

Effect of nitrogen form and pH of nutrient solution on the changes in pH and EC of spinach rhizosphere in hydroponic culture

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Abstract

In this study, the effect of nitrate to ammonium ratio and pH of nutrient solution on the changes in pH and EC of rhizosphere during spinach growth period in perlite culture, under greenhouse conditions, was investigated. A split factorial experiment in a completely randomized design with four replications was conducted with three factors including nutrient solution's pH in three levels (4.5, 6.5 and 8), nitrate to ammonium ratio of nutrient solution in five levels (100:0, 75:25, 50:50, 25:75 and 0:100) and 10 levels of time. Three seedlings of spinach plant (*Spinacia oleracea* L. cv. Sirius) were cultivated per pot and nourished with 15 different nutrient solutions. During the growth period and at different times, the leachate pH and EC of cultivated and uncultivated pots were measured. The results showed that the effects of time, pH and nitrate to ammonium ratio of nutrient solution on pH and EC of rhizosphere were significant ($P < 0.001$). By increasing the nitrate to ammonium ratio of nutrient solution, the pH of rhizosphere was increased but the EC of rhizosphere was decreased. At the end of the growth period, the pH of rhizosphere in the nitrate to ammonium ratio of 100:0 was about three units higher than the nitrate to ammonium ratio of 0:100 and two pH of 4.5 and 8. While, this difference was lower at the pH of 6.5. During the spinach plant growth period, the changes in pH and EC of rhizosphere in studied treatments were different. In the nitrate to ammonium ratio of 75:25 and pH of 6.5, the pH of rhizosphere was in the optimum range for plant growth and nutrients uptake. Except in the nitrate to ammonium ratio of 100:0 and pH of 8, in the rest of the treatments, the rhizosphere pH decreased during plant growth period. The initial pH of nutrient solution had different effects on the rhizosphere pH. The average rhizosphere pH in nutrient solutions with pH of 4.5, 6.5 and 8 was 5.94, 6.5 and 7.29, respectively. The results showed that in adaptation to adverse acidic or alkaline conditions, the spinach plant changes its rhizosphere pH actively. Also, undesirable effects of pH on the spinach growth in adverse acidic or alkaline conditions can be decreased with application of proper nitrate to ammonium ratio. The rhizosphere EC was more than the leachate EC of uncultivated pots and the initial EC of nutrient solution. By decreasing the pH of nutrient solution, the rhizosphere EC of spinach was increased.

Keywords: Plant nutrition, Rhizosphere, Spinach, Salinity, Hydroponic.

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