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研究报告

大豆和水稻对铝胁迫响应的生理机制

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摘要 通过水培方式，研究了铝处理对双子叶植物大豆和单子叶植物水稻根系生长、养分吸收、根系内含物及根分泌物的影响. 结果表明，低铝（10 μmol·L^{-1})浸种刺激大豆种子萌发和根系的生长，对水稻无明显促进作用. 铝处理增加了两种作物根系对P的吸收，降低K、Ca、Mg的吸收. 水稻比大豆根系积累较少的Al和更多的P. 铝胁迫条件下，大豆和水稻根系内源可溶性蛋白含量升高、可溶性酚含量下降、可溶性糖含量先上升后下降，且大豆根系内源柠檬酸含量下降明显. 与大豆相比，水稻积累较低的柠檬酸和较高的可溶性蛋白、可溶性酚，但两者可溶性糖没有差异. 铝处理增加大豆根系柠檬酸、可溶性蛋白、可溶性酚、可溶性糖的分泌量，且大豆分泌量显著高于水稻. 在铝处理条件下，大豆根系具有较高的阳离子交换量(CEC)，而水稻的CEC较低. 这说明大豆和水稻对铝胁迫具有不同的生理反应，水稻的高耐铝性可能与其较高的磷吸收和较低的CEC有关，而与其根系分泌物的关系不大.

关键词 Al胁迫 养分吸收 根系内含物 根系分泌物 阳离子交换量(CEC)

分类号

Physiological mechanisms of soybean and rice in responses to aluminum stress

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Abstract

A hydroponic study was conducted on the root growth, nutrient uptake,and root extracts and exudates of soybean and rice under aluminum (Al) stress. The results showed that low Al (10 μmol·L^{-1}) stimulated the seed germination and root growth of soybean, but had no obvious promotion effects on rice. Al stress increased the P uptake, but decreased the K, Ca and Mg uptake by both soybean and rice. Rice accumulated less Al and more P than soybean. When exposed to Al stress, the soluble protein content in soybean and rice roots increased, soluble phenol decreased, while soluble sugar increased first and decreased then. The citrate content in soybean roots decreased obviously under Al stress. Compared with soybean, rice accumulated more soluble protein and phenol and less citrate, but no difference was observed in soluble sugar content. Al increased the exudation of citrate and soluble protein, phenol and sugar from soybean roots. Under Al stress, soybean roots possessed a higher cation exchange capacity than rice roots. It was suggested that soybean and rice had different physiological responses to Al stress. The Al tolerance of rice was probably associated with its higher P uptake and lower cation exchange capacity than soybean, while root exudates had no significant correlation with its Al tolerance.

Key words Al stress nutrient uptake root extracts root exudates cation exchange capacity

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