The Effect of Nutrient Solution Concentration on Hydroponic Spinach Plants

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Studies comparing the mineral nutrition of hydroponically and conventionally grown vegetables have been inconclusive, an advantage of hydroponically grown vegetables is that mineral nutrient concentrations supplied to the plants can be directly controlled. Based on this information an experiment was designed to investigate whether the mineral nutrient content of spinach (Spinacia oleracea) could be increased by increasing the concentration of hydroponic nutrient solutions. Spinach was grown hydroponically using a commercially available nutrient source at 1.0, 2.6, 4.2, and 5.8 times the recommended concentration. Temperature and pH were monitored throughout the growing period. Plants were harvested at maturity. Plant length and mass were measured prior to analysis. Elemental analyses of the nutrient solutions and spinach leaves were performed by ICP-OES and ICP-MS. Speciation of the nutrient solutions was modelled using Visual Minteq. Plant biomass increased with increasing nutrient solution concentration. Free ion activities also increased with increasing nutrient solution concentrations. However, increasing the nutrient solution concentrations did not result in an increase the mineral nutrient concentration in the spinach leaves. The highest spinach leaf concentrations of all nine mineral nutrients investigated occurred in the lowest concentration of nutrient solution. The results illustrate the complex nutrient uptake dynamics of spinach, and that increasing the nutrient content of spinach may not be achieved by simply increasing the nutrient concentration of the growth medium.

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