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CO_2与NH_4^+/NO_3^-比互作对番茄幼苗培养介质pH、根系生长及根系活力的影响

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The effect of interactions between carbon dioxide enrichment and different NH4+/NO3- ratios on pH in nutrient solution,growth and root vigor system of tomato seedling roots

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摘要 为探讨CO_2浓度升高能否减缓高浓度NH_4^+-N对番茄根系的毒害作用,本试验在营养液栽培条件下,以番茄为材料,在CO_2生长箱中研究2个CO_2浓度与5个不同NH_4^+/NO_3^-配比的交互作用对生长介质的pH、根系生长及根系活力的影响。结果表明,随着生育期的推进与CO_2浓度的升高,pH变化幅度增大。两个CO_2浓度均表现为全NO_3^--N含量营养液的pH呈上升趋势,其它处理营养液的pH均呈现出不同程度的下降趋势,下降的幅度随NH_4^+/NO_3^-比例的增加而增加;而且全NH_4^+-N引起pH值下降的程度大于全NO_3^--N引起pH增加的程度。CO_2浓度升高增加了低NH_4^+/NO_3^-比例供应处理的蕃茄幼苗冠干重、根干重、根系活力、根系总吸收面积、活跃吸收面积。这些指标对CO_2的响应随NH_4^+/NO_3^-比例的降低而加强,冠干重、根干重、根系活力、根系总吸收面积、活跃吸收面积增加分别高达65.8%、78.0%、18.9%、12.9%与18.9%。说明在CO_2浓度升高条件下,番茄幼苗根生长潜力在全NO_3^--N处理中最大,但不能减弱全NH_4^+-N对番茄根系的毒害作用。

关键词： 番茄 pH 根系 生长发育 番茄 pH 根系 生长发育

Abstract： In order to understand whether the elevated CO_2 does alleviate the toxic effect on tomato root system due to high NH_4^+-N concentration in nutrient solutions,a growth chamber experiment was conducted to determine the influence of NH_4^+/NO_3^- ratio and elevated CO_2 concentrations on the pH in nutrient solution,growth and root vigor system of tomato seedling roots.Tomato(Lycopersicon esculentum Mill var.Hezuo 906) was grown in pots with nutrient solutions varying in NH_4^+: NO_3^- ratio(0: 1,1: 3,1: 1,3: 1 and 1: 0) in growth chambers with ambient(360 μL/L) or elevated CO_2 concentrations(720 μL/L).It enhanced the changes of pH with promotion of growth time and CO_2 enrichment.At two CO_2 levels,pH increased with whole NO_3^--N in nutrient solution and decreased in other treatments and enhanced the decrease of pH with increasing proportion of NH_4^+-N in nutrient solutions.The decrease in pH value with only NH_4^+-N in nutrient solution was higher than the increase in pH with only NO_3^--N in nutrient solution. Elevated CO_2 increased the dry weight of shoots and roots,root vigor system, total absorbing area,active absorbing area of tomato seedlings.All measurement indices above of tomato seedlings were increased in the elevated CO_2 treatment with increasing proportion of NO_3^- in nutrient solutions and the dry weight of shoots,dry weight of roots,root vigor system,total absorbing area and active absorbing area were up to 65.8%,78.0%,18.9%,12.9% and 18.9% higher at elevated than at ambient CO_2 concentration,depending on NH_4^+/NO_3^- ratio.The results indicated that tomato seedling roots may benefit best from CO_2 enrichment when 100% NO_3^--N in nutrient solutions is supplied,and elevated CO_2 did not inhibit the adverse effects on tomato seedling roots when 100% NH_4^+-N in nutrient solution is supplied.

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