

不同浓度的 NO_3^- 对黄瓜幼苗光合特性的影响苏秀荣¹, 王秀峰^{2*}, 丁方军³, 杨凤娟²

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Effects of different NO_3^- concentration on photosynthetic characteristics in cucumber seedlingSU Xiu-rong¹, WANG Xiu-feng^{2*}, DING Fang-jun³, YANG Feng-juan^{2*}

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摘要 水培条件下, 不同浓度的 NO_3^- 处理黄瓜幼苗7d, 测定了黄瓜幼苗光合速率及相关参数的变化, 揭示了黄瓜幼苗光合作用功能对高浓度 NO_3^- 胁迫响应机理。结果表明, 营养液中 NO_3^- 浓度在较低范围(14~98 mmol/L)内时, 适当增加 NO_3^- 有利于净光合速率的提高, 光饱和点的升高, 羧化效率增大, 淀粉粒增加, 叶面积增加; 有利于黄瓜幼苗光合物质的积累及植株的生长。营养液中 NO_3^- 浓度进一步增加(>98 mmol/L)时, 黄瓜幼苗叶绿素的含量降低, 净光合速率显著降低, 光饱和点、羧化效率均降低。182 mmol/L NO_3^- 的处理, 叶绿体的结构受到损伤, 基粒数、基粒片层数、淀粉粒均减少, 且淀粉粒变小, 干重和叶面积均降低。所以, NO_3^- 浓度过高时, 黄瓜幼苗利用强光、弱光、 CO_2 的能力减弱, 叶肉细胞被损伤, 非气孔限制造成光合速率降低, 不利于黄瓜幼苗的生长。

关键词: NO_3^- 胁迫 净光合速率 黄瓜幼苗 NO_3^- 胁迫 净光合速率 黄瓜幼苗

Abstract:

Cucumber plants grew in nutrient solution under different NO_3^- concentration for 7 d at hydroponic system. The changes of photosynthesis rate and related parameters in cucumber seedling leaves were studied in order to reveal the response mechanism of the photosynthetic functions of plants to NO_3^- stress in cucumber seedling. The results indicated that when available NO_3^- concentration was low (14 to 98 mmol/L NO_3^-), the net photosynthesis rate (Pn), light saturation point (LSP), carboxylation efficiency (CE), number of starch grains and absolute increment of leaf area were increased by proper supplement of NO_3^- . Supplement of NO_3^- at appropriate range improved the accumulation of photosynthates and the growth of plants. With further increase of NO_3^- concentration (>98 mmol/L NO_3^-) in the medium, the pigment contents in cucumber seedling leaves were lower; the apparent quantum yield (AQY), Pn, LSP, CE all significantly decreased compared to control. When NO_3^- concentration increased to as high as 182 mmol/L, the ultrastructure of chloroplasts were damaged, and the number of grana in cells and number of lamellae in granas, the number of starch grains in cells as well as starch grain size all decreased. Leaf area was reduced and dry weight was significantly lower than that of control plants. Consequently, the capabilities of cucumber seedlings using light and CO_2 were lower than control. Factors caused reduction of Pn was non-stomatal limitation because mesophyll cell were damaged.

Keywords:

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