



University of Zabol

Graduate school

Faculty of Agriculture

Department of Agronomy and Plant Breeding

**Thesis Submitted in Partial Fulfillment of the Requirement for  
the Degree of Master of science (Agroecology)**

**Evaluation of environmental effects and some  
morphophysiological characteristics of *Chenopodium*  
quinoa production in Sistan**

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## **Abstract**

In order to evaluation of some morphological and physiological characteristics of quinoa, split plot experiment was conducted in a randomized complete block design with three replications 2019-2020 cropping season, at the Agricultural Research station of University of Zabol, Iran. Vermicompost at three levels (0, 5 and 10 ton/ha) considered as main factor and chemical fertilizer at four levels (25, 50, 75 and 100%) considered as sub-factor. SAS9.4 software was used to analyze the data of the mentioned section. Also, in this study the life cycle assessment with a cradle-to-gate approach analyze an environmental load of these product while a functional unit of one ton of produced crop was adopted. The data was collected from meteorological organizations, Agriculture Jihad, relevant organizations, distribution of surveys among local farmers and databases such as Ecoinvent®3.0. SimaPro®8.3 was used for the initial analysis of the data. Nine impact categories are studied using the CML 2 baseline method. Totally, results showed the positive effects of vermicompost on the morphological and physiological properties of quinoa. Application of 10 tons of vermicompost per hectare led to the maximum level on the morphological properties. Also, the highest amounts physiological properties were achieved from combined application of 10 tons/ha of vermicompost and 50% chemical fertilizer (25 kg/ha Urea + 50 kg/ha triple superphosphate + 50 kg/ha potassium sulfate). It can be concluded that the combined use of chemical fertilizers and vermicompost can increase the yield of quinoa while reducing the use of chemical fertilizers and thus reduce the environmental impacts caused by them. In the environmental impact assessment section for quinoa production in Sistan region, the highest environmental impact is related to global warming potential and the lowest environmental impact is related to ozone depletion potential. Also, the results indicated that in most impact categories, machinery, fuel and chemical fertilizers have the highest share among the inputs. In fact, they are one of the most important determinants of environmental damage.

**Keyword:** Environmental effects, Global warming potential, Life cycle, Pollutant release, Quinoa, Vermicompost