

外源NO对缺铁胁迫下花生生理特性的影响

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Effects of exogenous nitric oxide on physiological characteristics of peanut under iron-deficient stress

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摘要

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摘要 为探讨外源NO对缺铁胁迫下花生生理特性的影响, 采用溶液培养方法, 研究了营养液中Fe(III)-EDTA浓度分别为0、10、100 μmol/L条件下, 外施250 μmol/L硝普钠(SNP, 一种NO供体)对花生生理特性以及矿质元素含量的影响。结果表明, 在相同供铁水平下, 外施NO可促进花生幼苗的生长, 提高根系活力、净光合速率、蒸腾速率、气孔导度和叶片抗氧化酶活性, 降低胞间CO₂浓度和MDA含量, 抑制花生对P的吸收; 在Fe(III)-EDTA浓度分别为0、10 μmol/L条件下综合效果更显著。在0、10、100 μmol/L Fe(III)-EDTA中施加SNP处理20d后, 叶片活性铁含量分别比未施加SNP处理提高了130.7%、136.4%、56.1%, 差异显著; 同时植株全铁含量及地上部吸铁量占植株总量的百分率也显著提高。说明外源NO可促进铁从根部向植株地上部的运输以及植株体内铁的有效性, 提高了铁的运输和利用效率, 有效缓解缺铁胁迫的抑制。同时, 外施NO还可提高花生叶片叶绿素、类胡萝卜素含量和叶绿素a/b值。在Fe(III)-EDTA浓度分别为0、10 μmol/L条件下, 添加SNP可以明显降低生长介质的pH, 比较1d内生长介质中pH变化看出, 花生在14h左右分泌H⁺的能力最强。

关键词: 一氧化氮 缺铁胁迫 花生 生理特性

Abstract: Nitric oxide (NO) plays an important role in crop growth and development. A hydroponic experiment was conducted to investigate the effects of sodium nitroprusside (SNP), a NO donor, on seedling growth, root activity, chlorophyll, photosynthetic characteristics, active oxygen metabolism and mineral element contents in peanut (*Arachis hypogaea* Linn.) plants and the change of pH in the culture medium. There were three treatments, 0, 10 and 100 μmol/L Fe(III)-EDTA. The results show the plant growth, root activity, net photosynthetic rate (Pn), transpiration rate (Tr), stomatal conductance (Gs) and active oxygen metabolism are significantly increased under the application of 250 μmol/L SNP, while the intercellular CO₂ concentration (Ci), the contents of MDA and phosphorus (P) are decreased. The effects are more significant under the Fe(III)-EDTA concentration of 0 and 10 μmol/L than those of 100 μmol/L. Compared with the treatments of 0, 10 and 100 μmol/L Fe(III)-EDTA, the contents of active Fe of leaves at 20 days' cultivation are significantly increased by 130.7%, 136.4% and 56.1% under the treatments of SNP+0, 10 and 100 μmol/L Fe(III)-EDTA. At the same time the total iron content of the plants, the percentage of shoot's total iron absorption to that of the plants are also significantly increased. These indicate that the NO donor can increase the chlorophyll contents, the transportation of iron and the efficiency of utilization of iron. Under Fe(III)-EDTA concentration of 0 and 10 μmol/L, the application of SNP obviously lowers the pH of nutrient medium, and the pH is the lowest at 14h.

Keywords: nitric oxide ferrous stress peanut physiological characteristics

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