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Effect of nutrient solution pH on the quality of *Lactuca sativa* L. in a hydroponic system under struvite fertilization

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Abstract

In this study, we proposed the application of Crystal Green as P fertilizer in lettuce cultivation in non-recirculating hydroponics in solution with a different range of pH (4.5-8.5) instead of superphosphate. The experiment was conducted at the Wroclaw University of Environmental and Life Sciences, in greenhouse conditions, in 2022. The results showed that the nutrient solution pH differences were reflected in the content of nutrients in the leaves and roots as well as the mass of lettuce plants under struvite fertilization. Macronutrients such as nitrogen, potassium, calcium, magnesium were highly available in stagnant hydroponics at pH 6.0-6.5. The phosphorus content in leaves was found to be the lowest in pH solution 7.5 and 8.5, being lower by about 34% than in control at pH 5.5. The uptake of this element was also dependent on the pH of nutrient solution. The higher pH of the solution, the lower the P uptake (42% lower at pH 7.5 and 50% at pH 8.5 compared to the control pH 5.5). A similar trend was found for K, where the higher the pH, the lower the uptake of this element (by 33% at pH 6.5, 32% at pH 7.5 and 48% at pH 8.5 compared to control). A higher amount of phosphorus was found in the root system (6459 mg kg^{-1} dm) than in leaves (6138 mg kg^{-1} dm). All micronutrients except boron became less available at alkaline pH. The higher the reaction of the solution, the lower the weight of lettuce leaves (8% less at pH 4.5, 11% less at pH 7.5 and 24% less at pH 8.5 compared to control), roots (30% at pH 4.5, 36% at pH 7.5 and 51% at pH 8.5 compared to the control) and the whole plants (6% in total biomass at pH 4.5, 9% at pH 7.5 and 181% at pH 8.5 compared to the control). Further study is needed to evaluate whether struvite will be suitable for the formation of nutrient solution for the next cycle of production.

Keywords: hydroponics; lettuce, struvite, pH, phosphorus, microelements

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N020/0001/24 - PhD Fellowship Application – Evaluation of the Fertilizer Value and Impact of Struvite as a Phosphorus Source in the Cultivation of Various Plant Species and N0N00000/0241/14/2024 ((Effect of struvite fertilization on the photosynthetic rate of selected plants grown in hydroponic culture).