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# Potassium quantity-intensity relationships of a hydrosequence of soils from the Cerrado region of Brazil

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## Abstract

This study was conducted to compare the Q/I curves obtained in highly weathered soils with 10 m*M* $CaCl_2$ and or 2 m*M* $AlCl_3$ solutions. We chose a hydrosequence of soils from the Cerrado (Savanna) region of the central plateau of Brazil. The Q/I relationships were constructed by plotting K against AR (activity ratio), and then determining $A_0R$ (activity ratio at equilibrium), $BP_0$ (buffer power at equilibrium) and $BP_{100\text{-}150}$ (buffer power in the $100 \times 10^{-3}$ and $150 \times 10^{-3}$). To compare soils, however, the $BP_{100\text{-}150}$ values were used instead of LBP (linear buffer power), because some Q/I curves did not have a well-defined linear part. Due to the acidic nature of these soils, in order to produce better results, it is suitable to utilize aluminum instead of calcium as reference cation for the measure of $A_0R$, $BP_0$ and $BP_{100\text{-}150}$. Positive correlations between $A_0R$ and the initial exchangeable potassium percentage ($EPP_0$), and between $BP_{100\text{-}150}$ and the CEC of the soils were found.

## Introduction

The objective of this study was to apply the Q/I approach in order to evaluate the status of K in 12 samples representative of a typical hydrosequence of soils from the Cerrado region in the Federal District, central plateau of Brazil, using calcium and or aluminum as reference cations.

## Materials and methods

Detailed description of soil classification and chemical properties of the samples used in this study have been described elsewhere (de Mesquita Filho and Torrent, 1993). The Q/I curves were obtained as follows: 4 g of each of the soil samples was added to 30-mL portions of each of 0, 0.3, 0.5, 1.0, 3.0, 6.0, 10.0, and 20.0 m*M* KCl in 10 m*M* $CaCl_2$ and or 2 m*M* $AlCl_3$. Suspensions in three replicates were shaken for 60 min at 25°C and centrifuged, and then the supernatant was analyzed for K by atomic absorption spectrophotometry. The AR was determined for each equilibrated suspension. The change in K quantity ($\Delta K$) of the soil in each suspension was calculated from the difference between the initial and final K concentration in both solutions.

## Results and discussion

The Q/I plots have the common shape described by Beckett (1964). For this reason we decided to show the Q/I plot of only one representative soil (Fig. 1). Positive correlations between $A_0R$ and $EPP_0$, and between $BPP_0$ and CEC were found for all soils, when aluminum was used as the reference cation $A_0R = - 0.005 + 0.042\ EPP0$ ($r^2 = 78.7$), and $BP_{100\text{-}150} = - 0.29 + 0.096$ CEC ($r^2 = 54.2$). Similar results were obtained by Goedert et al. (1975), working with acid soils fom the South of Brazil. These authors stated that when $CaCl_2$ was used as the equilibration solution, some of the calcium displaced exchangeable aluminum from the acid soils, which

*Table 1.* Quantity-intensity (Q/I) parameters of soil samples from a hydrosequence in Cerrado soils using $CaCl_2$ and or $AlCl_3$ extractants

| Sample | $CaCl_2$ | | | $AlCl_3$ | | |
|---|---|---|---|---|---|---|
| | $BP_{100\text{-}150}$ | $BP_0$ | $A_0R \times 10^{-3}$ | $BP_{100\text{-}150}$ | $BP_0$ | $A_0R \times 10^{-3}$ |
| | cmolc.kg$^{-1}$ | | | cmolc.kg$^{-1}$ | | |
| 1 | 0.62 | 7.25 | 5.90 | 1.04 | 6.54 | 4.98 |
| 2 | 0.60 | 8.57 | 3.25 | 1.04 | 8.98 | 0.98 |
| 3 | 0.34 | 0.81 | 29.00 | 0.78 | 2.35 | 17.00 |
| 4 | 0.56 | 0.88 | 20.00 | 1.60 | 9.50 | 10.00 |
| 5 | 0.28 | 1.16 | 24.00 | 1.38 | 2.20 | 35.00 |
| 6 | 0.18 | 3.73 | 3.60 | 1.24 | 4.80 | 3.40 |
| 7 | 0.60 | 1.46 | 30.00 | 3.20 | 6.54 | 14.00 |
| 8 | 0.34 | 3.68 | 3.72 | 1.12 | 6.20 | 2.80 |
| 9 | 0.34 | 5.20 | 2.40 | 0.64 | 10.80 | 2.00 |
| 10 | 0.48 | 8.00 | 2.10 | 1.04 | 6.47 | 2.55 |
| 11 | 0.15 | 1.85 | 8.30 | 0.16 | 2.78 | 5.12 |
| 12 | 0.10 | 1.43 | 12.30 | 0.19 | 2.08 | 8.05 |

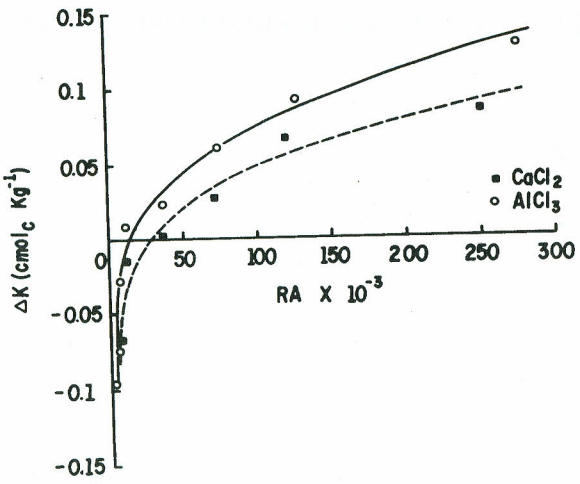


*Fig. 1.* Potassium quantity-intensity curve for a Dark-Red Latosol, Acrustox (depth 0-20 cm).

resulted in an undesirable displacement of the Q/I curves. In our study, we concluded that the 10 m*M* $CaCl_2$ curves do not reflect adequately the equilibrium between $EPP_0$ and the K in the solution. Because of the dominant qualities of $Al^{3+}$, it is convenient to select this cation instead of $Ca^{2+}$ as referent in the Q/I curves.

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