Title Arugula crop production in arid and semi-arid regions: Nutritional value, postharvest quality, and sustainability in controlled environments

Author Jeffrey Hamilton, Jorge M.Fonseca, Charles F. Hutchinson, Stuart Marsh and Michael J. Ottman

Citation Thesis, Doctor of Philosophy (Arid Lands Resource Sciences), The University of Arizona. 203 pages. 2009.

Keywords Arugula; Controlled environments; *Diplotaxis tenuifolia*; *Eruca sativa*, Phenolics; Salinity stress; Nutritional value; Postharvest quality

Abstract

Plant responses to abiotic stress are neither singular nor linear. The research represented within this dissertation was intended to evaluate selected biochemical and physiological responses in two Arugulas (Images 1- 5), to agronomic interventions designed to mitigate extreme environmental abiotic factors, characteristic of arid agricultural production regions. Plant stress responses were investigated under field conditions and within controlled environments (CE), during the course of a preliminary trial and three independent studies, all four directly related.

The preliminary trial evaluated harvest and postharvest nutritional content (i.e., antioxidants) of two Arugulas, *Eruca sativa* (L.) Cav. ssp. *sativa* (P. Mill.) and *Diplotaxis tenuifolia* (L.) DC cv. Sylvetta; grown under field conditions in the semi-arid upper Sonoran Desert. In this trial, we defined baseline harvest and postharvest antioxidant values for the Arugulas, cultivated in a semi-arid environment.

The initial study, conducted within a CE utilizing a water recycling system, evaluated changes in the nutritional value of three specialty leafy cruciferous vegetables: *D. tenuifolia, E. sativa* and *Lepidium sativum* ; when subjected to increasing salinity levels in the nutrient solution. It was concluded that, when specific Crucifers are not irrigated with moderately high levels of salinity, harvest nor postharvest nutritional values are compromised.

The second study, investigated the response of a suite of plant physiological parameters (e.g., yield and photosynthetic rate) in the three Crucifers to salinity, within the CE. This research provided guideline salinity values where yields did not decline, and encourages growers to consider water resources compromised by salinity and nutrient solution recycling.

During the third study, the influence of environmental conditions on the nutritional content in leafy vegetables, prevalent immediately before harvest, was investigated; by subjecting plants to reduced sunlight treatments and early irrigation termination. We observed that, modulating light intensity late in

the season, and early irrigation termination strategies, modify the nutritional content of leafy vegetables; and potentially the subsequent postharvest shelf life.

Collectively evaluated, this research suggests that simple agronomic interventions are valuable, yet practicable, tools that can enhance the nutritional content of specialty vegetables, in arid regions: be that intervention an imposed controlled-stress, utilizing nutrient recycling systems within a CE, or basic light-reduction and irrigation termination strategies within conventional fields systems.