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**PhD Dissertation Defense**

Entitled

*EVALUATION OF NATIVE PLANT INTEGRATION, SUBSOIL AMENDMENT, AND 'FOODSCAPING' AS MEANS OF  
INCREASING THE ENVIRONMENTAL FEASIBILITY OF PUBLIC URBAN GREENERY IN THE GULF REGION*

by

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Abstract

Public parks and gardens greatly contribute to the residential and touristic value of cities of the Gulf Region, but their maintenance is associated with high environmental and economic costs. The high potential evapotranspiration and summer temperatures greatly limit the choice of suitable landscaping plants, and light sandy soils with a high weed potential challenge the water management. The United Arab Emirates is characterized by a rapid urban development and population growth, resulting in increasing competition between green amenities and crop farming for irrigation water, cultivable land, and workforce. Various strategies and technologies have been proposed to increase the resource use efficiency of UAE's urban greenery, such as the replacement of exotic by native xerophytic vegetation, amendment of the soil, water saving irrigation practices, as well as the integration of crop production with ornamental plantations ('foodscaping'). However, little is known about how such techniques could be integrated into existing landscape management concepts, and there is a need to comparatively assess resource saving potentials. For this purpose, two field experiments were conducted in public urban parks in the city of Al Ain, UAE, as part of the present study. The first one tested eight native and four exotic plant ornamental species for their performance under four levels of supply with mineral fertilizer and irrigation water in form of treated sewage effluent (TSE). One year after establishment, the native plants provided a similar ornamental value at up to 70 % reduced irrigation water expenditure compared with standard exotic plant stands. The native plants were also found to have a positive impact on the soil physical and chemical properties. The second field experiment tested the hypothesis that subsoil amendment in combination with water supply to the subsoil via deep pipes would increase the water use efficiency of ornamental plant stands. The results of this experiment revealed that, irrespective of the mode of water supply, the native plant species grew more biomass and tended to outcompete neighbouring exotic plants when grown in mixed stands. The soil amendment had no impact on the plant performance, but deep pipe irrigation reduced the emergence of weeds.

Based on literature research, site observations, and satellite image mapping, the present study also evaluated the potential contribution of foodscaping to Al Ain's supply with fresh fruits and vegetables. This study revealed that foodscaping could potentially contribute around 10 % to the total fruit and vegetable consumption of urban residents, which is notable, given that the Gulf Region currently imports more than 90 % of its food. For a preliminary assessment of risks pertaining to urban crop production, date fruits from palms growing along roads within and outside of Al Ain were sampled and analysed for their element concentrations. The results revealed that some fruits grown near roads contained elevated levels of certain heavy metals, likely from atmospheric deposition.

Based on the results of the present study it is concluded that the resource saving potential of alternative soil amendment or irrigation technologies for public urban greenery is rather low. A far greater potential seems to lie in a modification of the composition of urban landscape plantations. It is recommended that strategies for the integration of native plants and crops into urban gardens and parks are further developed. These would need to take differences in competitive strength between native and exotic plant species into account, as well as the potential contamination of plant material in the proximity of roads.

**Keywords:** Native plants, nonnative plants, competitive strength, soil improvers, reclaimed water, food security, heavy metals deposition, roadside plantations, urban green spaces, nutrients acquisition.