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水分胁迫对水稻幼苗氮素同化酶及光合特性的影响

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Effects of water stress on activities of nitrogen assimilation enzymes and photosynthetic characteristics of rice seedlings

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摘要

用不同浓度的聚乙二醇（PEG-6000）模拟干旱处理，以探明水分胁迫对4 叶期的扬稻6号（籼稻）幼苗氮素形态、氮代谢关键酶以及对光合特性的影响。结果表明，轻度水分胁迫（PEG≤5%、水势≥-0.05 MPa）不影响氨基酸态氮、可溶性蛋白含量以及硝酸还原酶（NR）、谷氨酰胺合成酶（GS）、谷氨酸合酶（GOGAT）和谷氨酸脱氢酶（GDH）活性；但对硝态氮的吸收和积累有一定刺激作用，并显著降低幼苗净光合速率和干物质累积。相关分析表明，光合速率的降低对茎叶干物质累积的影响明显大于水稻体内通过代谢抵御外界不良环境的正面效应，导致茎叶干物质积累降低。当高水分胁迫强度（PEG≥10%、水势≤-0.15 MPa），不同氮素形态的含量、氮代谢关键酶以及光合速率显著降低；而且根器官对水分胁迫的敏感程度明显大于叶片。表明水稻幼苗中不同氮素形态的含量、氮代谢关键酶以及光合速率与水分胁迫强度密切相关。

关键词： 水稻 水分胁迫 氮同化酶 光合特性 水稻 水分胁迫 氮同化酶 光合特性

Abstract:

The effects of water stress on nitrogen forms, activities of some enzymes related to nitrogen metabolism and photosynthetic properties in rice were studied using a hydroponic experiment. Water stress was caused by adding PEG-6000 into the solution. Slight water stress (PEG ≤ 5%, Water potential ≥ - 0.05 MPa) has little effects on contents of amino acid nitrogen, soluble protein and activities of nitrate reductase (NR), glutamine synthetase (GS), glutamate synthase (GOGAT) and glutamate dehydrogenase (GDH), and moreover the absorption and accumulation of nitrate nitrogen are stimulated. However, photosynthetic rate and dry matter accumulation are significantly inhibited. The dry matter accumulation change is significantly correlated with the regulation of photosynthetic rate more than that positive effect of resisting badness effect from environment. Therefore, photosynthetic rate has much more effect on dry matter accumulation than metabolism in vivo of rice. When PEG concentration ≥10 %(Water Potential≤-0.15 MPa), the concentrations of different nitrogen forms, some key enzymes of nitrogen metabolism and photosynthetic rate are significantly decreased. These effects on roots under the water stress are significantly larger than those on leaves. The above results indicate concentrations of different nitrogen forms and some key enzymes of nitrogen metabolism and photosynthetic rate are closely related to the intensity of water stress.

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