Theme 1 | Mainstreaming soil data: innovations in analysis, standardization, harmonization and communication

Influence of pH and calcium to estimate the cation exchange capacity of soils in the northern and western zones of Honduras

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INTRODUCTION

Chemical characterization of agricultural soil is necessary to predict soil fertility potential, as well as to develop a plan for improving fertilization. An indicator of soil fertility and chemical quality is the Cation Exchange Capacity (CEC) of the soil, which is an indicator of the soil's ability to absorb and provide cations. Cations found on the soil surface are easily exchangeable in solution, being a reversible process by which solid soil particles absorb cations from the aqueous phase, while releasing other cations in equivalent quantities.The CEC depends on the pH, the percentage of organic matter, the type of clay in the soil and the concentration of the predominant cations in solution (Mattila *et al.*, 2022) . The CEC is determined from the adsorbed amount of an index cation and by saturating a solution containing said cation through a soil sample. This work aims to estimate the influence of Calcium and pH of soils in the northern and western areas of Honduras on the direct method and the summation exchangeable bases method to determine the CEC of soil

METHODOLOGY

The research was conducted at the Agricultural Chemical Laboratory of the Honduran Foundation for Agricultural Research (FHIA), located in the municipality of La Lima, Department of Cortés, Honduras CA, 65 soil samples were selected from those existing in the laboratory warehouse, coming from producers in the north and west of Honduras (Fig. 1). Samples were selected and taken from 0 to 0.2 m depth, dried at room temperature and under shade, macerated, and passed through a 2 mm sieve

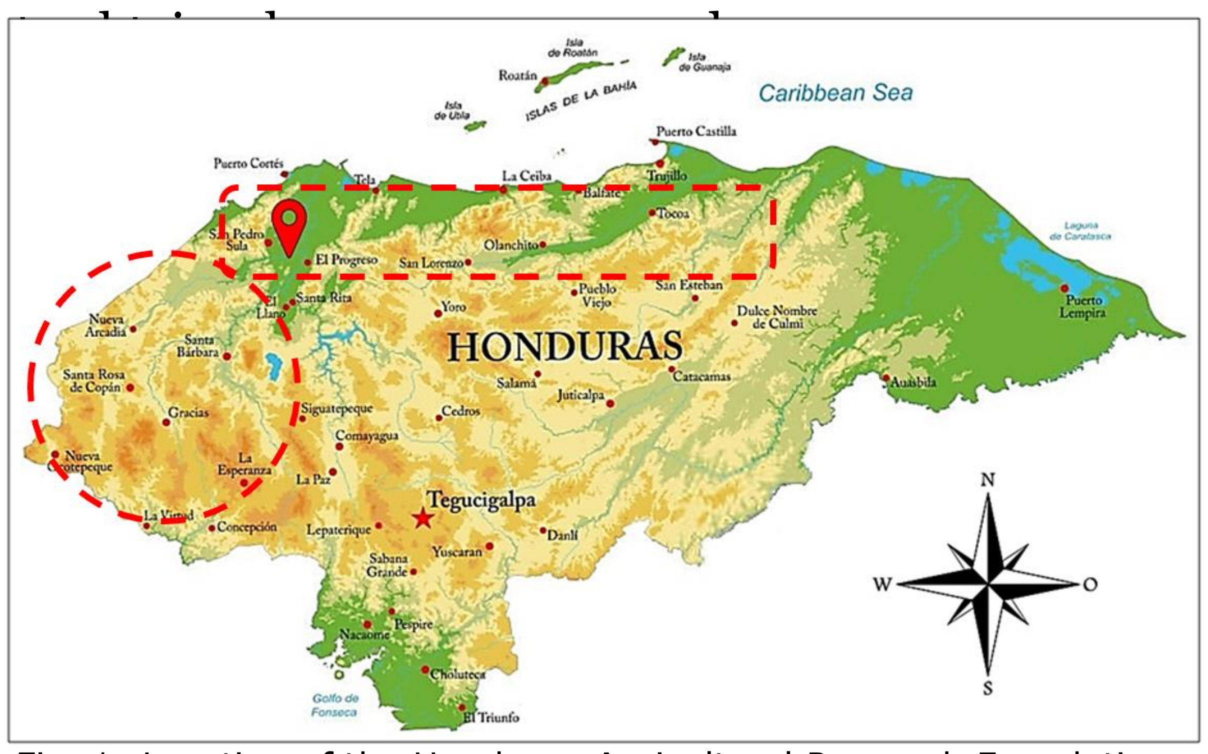

Fig. 1: Location of the Honduran Agricultural Research Foundation (FHIA) and areas where soil samples were collected.

