



University of Zabol  
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**The Thesis Submitted for the Degree of Ph.D (in the field of  
Agronomy Science - Crop physiology)**

**Evaluation of ecophysiological aspects of sunflower  
(*Helianthus annuus*) and basil (*Ocimum basilicum*)  
intercropping affected by irrigation management  
with saline and fresh water**

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## **Evaluation of ecophysiological aspects of sunflower (*Helianthus annuus*) and basil (*Ocimum basilicum*) intercropping affected by irrigation management with saline and fresh water**

### **Abstract**

By increasing population and limited water resources, the use of saline water, as well as the combination of saline and freshwater, seems necessary. Intercropping as one of the components of sustainable agriculture creates ecological balance, increases productivity, reduces the environmental impact of chemicals, and maintains the fertility of cultivated soil. This study has been conducted to evaluate the ecophysiological aspects of sunflower (*Helianthus annuus* L.) and basil (*Ocimum basilicum* L.) intercropping under the influence of irrigation management with salt water ( $EC_e = 3.9 \text{ dS.m}^{-1}$  and freshwater  $EC_e = 1.1 \text{ dS.m}^{-1}$ ) as a split-plot experiment in the basic design of randomized complete blocks with three replications during two cropping years (2017 and 2018) was implemented in the Agricultural Research Institute of Zabol University. Research treatments include Irrigation treatment as the main factor in three levels of freshwater irrigation, saltwater irrigation, and fresh and saltwater irrigation (one in between); Different levels of intercropping were performed as a sub-factor in five levels including sole sunflower, sole basil, 100% sunflower + 50% basil, 50% sunflower + 100% basil, 100% sunflower and 100% basil. The results showed that the interaction effect of intercropping pattern and irrigation regimes on 1000-seed weight, grain yield, percentage and yield of sunflower seed oil, harvest index, chlorophyll (a, b and total), catalase and guaiacol peroxidase in sunflower had a significant effect ( $P < 0.05$ ). Also, fresh and dry weight yield, chlorophyll content (a, b and total), percentage and yield of essential oil of basil, dominance index, relative crowding coefficient, land parity ratio and yield index were significantly affected by irrigation type and mixed cultivation pattern. Although increasing water salinity reduced sunflower seed yield and fresh weight of basil, the results of the total land parity ratio showed well that the Intercropping pattern with a total land parity ratio higher than one compared to the sole cropping model had a comparative advantage. And is effective in modulating the negative effect of irrigation with saltwater.

The highest land equality ratio was recorded in two patterns of 100% sunflower + 100% basil (1.35) and 50% sunflower + 100% basil (1.32), under irrigation with fresh and salt water, respectively. Among the different patterns of intercropping, the pattern of 50% sunflower + 100% basil irrigated with fresh water showed higher profitability (0.98) compared to other patterns of intercropping. However, the final evaluation depends on examining other factors affecting the profitability of crops.

**Keywords:** Essential oil, Volumetric moisture, Soil salinity, Enzymatic activity, Intercropping, Irrigation management