

## **Root Elongation, Root Surface Area and Organic Acid by Rice Seedling Under Al<sup>3+</sup> and/or H<sup>+</sup> Stress**

### **ABSTRACT**

Problem statement: Under acidic condition, Al<sup>3+</sup> is the most common species in solution. An experiment was conducted to study the effects of Al and/or pH on rice seed germination, root morphology and organic acids release. This study was conducted at ambient temperature in Malaysia. Approach: Two experiments were conducted: (1) Rice seeds undergoing germination were exposed to 0.5 mM CaCl<sub>2</sub> solutions containing various concentration of Al (10, 20, 30, 40-50 μM) and (2) The seeds were soaked in water taken from an acid sulfate soil area in Malaysia for which the pH was adjusted to a range of values using 0.01 M HCl or NaOH. Results: Root length decreased with increasing Al concentration, while the opposite was true for pH. The trend for the change of root surface area with Al concentration and pH is the same as that of root length. The critical Al concentration for rice growth is 15 μM. This means that rice variety MR 219 grown on 90% of the granary areas in Malaysia is relatively less tolerant compared to other rice varieties. At low pH and high Al concentration, the rice roots secreted citrate and/or oxalate which subsequently formed Alcitrate and Al-oxalate, respectively. This, to a certain extent, had reduced Al toxicity. This is the mechanism of rice tolerance to Al toxicity. Conclusion: Acid sulfate soils in Malaysia allocated for rice production should be limed to increase water pH in the paddy field to 5.0. Then, rice can grow without Al<sup>3+</sup> and/or H<sup>+</sup> stress.