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Assessment of Ammonium ($\text{NH}_4\text{-N}$) Adsorption and Fixation as Affected by Different Soil Salinity and Sodicity Levels in two Types of Sudan Soils

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Abstract

This study was conducted to investigate the effect of different levels of salinity and sodicity on the adsorption and fixation of ammonium produced from waste ammonia in two soil types. The waste aqueous ammonia was obtained from Khartoum Refinery at El-Jaily, 50 km north of Khartoum city. The laboratory experiments were run in two soils Vertisols and Entisols. The rate of application was 80 kg N ha^{-1} . The aqueous ammonia was added to the soils at different levels of salinity: 40, 60 and 80 mmol l^{-1} and sodicity (SAR): 10, 15 and 25. The readings were taken every week for five weeks. The adsorbed ammonium was estimated using the potassium chloride method, and the fixed ammonium was determined using the mixture of hydrofluoric and hydrochloric acids.

The results showed that with an increasing salinity level from 40 to 80 mmol l^{-1} the mean adsorbed ammonium decreased from 331 to 263 mg kg^{-1} soil. An increase in SAR levels from 15 to 25 resulted in an increased adsorbed ammonium level of 256 to 324 mg kg^{-1} soil, respectively. The values of adsorbed ammonium were higher in Vertisol (up to 147 mg kg^{-1}) compared with Entisols (only 62.7 mg kg^{-1}). It can be concluded that aqueous ammonia produced from Khartoum Refinery, as a by-product of petroleum industry, can be used in saline soils as a cheap source of nitrogen fertiliser. As a potential side effect in such soils, high levels of salinity produce more soluble cations which will compete for the adsorption and fixation of ammonium ions into the exchange sites of clay, and this will increase vulnerability of N to be leached from such soils. Therefore, new policies and management strategies are needed for the efficient use of waste aqueous N fertilisers in such soils. Nevertheless, utilising aqueous ammonia as fertiliser in such manner will definitely decrease the hazards of disposing the ammonia onto the surrounding area near the refinery.

Keywords: Ammonium fixation, ammonium adsorption, salinity, sodicity