RESTRICTION IN XYLEM NH_4^+-FLUX IS AN EXCLUSION MECHANISM FOR AMMONIUM TOLERANCE IN RICE PLANTS

RESTRIÇÃO DO FLUXO DE $NH4^+$ NO XILEMA É UM MECANISMO DE EXCLUSÃO PARA TOLERÂNCIA DE AMÔNIO EM PLANTAS DE ARROZ

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Land plants can utilize nitrate (NO_3^-) or ammonium (NH_4^+) as preferably nitrogen (N) source, however high tissue NH_4^+ accumulation presents potential harmful effects for cell metabolism, such as growth stunting and occasionally leading to plant death. Rice plants (*Oryza sativa japonica* cv. Nipponbare) are ammonium tolerant that have developed several mechanisms to cope with high NH_4^+ concentrations in paddy soils. Despite the NH_4^+ tolerance in rice plants has been known for a long time the physiological mechanisms involved in this process are still partially understood. Aiming to investigate if rice NH_4^+ tolerance is related to shoot NH_4^+ exclusion mechanisms, 30-day-old rice plants previously grown in Hoagland and Arnon solution were deprived of N for 3 days. Then, these plants were exposed to 10 mM NO_3^- or 10 mM NH_4^+, as sole N source, by 24 h in greenhouse conditions. After 24 h, nitrate and ammonium root influx were quite similar, but xylem NO_3^- flux was 7.6 times higher than NH_4^+ flux to shoot in NO_3^-- and NH_4^+-supplied plants, respectively. The concentration of ammonium and nitrate in leaf tissues were alike, while in roots the ammonium content was 4-times higher than nitrate content in NH_4^+- and NO_3^--treated plants, respectively. Net CO_2 assimilation, stomatal conductance and actual quantum efficiency of PSII did not change in both NH_4^+- and NO_3^--treated plants. In fact, these results demonstrate that rice plants are tolerant to high ammonium concentrations, as reported in the literature. In conclusion, this NH_4^+ tolerance is related to the high compartmentalization of this ion in roots, inside of vacuoles or apoplast, reducing the xylem flux to shoot and accumulating small amounts of NH_4^+ in leaf tissues. This low concentration of NH_4^+ in green leaves allowed a normal photosynthetic activity and cell metabolism. Moreover, it is also important to highlight other exclusion mechanisms, such as an efficient NH_4^+ assimilatory system, particularly glutamine synthase and glutamate synthetase (GS-GOGAT) cycle which could be involved with ammonium tolerance in rice plants. However, further investigations are needed to better understand the mechanisms related to green leaves ammonium exclusion in rice plants.

Keywords: CO_2 assimilation; Nitrogen source; Xylem flux; *Oryza sativa*.

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