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# Investigating Growth and Safety for Food Production of the Cretan Herb Origanum Dictamnus on an Urban Green Roof

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## Abstract

Food production and consumption in urban areas has become a global concern due to increasing population density, which threatens food security. Green roofs can create spaces for the production of edible crops, offering opportunities to integrate sustainable agriculture into urban communities. However, urban agriculture also involves the risk of contamination of cultivated plants by pollutants produced by human activities in the urban environment. Thus, the aim of the present study was to evaluate the growth performance and safety for consumption of the edible medicinal plant Origanum dictamnus L. (Lamiaceae) when cultivated on an extensive green roof system, using different substrates and sites within the urban fabric. Plants were planted in December 2016 in plastic containers (40×60×22 cm; 2 plants per container; 6 containers per treatment) equipped with a green roof infrastructure consisting of a moisture retention and protection of the insulation mat, a drainage layer and a filter sheet. Containers were placed at two cultivation sites: on a fully exposed second-floor rooftopat the Agricultural University of Athens and at ground level, along a moderately trafficked street (Iera Odos). Two substrate types were used: a soilless substrate consisting of grape marc compost: perlite: pumice (3: 3: 4, v/v), and a substrate containing soil, composed of grape marc compost: perlite: pumice: soil (3: 3: 2: 2, v/v), both at a depth of 10 cm. Plants were regularly irrigated during the April-September period and their growth was evaluated. In September 2017, the concentrations of heavy metals (Cu, Pb, Ni, Mn and Zn) in the edible parts of the plants (leaves and flowers) were determined by atomic absorption spectrometry. Before flowering (late May 2017), plants grown at street level were taller than those grown on the rooftop. However, after flowering (late August 2017), cultivation site no longer had a significant effect on plant height or diameter. Substrate type affected foliage and root growth, which were greater in the substrate containing soil. The number of flowering shoots and flower dry weight did not differ among treatments. Cultivation site affected heavy metal accumulation, resulting in higher concentrations at street level. Substrate type significantly affected Mn concentration, with the highest values measured in the soil-containing substrate. Concentrations of all heavy metals, except for Cu and Zn in flowers, exceeded the permissible limits at both cultivation sites. Overall, O. dictamnus could be effectively cultivated on

sustainable green roofs, supporting urban horticulture. Plant growth was favored by the substrate containing soil, although growth was also satisfactory in the soilless substrate, which should be preferred due to its lower construction load. Careful selection of the cultivation site could minimize contamination with environmental pollutants when human consumption is also intended.

**Keywords:** urban agriculture, native medicinal aromatic plant, soil vs. soilless substrate, grape marc compost, heavy metals accumulation

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