



دانشگاه زابل

University of Zabol  
Graduate School  
Faculty of Agriculture  
Department of Agronomy

**Thesis Submitted in Partial Fulfillment of the Requirement  
for the degree of Phd in Agroecology**

**The life cycle assessment and sustainability indicators of  
melon cultivation under the different management of fertilizer  
levels based on nonlinear modeling**

**Supervisor:**

Dr. Mahdi Dahmardeh

**Advisor:**

Dr. Behrooz Keshtegar

Prof. Ahmad Ghanbari

Dr. Issa Khammari

**By:**

Abbas Keshtegar

June 2021

## Abstract

To evaluate the production of Mashhadi melon (Khatouni cultivar) affected as different fertilizer levels, this study was conducted as factorial layout based on a randomized complete block design with three replications during the spring of 2020 crop year as two separate designs in Fariman and Zahak counties. Application of fertilizers in six levels include non-use of fertilizer (control), cow manure, sheep manure, nanobiomic as foliar application, silicone foliar application, and chemical fertilizer as the first factor and four different levels of vermicompost include non-use of vermicompost (control), 5, 10 and 15 tons per hectare as the second factor. Results showed that the highest fruit yield, total titration, percentage of nitrogen, phosphorus, fruit potassium, and fruit flesh thickness in both Fariman and Zahak counties was obtained from nanobiomic foliar application under 15 tons per hectare of vermicompost. Therefore, nanobiomic foliar application under 10 tons per hectare of vermicompost is recommended for melon cultivation in Fariman county. This prediction results of the content of macroelements in different organs of Melon in response to soil elements using support vector regression model (SVR) showed that the predicted amounts of fruit nitrogen (RMSE= 0.122); fruit phosphorus (RMSE= 0.228) and potassium fruit (RMSE= 0.465), that lowest error values and the highest accuracy in fitting the model. According to the results, the coefficients of determination of the output of fruit phosphorus ( $R^2= 0.99$ ) had the highest ratio in prediction compared to real values; thus were identified as the best model compared to other ones. According to the results, the highest increase in the number of elements in the crop was in response to the amount of soil elements, for fruit nitrogen in the range of 1.27 to 4.33 percent and leaf nitrogen in the range of 3.04 to 9.18 percent, for fruit phosphorus in the range of 15.74 to 26.19% and leaf phosphorus in the range of 19.44% to 27.97%, and for potassium fruit in the range of 15.19% to 19.67, was predicted under NPK chemical fertilizers using with the application of 15 t.ha<sup>-1</sup> of vermicompost. To compare environmental impacts of *Cucumis melon* production in Fariman and Zahak cities using Life Cycle Assessment (LCA) method. In general, it was found that for production of one ton of melon fruit, less environmental impact was caused in Fariman City than Zahak City due to less use of inputs in all sectors. According to the results obtained from assessing the final index, it was concluded that among the impact groups, global warming (5.812 kg CO<sub>2</sub> eq.) in Fariman and Zahak cities (5.809 kg CO<sub>2</sub> eq.) and depletion of fossil resources (4.489 MJ.kg<sup>-1</sup> crude oil eq.) in both Zahak and Fariman cities had higher potential environmental damage than other impact groups. According to the results obtained from evaluation of environmental index (Eco-X) and resource depletion index (RDI) regarding production of one ton of melon fruit, Zahak City had higher environmental index (Eco-X= 8.315) than Fariman City (Eco-X= 7.502) and caused higher environmental burdens. However, RDI was calculated as 5.026 and 4.875 for Zahak and Fariman cities, respectively.

**Key words:** Depletion of resources, Melon, Fruit yield, Organic carbon soil, Fertilizer, Modeling, Cost / benefit ratio