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The different effects of nitrogen forms (NH4+ and NO3-) on cell wall phosphorus remobilization in rice

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Nitrogen (N) and Phosphorus (P) are vital macronutrients for plant growth. Plants mainly fulfill their N requirements by absorbing ammonium (NH4+) and inorganic nitrate (NO3–) from the soil. These two different forms of nitrogen significantly affected plant P uptake. However, whether them affect the P remobilization in rice, especially the cell wall P reutilization, is still unclear. Two rice cultivars, 'Nipponbare' (Nip) and 'Kasalath' (Kas) were cultured in the +P (complete nutrient solution) and -P (withdrawing P from the complete nutrient solution) nutrient solution with different nitrogen forms (NH4+ and NO3-) or different nitrogen concentrations (0 or 1 mM NO3-) for 7 days. The results displayed that NH4+ positively regulates the pectin content and activity of Pectin Methylesterase (PME) in root cell walls under -P conditions, thereby remobilizing more P from the cell wall and increasing soluble P in rice. In addition, compared with NO3-, NH4+ significantly increased the accumulation of Nitric Oxide (NO) in the rice root under -P conditions. The effect of NO on the reutilization of P from the cell walls was further demonstrated through the application of the NO donor Sodium Nitroprusside (SNP) and NO scavenger 2-(4-carboxyphenyl)-4, 4, 5, 5-tetramethylimidazoline-1-oxyl-3-oxide (c-PTIO). The P-transporter gene OsPT2 is up-regulated under NH4+ supplementation and is therefore involved in the stimulated P translocation. However, compared with 0 mM NO3-, 1mM NO3- significantly decreased NO accumulation in rice root, thereby decreased cell wall P release by decreasing pectin synthesis and suppressing the activity of PME, and also significantly inhibited the translocation of soluble P from the root to the shoot under P-absence conditions. In conclusion, our data provide novel (to our knowledge) insight into the regulatory mechanism by which NH4+ stimulates Pi reutilization in cell walls of rice.

Biography

Chunquan Zhu is currenting working as research assistant professor at China National Rice Research Institute, China, Hang Zhou. After obtaining his Masters in Plant Sciences (2014) and PhD in Plant Nutrition (2017), he is engaged in research the role and underling mechanism of cell wall in rice phosphorous and iron reutilization and rice response to heavy metal stress, such as Al and Cd. He has published 19 research papers.

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