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Effect of Nitrogen Source, Soil Type and Depth of Application on Ammonia Volatilisation

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Abstract

A field experiment was conducted to study the effect of soil type and methods of fertilizer application on the ammonia volatilisation when three orders of Sudan soils (Aridisols, Vertisols and Entisols) were fertilised by three types of nitrogenous fertilisers; namely, aqueous ammonia, urea and ammonium sulphate, in Berber, Gezira and Shambat, respectively. These fertilisers were applied by three methods: superficial application with irrigation water and injection in depth of 5 cm and 15 cm at a rate of 200 kg N ha⁻¹. A closed system was prepared around the points of application to collect volatile ammonia gas on diluted sulfuric acid 0.25 N and ventilation was ensured by using a semi-permissible membrane called parafilm. Sulfuric acid was analysed using steam distillation apparatus, and then titrated with hydrochloric acid. The results indicated that the rate of ammonia loss by volatilisation in Aridisols was lower than on Vertisols and Entisols and this is attributed to the different climatic conditions. In Berber the experiment was carried out during winter when temperature is low, causing a decrease in volatilisation, while in Gezira and Shambat the experiment was carried out in summer, and high rate of ammonia loss by volatilisation was observed in Entisols. This may be ascribed to the high silt content in this soil. The results demonstrated that surface application of nitrogen fertilisers increased loss of ammonia by volatilisation more than in the injection method since the fertilisers applied on the soil surface are more exposed and this increases volatilisation. In Vertisols and Entisols, the rate of ammonia volatilisation decreased gradually from the first week to the fourth week. But in Aridisols, increased rate of volatilisation occurred in the fourth week due to negative impact of cold season on the microbial growth which limits the hydrolysis of ammonium carbonate resulting in delaying of volatilisation process. In Vertisols and Entisols, high rates of ammonia volatilisation were noticed in aqueous ammonia more than in urea and ammonium sulphate due to the fast hydrolysis of aqueous ammonia compared with other types of fertilisers, while in Aridisols, the ammonia volatilisation recorded inconsistent values which attributed to cold weather.

Keywords: Ammonia, fertilisers, soil, volatilisation