

## 铵态氮营养下水稻根系分泌氢离子与细胞膜电位及质子泵的关系

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Relationship between membrane potential, plasma membrane H<sup>+</sup>-Pump and H<sup>+</sup> release by rice root under ammonium nutrition

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摘要

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**摘要** 为了研究水稻在铵态氮营养下分泌氢离子的机理, 采用不同浓度的铵态氮(0.1~1.0 mol/L)处理水稻幼苗根系, 4h后用1 mol/L NaOH滴定培养液, 计算氢离子的分泌量; 同时, 将水稻根系用多聚糖PEG-DEXTRAN两相系统分离出细胞膜囊体, 并测定细胞膜H<sup>+</sup>-ATPase的水解活性和质子泵活性。另外, 利用毛细管微电极测定水稻根细胞在上述不同铵浓度下膜电位的变化, 以阐明水稻根系吸收铵态氮后分泌氢离子与细胞膜电位及细胞膜质子泵之间的关系。结果表明, 随着培养液中铵离子浓度的升高, 根系分泌氢离子的量随之增加; 分离细胞膜后, 离体细胞膜囊体H<sup>+</sup>-ATPase的水解活性和质子泵活性也相应增强。原位测定细胞膜电位时, 膜电位去极化程度亦随NH<sub>4</sub><sup>+</sup>浓度的升高而升高; 氢离子分泌量与细胞膜电位、细胞膜H<sup>+</sup>-ATPase水解活性及质子泵活性之间的均具有一定的相关性。说明根系在NH<sub>4</sub><sup>+</sup>-N营养下分泌氢离子是由于细胞膜上H<sup>+</sup>-ATPase主动泵出氢离子造成的, 这与根系吸收NH<sub>4</sub><sup>+</sup>后引起细胞膜去极化, 需要通过提高质子泵活性来维持膜电位有关。

**关键词:** 水稻 细胞膜H<sup>+</sup>-ATPase 铵态氮 膜电位

**Abstract:** To characterize the mechanism of H<sup>+</sup> release from rice roots under ammonium nutrition, rice seedlings (*Oryza sativa* L.) were incubated in a range of NH<sub>4</sub><sup>+</sup> concentration (0 – 1 mol/L) for 4 hours. H<sup>+</sup> release was calculated by titration of the root exudation solution with 1mol/L NaOH. The plasma membrane vesicles of roots were isolated by PEG-DEXTRAN two-phase system. The plasma membrane H<sup>+</sup>-ATPase hydrolytic activity and pump activity was tested. In addition, plasma membrane potential was investigated by micro-electrode in situ. The correlations between the H<sup>+</sup> release, membrane potential, plasma membrane H<sup>+</sup> ATPase activity were analyzed. The results show that: (1) the H<sup>+</sup> release is increased with the increase of NH<sub>4</sub><sup>+</sup> concentration in root medium, (2) in vitro, both the plasma membrane hydrolytic and pump activities are increased, (3) in situ, membrane potential depolarization is also increased, and (4) there correlations between membrane potential, plasma membrane H<sup>+</sup> ATPase, H<sup>+</sup> pump activity and H<sup>+</sup> release. These results indicate that the H<sup>+</sup> release is closely related to the plasma membrane H<sup>+</sup> pump activity, which is induced by membrane depolarization under NH<sub>4</sub><sup>+</sup>-N.

**Keywords:** rice plasma membrane H<sup>+</sup>-ATPase ammonium membrane potential

Received 2010-11-19; published 2011-09-01

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## 引用本文:

缪其松 曾后清 朱毅勇 范晓荣 徐国华 沈其荣. 铵态氮营养下水稻根系分泌氢离子与细胞膜电位及质子泵的关系[J] 植物营养与肥料学报, 2011, V17(5): 1044-1049

MIAO Qi-song ZENG Hou-qing ZHU Yi-yong FAN Xiao-rong XU Guo-hua SHEN Qi-rong. Relationship between membrane potential, plasma membrane H<sup>+</sup>-Pump and H<sup>+</sup> release by rice root under ammonium nutrition[J] Acta Metallurgica Sinica, 2011, V17(5): 1044-1049

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