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Faculty of Agriculture
Department of Agronomy

**The Thesis Submitted for the Degree of M.Sc in the field of
Agroecology**

Title:

**Emergy and economic analysis of mung bean
(*Vigna radiata* L.) and local cowpea (*Vigna
unguiculata* L.) production systems in Hirmand city**

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Abstract

This study aimed to assess the sustainability and compare the cultivation systems of local mung bean (*Vigna radiata* L.) and cowpea (*Vigna unguiculata* L.), employing a combined emergy and economic analysis. The research was conducted in two agricultural systems producing mung bean and local cowpea in Hirmand County, located in the north of Sistan and Baluchestan province. Necessary data was collected from ۱۸ villages in Hirmand County through questionnaires. A random sampling of farms was determined using the Neyman method. All information was obtained through verbal estimates using questionnaires during the period from January ۲۰۲۳ to July ۲۰۲۳ and through field measurements and observations during the same period. Long-term meteorological data and solar radiation data were obtained from Hirmand and Zahak meteorological stations. According to previous studies, the share of renewable energy in Iran was considered to be ۱۰٪. At the end of the season, the total emergy consumption for each agricultural system, including the emergy of machinery, seeds, various fertilizers and pesticides, irrigation water, electricity, human labor, organic matter, wind, rain, and sun, was measured. To evaluate emergy and economic indicators, the total emergy input and output to the studied systems were first measured, and then various indicators were calculated. The results of this study showed that in the mung bean agricultural system, the highest share of emergy belonged to the manure fertilizer input, while in the local cowpea system, the highest share of emergy belonged to the seed input. The lowest share of emergy was related to irrigation equipment. In the production of mung bean and local cowpea, the ratio of non-renewable emergy was higher than the share of renewable emergy, indicating a high dependence on them. Emergy analysis revealed that in this region, the production of local cowpea was more sustainable than mung bean. The results showed that in the Unit Emergy Value (UEV), percentage of renewability (R%), Emergy Investment Ratio (EIR), and Emergy Yield Ratio (EYR) indices, the local cowpea agricultural system was superior to the mung bean agricultural system in this region, indicating greater sustainability of the local cowpea agricultural system. However, in the Emergy Yield Ratio (EYR), Environmental Load Ratio (ELR), Self-Support Ratio (ESR), and Emergy for Sustainable Development (EISD) indices, the mung bean agricultural system was superior to the local cowpea agricultural system. Also, in terms of the Environmental Sustainability Index (ESI), the two agricultural systems were equal. However, in the modified Environmental Sustainability Index (ESI*), the local cowpea

agricultural system was superior to the mung bean agricultural system. If the use of renewable resources increases, the Environmental Sustainability Index (ESI) and the Environmental Load Ratio (ELR) and the percentage of renewability (R%) index can be improved for both processes. Based on the results obtained in this research, it can be stated that the type of cultivation process in the local cowpea production system is relatively more economical and justified and more sustainable. This system has experienced a significant reduction in labor and manure compared to mung bean.

Keywords: Emergy analysis, renewable energy, percentage of renewability, local cowpea , mung bean.