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铝胁迫下不同小麦基因型根际pH的变化、NH_4^+和NO_3^-吸收及还原与其耐铝性的关系

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Tolerance of wheat genotypes to Al toxicity in relation to their rhizosphere pH change, NH4+ and NO3- uptake, and nitrate reduction under Al stress

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摘要 以耐Al性明显差异的 2个小麦基因型为材料 ,采用溶液培养试验和动力学方法研究了根际 pH变化、NH_4^+和NO_3^- 的吸收以及NO_3^- 还原与其耐Al性的关系。结果表明 ,A1胁迫下鉴 86.4(耐性基因型)比扬麦 5号 (敏感基因型)能维持较高的根际 pH值 ,当溶液 pH值下降到最低时 ,前者比后者高 0.23个pH单位。吸收动力学研究表明 ,鉴 86-4在无Al和有Al胁迫时对NO_3^- 的吸收速率和亲和力大于扬麦 5号 ;而对NH_4^+的吸收速率和亲和力却小于扬麦 5号。Al还降低叶片和根系的硝酸还原酶活性 ,但鉴 86.4的叶片和根系硝酸还原酶活性均高于扬麦 5号。此外 ,在Al胁迫下 ,植株体内游离脯氨酸含量迅速提高 ,但扬麦 5号积累量高于鉴 86.4。鉴 86.4具有较高的耐Al能力可能与其在Al胁迫下对NO_3^- 的吸收速率、亲和力以及硝酸还原酶活性较高 ,而对N_4^+的吸收速率和亲和力较低 ,从而能维持较高的根际 pH值有关

关键词： 耐Al性 根际pH 吸收动力学 硝酸还原酶 耐Al性 根际pH 吸收动力学 硝酸还原酶

Abstract： Two wheat genotypes differing in Al tolerance were employed to study the relationship between changes of rhizosphere pH and NO_3^- and NH + 4 uptake kinetics under Al stress. Tolerant genotype, Jian86-4, was able to maintain higher rhizosphere pH than the sensitive one, Yangmai-5. The lowest rhizosphere pH of Jian86-4 was higher than that of Yangmai-5 by 0.23 unit. The maximum uptake rate (Vm) and affinity indicated by Km for NO_3^- and NH_4^+ were strongly reduced by Al in both genotypes, with greater reduction in the Al-sensitive one. Jian86-4 had larger maximum uptake rate and affinity for NO_3^- and lower for NH + 4 than Yangmai-5 with and without Al supply. Nitrate reductase activities in leaves and roots were severely decreased by Al, and a greater decrease was noted in Yangmai-5. Al increased the content of free proline in leaves and roots of both two genotypes. The increases were greater in Jian-86-4 than Yangmai-5. It suggested that tolerance of Jian-86-4 to Al was partially achieved by increasing the rhizosphere pH to reduce the solubility, hence the reduction of toxicity of Al, which resulted from the high NO - 3 and low NH_4^+ absorption, and higher nitrate reductase activity.

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