1.08\text{E}+17$, $6.21\text{E}+16$, and $5.90\text{E}+16$ sej/ha/yr, respectively, while the equivalent amounts in Aliabad-e-Katul were $9.44\text{E}+16$, $6.42\text{E}+16$, and $4.28\text{E}+16$ sej/ha/yr, respectively. Environmental inputs from nonrenewable sources accounted for the greatest proportion of total emergy input in all of the studied systems, accounting for 81.34 percent, 77.75 percent, and 82.39 percent, respectively, in Aq Qala and 78.27 percent, 73.27 percent, and 85.24 percent, respectively, in Aliabad-e-Katul, respectively. Emergy yield ratio (EYR) in rice, soybean, and cotton systems in Aq Qala were 5.553, 4.312, and 6.57, respectively, and in Aliabad-e-Katul were 4.744, 3.884, and 7.515, respectively, standard environmental loading ratio (ELR) in rice, soybean, and cotton in Aq Qala were 153.64, 94.96, and 89.93, respectively, and in Aliabad-e-Katul. Furthermore, the productivity of economic performance in rice, soybean, and cotton in Aq Qala was 8.97, 11.43, and 11.86 Rials/ha, respectively, and in Aliabad-e-Katul was 8.61, 11.15, and 19.84 Rials/ha. In general, the cotton crop system in Aq Qala and Aliabad-e-Katul counties performed better in terms of sustainability, production efficiency, resource consumption efficiency, economic productivity, and environmental load than other systems, particularly rice. In addition, the rice production systems in both counties were under severe environmental stress and had a low level of ecological sustainability. As a result, it will not be appropriate based on the results of ongoing rice production.

Keywords: Groundwater, Productivity, Sustainability, Efficiency