

Aluminium Dynamics in The Rhizosphere of Maize were Affected by Application of Phosphate Rock in Tropical Acid Soils

Firdaus^{1,2}, Henri Calba², Patrick Cazevielle², Benoît Jaillard³

¹Jurusan Pendidikan Matematika dan Ilmu Pengetahuan Alam,

Fakultas Keguruan dan Ilmu Pendidikan, Universitas Riau, Pekanbaru 28293

²AMIS Programme Agronomie, Centre de Coopération Internationale en Recherche Agronomique pour le Développement, 2477 Avenue du Val de Montferrand, 34032 Montpellier cedex 1, France

³UMR Sols, Symbioses et Environnement, Institut National de la Recherche Agronomique, Place Pierre Viala, 34060 Montpellier cedex 2, France

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ABSTRACT

Acid soils in the tropics are generally deficient in available P because of their low content in total P and large P fixing capacity. To alleviate this constraint, P fertilizers are usually applied, phosphate rock (PR) being a cheap alternative to soluble P fertilizers. The aim of this work is to study the effect of PR application on P and Ca availability for plants and on Al and H dynamics in the rhizosphere. The experimental device enabled to easily collect rhizosphere soil and roots. An Al-tolerant cultivar of maize (*Zea mays* L. cv ATP Yellow) was cultivated for 14 days on two soils differing in their P fixing capacity, mixed with 0, 0.2 and 2.0 mg g⁻¹ of Gafsa PR. The ability of maize to acidify its rhizosphere was affected by supplying the plants with different sources of N. The results showed that, without PR and whatever the N-source supplied, maize decreased rhizosphere pH and exchangeable Ca while it increased exchangeable Al. The three parameters were in close relation. The application of PR did not affect this general pattern. However, it buffered the induced pH decrease, slightly increased exchangeable Ca and thus decreased exchangeable Al. Otherwise, P and Ca concentrations increased in the soil solution, whilst Al concentration increased in the soil solution and in the roots. This increase of Al uptake by roots is discussed in terms of rhizosphere acidification by roots, dissolution of PR in the rhizosphere, and mobilization and phytotoxicity of Al, as estimated by Al/P ratio in rhizosphere soil solution. We conclude that the use of PR fertilizers could be optimized if account was taken of (i) soil buffering capacity for P, Ca and H on the one hand, and (ii) plant ability to modify rhizosphere pH on the other hand.

Keywords: acid soils, aluminium, Al toxicity, H⁺ release, H/Al/Ca dynamics, phosphate rock, rhizosphere, *Zea mays* L.