

Can the acidic Ultisols in Peninsular Malaysia be alleviated by biochar treatment for corn cultivation?

ABSTRACT

Arable land in Peninsular Malaysia is dominated by highly weathered infertile soils which are taxonomically classified as Ultisols. The production of non-acid tolerant sweet corn on these acidic Ultisols is known to be negatively affected by soil acidity and/or Al³⁺ toxicity. However, to some extent, corn is able to defend itself against Al³⁺ toxicity and/or H⁺ stress. For Al³⁺ toxicity problem, the defence mechanism is along this line. The positively-charged Al³⁺ is attracted to the negatively-charged root surface of the sweet corn. When the Al³⁺ touches the surface of the root, the corn plant reacts instantly to release oxalic acid that chelates the Al³⁺. By this mechanism some of the Al³⁺ at the solution-root interface will be deactivated by the organic acid and rendered unavailable for uptake by corn. The chelation of Al³⁺ occurring in soil solution by this mechanism is a crucial step to help sustain the production of corn growing on the Ultisols. For sustainable corn production, the pH of the Ultisols has to be raised to a level above 5.3 by liming or other agronomic means. In the final analysis, Al³⁺ activity in the soil solution is less than the critical level of 10 µM. The low productivity of the Ultisols can be overcome by applying EFB-biochar at a rate of 10 t biochar/ha, which is an economically viable agronomic practice.

Keyword: Acid soils; Al toxicity; Biochar treatment; Corn production; Oxalic acid