

**Technical Session I :**  
**Potassium in Soils**

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# Dynamics of K in Soils and Their Role in Management of K Nutrition

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## Introduction

The role of K in soils is prodigious. Of the many plant nutrient-soil mineral relationships, those involving K are of major if not prime significance (Sparks and Huang, 1985). Since the middle of the 17th century, when J.R. Glauber in The Netherlands first proposed that saltpeter ( $\text{KNO}_3$ ) was the principle of vegetation, K has been recognized as being beneficial to plant growth (Russell, 1961). Glauber obtained large increases in plant growth from addition of saltpeter to the soil that was derived from the leaching of coral soils. The essentiality of K to plant growth has been known since the work of von Liebig published in 1840 (Sparks, 2000).

Of the major nutrient elements, K is usually the most abundant in soils (Reitemeier, 1951). Igneous rocks of the Earth's crust have higher K contents than sedimentary rocks. Of the igneous rocks, granites and syenites contain 46 to 54, basalts 7, and peridotites 2.0 g K  $\text{kg}^{-1}$ . Among the sedimentary rocks, clayey shales contain 30, whereas limestones have an average of only 6 g  $\text{kg}^{-1}$  (Malavolta, 1985). Mineral soils generally range between 0.04 and 3% K. Total K contents in soils range between 3000 and 100,000  $\text{kg ha}^{-1}$  in the upper 0.2 m of the soil profile. Of this total K content, 98% is bound in the mineral form, whereas 2% is in soil solution and exchangeable phases (Schroeder, 1979; Bertsch and Thomas, 1985).

Potassium, among mineral cations required by plants, is the largest in nonhydrated size ( $r = 0.133 \text{ nm}$ ) and the number of oxygen atoms surrounding it in mineral structures is high (8 or 12), which suggests that the strength of each K-O bond is relatively weak (Sparks and Huang, 1985). Potassium has a polarizability equal to  $0.088 \text{ nm}^3$ , which is higher than for  $\text{Ca}^{2+}$ ,  $\text{Li}^+$ ,  $\text{Mg}^{2+}$ , and  $\text{Na}^+$  but lower than for  $\text{Ba}^{2+}$ ,  $\text{Cs}^+$ ,  $\text{NH}_4^+$ , and  $\text{Rb}^+$  ions (Rich, 1968, 1972; Sparks and Huang, 1985). Ions with higher polarizability are preferred in ion