

Protocol for the determination of mean uptake concentrations (nutrient to water uptake ratios) during a particular time interval

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Plants are grown in a closed hydroponic system in which the fertigation effluents are collected and recycled. The net uptake of nutrients and water by plants is replenished by supplying a replenishment nutrient solution with standard concentrations. Samples of recirculating NS are selected at the beginning and the end of a particular time interval (e.g., monthly) from all experimental units to determine the actual Ca, Mg, K, P, S, N, Fe, Mn, Zn, Cu and B concentrations. During the trial, the net supply of replenishment nutrient solution that is consumed by plants is recorded accurately. Special care is taken to avoid any leakage of nutrient solution from the closed hydroponic system.

Nutrient to water uptake ratios (uptake concentrations) for the above-referenced nutrients are estimated based on the removal of nutrients from the nutrient solution. In particular, the mean uptake concentration of the x nutrient (C_{xu} in mmol L⁻¹ if x = Ca, Mg, K, P, S, N; C_{xu} in μmol L⁻¹ if x = Fe, Mn, Zn, Cu, B) during a particular time interval is determined using the following mass balance equation:

$$C_{xu} = \frac{V_r(C_{xb} - C_{xe}) + V_u C_{xa}}{V_u}$$

where V_r (L) denotes the total volume of the recirculating nutrient solution in the experimental unit of soilless cultivation, V_u (L) denotes the total volume of NS that has been taken up by the plants in each experimental unit during the particular time interval, C_{xb} and C_{xe} (mmol L⁻¹ if x = Ca, Mg, K, P, S, N; μmol L⁻¹ if x = Fe, Mn, Zn, Cu, B) denote the concentrations of the x nutrient in the recirculating nutrient solution on the first and the last day of the particular time interval (first and last day of the month), respectively, and C_{xa} denotes the concentration of the x nutrient in the replenishment NS.