Photosynthetic and morpho-physiological responses to salinity in wild and cultivated rice

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Rice is the most widely used cereal for human consumption, with about 50% of the world's population dependent on it, but also the most salt-sensitive cereal. Soil salinization affects approximately 7% of the earth's land surface, and is becoming a major environmental constraint for rice crop production that will worsen in many regions because of global climate change.

Domesticated rice *Oryza sativa* L. originated from its wild ancestor *Oryza rufipogon* Griff., which seems to possess superior salinity tolerance. However, a salt tolerance mechanism regarding the photosynthetic activity in relation to the morpho-physiological characteristics of this wild rice is still unknown. With this aim, we investigated the responses to salinity stress (80 mM NaCl for 7 days) in seedlings of the wild *O. rufipogon* compared to two Italian cultivated *O. sativa* varieties, Baldo (mildly salt-tolerant) and Vialone Nano (salt-sensitive) [1].

Under salt treatment, *O. rufipogon* showed the highest percentage of plants with no to moderate stress symptoms; conversely, Vialone Nano displayed the lowest percentage of surviving plants, and Baldo an intermediate behaviour. Salt-treated *O. rufipogon* plants, despite a modest perturbation of the photosynthetic performance, as attested by a slightly decreased $PI_{(ABS)}$ and increased DI_o/RC values by JIP-test, preserved the overall photosynthetic apparatus integrity and leaf carbon to nitrogen balance. This was paralleled by an unchanged shoot/root biomass ratio, the highest Na^+ accumulation in roots, the lowest root and leaf Na^+/K^+ ratio, and highest leaf relative water content, leading to a better preservation of the plant architecture, ion homeostasis, and water status. Conversely, in Vialone Nano salt treatment heavily impaired the PSII functionality (i.e., strongest reduction in F_o, F_m, F_v, φ_0, and $PI_{(ABS)}$ JIP-test values) and photosynthetic apparatus integrity (i.e., highest increment of accumulation of PSII and particularly PSI reaction center subunits). Salt-treated Vialone Nano plants also displayed reduced leaf carbon and nitrogen content and a higher reduction in the growth of shoots rather than roots, with leaves compromised in water and ionic balance.

[1] Trotti et al., 2024. Physiological responses to salt stress at the seedling stage in wild (*Oryza rufipogon* Griff.) and cultivated (*Oryza sativa* L.) rice. *Plants* 13, 369.