Comparative Study of the Nutritional Composition of Red Amaranth, Green Amaranth and Roselle Cultivated in Aquaponics and Soil-Based System

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Abstract

This study presents a comparative analysis of the proximate composition of *Amaranthus viridis, Amaranthus cruentus,* and *Hibiscus sabdariffa* cultivated in aquaponic and conventional soil bed systems. The aim was to evaluate the nutritional implications of these two cultivation systems by measuring key proximate parameters: moisture, ash, crude protein (CP), ether extract (EE), crude fiber (CF), carbohydrate (CHO), and nitrogen-free extract (NFE), using standard AOAC methods. Results showed significant differences ($p < 0.05$) across species and cultivation systems. *A. viridis* grown in aquaponics had significantly lower moisture (4.56±0.12%) than its soil-grown counterpart (6.55±0.17%) and higher carbohydrate content (79.31±0.24%). *A. cruentus* showed the highest NFE in aquaponics (85.76±0.37%), while *A. viridis* in soil beds recorded the highest CP (7.68±0.29%) and CF (7.58±0.50%). In *H. sabdariffa*, aquaponically grown samples had higher CP (6.64±0.20%) compared to those from soil beds (5.72±0.40%), while soil-grown samples had higher EE (2.00±0.21%). Across all species, aquaponic cultivation consistently yielded crops with lower moisture and lipid content but significantly higher carbohydrate and NFE values, suggesting improved energy content and storage potential. The results also revealed significant differences ($p < 0.05$) in nutrient profiles across systems. Aquaponics systems consistently produced higher concentrations of essential nutrients such as nitrogen, phosphorus, potassium, calcium, and trace elements compared to soil beds. These findings underscore aquaponics as a promising method for enhancing specific nutritional attributes of leafy vegetables.

Keywords

Aquaponics, soil beds, *Amaranthus, Hibiscus,* sustainable agriculture.