CHEMISTRY AND AVAILABILITY OF POTASSIUM SILICATES IN SOILS

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Abstract

The effect of anions on potassium (K) mobility, retention, and rate of K reactions in three variable charge Delaware Coastal Plain soils was investigated. The soils studied in both the greenhouse and the laboratory were a Rumford loamy sand (coarse-loamy, siliceous, thermic Typic Hapludults), a Matapeake silt loam (fine-silty, mixed, mesic Typic Hapludults), and a Kenansville loamy sand (loamy, siliceous, thermic Arenic Hapludults). In the greenhouse, undrained and drained pot studies were conducted using K rates of 0, 50, 100, and 300 kg ha^{-1} as K-silicates and KCl. Wheat (Triticum aestivum L.) was grown over a six-week period and levels of K in the plant and in the soil were analyzed to determine K uptake by the plant and K mobility in the soil as affected by K source. Overall, K source did not significantly affect K concentration in the plant tissue or total K uptake by the plant. A few instances of significant differences between sources in total K uptake were related to plant dry weight yield. However, extractable K levels of the soils were generally higher when silicate rather than chloride was the K source. In the laboratory, the effect of anions on rate and magnitude of K adsorption was investigated at pH 5 and 6 using a stirred-flow kinetic technique. The anions studied were perchlorate, chloride, sulfate, phosphate, and silicate. The type of anion present did not affect the rate of K adsorption but had a pronounced effect on the amount of K adsorbed. In general, the amount of K adsorbed with a particular accompanying anion was of the order silicate > phosphate > sulfate > chloride > perchlorate. These studies demonstrate the role of anions in cation retention and mobility, and specifically on Coastal Plain soils, anion type has an effect on K adsorption and retention.