Aluminum uptake, translocation, physiological changes, overall growth inhibition in indica rice genotypes (*Oryza sativa* L.) at vegetative stage

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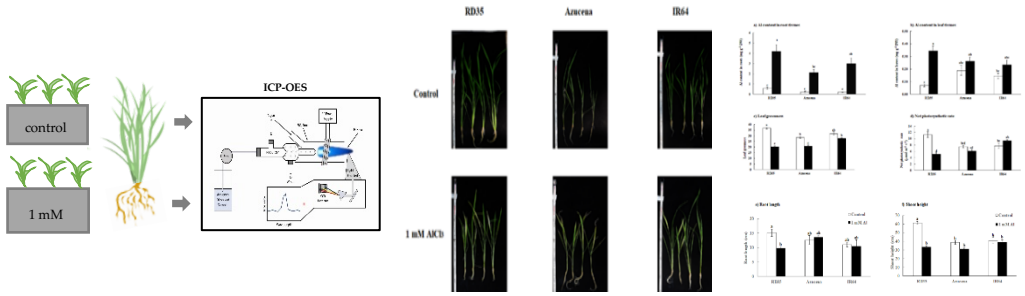
Abstract: The objective of this investigation was to evaluate the Al root absorption, translocation to leaves and Al toxicity of three rice genotypes, RD35 (local acidic-tolerant), Azucena (positive –check Al-tolerant), and IR64 (high yielding) grown under 0 (control) and 1 mM $AlCl_3$ with acidic condition (pH 4.5). Root and leaf tissues of Al treated plants were collected to assay Al content using inductively coupled plasma optical emission spectrometry (ICP-OES). Al content in the root tissues of rice cv. RD35 was peaked at 4.18 mg g^{-1} DW, significantly translocated to leaf tissues (0.35 mg g^{-1} DW), leading to damage the leaf greenness (SPAD) (by 44.9% over control) and consequently to decline net photosynthetic rate (P_n) (by 54.5% over control). In contrast, Al level in cvs. Azucena and IR64 was restricted in the roots with low amount in the leaf tissues, resulting in maintaining SPAD and P_n. In cv. RD35, root traits including root length, root fresh weight as well as shoot traits i.e., shoot height, shoot fresh weight and shoot dry weight in 1 mM Al treatment were significantly dropped >35% over control, whereas those parameters in cvs. Azucena and IR64 were retained. Based on the results, RD35 rice genotype was identified as Al sensitive, representing by Al toxicity in both root and shoot organs whereas Azucena and IR64 were tolerant to 1 mM Al in the vegetative stage (tillering), leading to storage of Al in the root and reduce toxicity in the leaf tissues as well as retain overall growth performance.

Graphic Abstract



Keywords: aluminum, growth characters, leaf greenness, net photosynthetic rate, tillering

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