

ALUMINUM AVAILABILITY TO RICE IN ACID AND NON-ACID
SULFATE SOILS UNDER CONTROLLED PH AND REDOX POTENTIAL
CONDITIONS

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ABSTRACT

Aluminum availability to rice was investigated in laboratory macrocosms using soil suspensions of acid sulfate (Sulfic Tropaquept) and non-acid sulfate (Typic Tropaquept) soils. Some microcosms were incubated at selected controlled redox (500,250,50, and -150 mV). Others were incubated at various combinations of controlled pH (3.5,4.5, and 5.5 and redox > 500,250 and 50mV respectively). Seedlings of rice varieties tolerant (IR46) and sensitive (IR26) to acid sulfate soils were planted in these soils suspensions. Three weeks after transplanting, soil solution and plant tissue samples were processed and analysed. The activity of Al³⁺ and other metals was determined by the computer program (GEOCHEM).

Results revealed that Al³⁺ activity in the soil solution was the only Al parameter negatively associated with pH in both soil types and over all of the different conditions. Water-soluble Al and percent Al saturation of the CEC was negatively related to pH in both soil types under controlled pH and redox conditions.

Aluminum uptake in both rice varieties correlated best with Al³⁺ activity in soil solution rather than with water-soluble Al or percent Al saturation of the CEC in both soil types under controlled redox.

Under controlled pH and redox conditions, only Al uptake in the IR26 rice grown in acid sulfate soils significantly correlated with water-soluble Al and percent Al saturation of the CEC. No statistical correlation between Al uptake and soil Al parameters for IR46 was observed in acid and non-acid sulfate soils. Uptake of Mn negatively related to Al³⁺ activity for both varieties in all soil types under controlled pH and redox conditions.

Shoot and root weight were significantly decreased with an increase of Al³⁺ activity in soil solution for all plant and soil under controlled pH and redox. Generally, roots were more affected than shoots and the IR26 shoots were more affected than the IR46 shoots.

Results indicated that the two solid phase species, jurbanite (Al (SO₄)(OH).5H₂O) and amorphous Al(OH)₃, probably controlled Al solubility at low and high pH conditions respectively.