The pH analyses were performed in water at a ratio of 1:2.5, the exchangeable bases (Ca^{2+}, Mg^{2+}, K^{+} and Na^{+}) were determined by atomic absorption (Fig. 2), they were extracted with 1N ammonium acetate at pH 7.00 and the exchangeable acidity (H^{+} and Al^{3+}) was determined by the 1N KCl method by titration, the exchangeable bases were added to find the Effective Cation Exchange Capacity of the soil (ECEC). Subsequently, the Cation Exchange Capacity (CEC) was determined by the direct method of soil washing and ammonium distillation (Fig. 2) The data were subjected to multiple correlation and regression analysis.

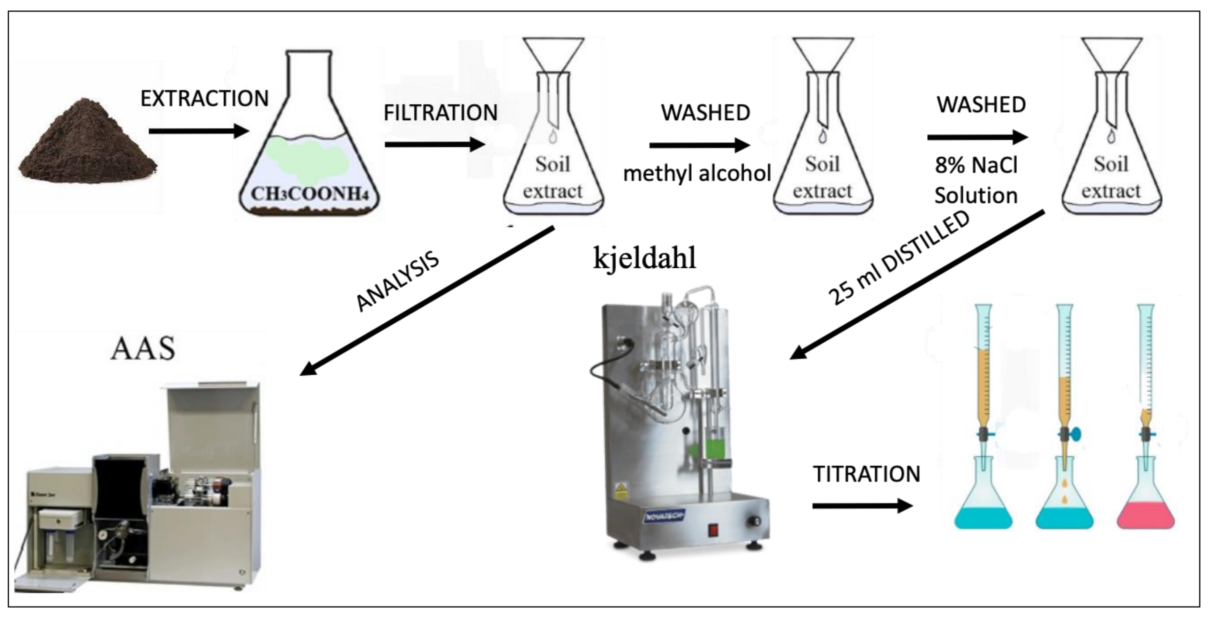

Fig. 2: Schematic of the analytical process for determining the exchangeable bases in atomic absorption and for determining the exchange capacity by micro Kjeldahl distillation.

RESULTS

The analysis between pH and Ca *versus* the summation method (Fig. 3) presented a multiple correlation of r = 0.97, indicating that the exchange capacity by summation of bases can be estimated using pH and Ca with the prediction equation $Y = -0.49 + 1.09 X_1 + 0.76 X_2$. The pH and Ca *versus* the direct method (Fig. 4) presented a multiple correlation of r= 0.85, with which we can predict the exchange capacity of a soil using the pH and Ca data in the equation $Y = 3.99 + 0.91 X_1 + 0.49 X_2$.

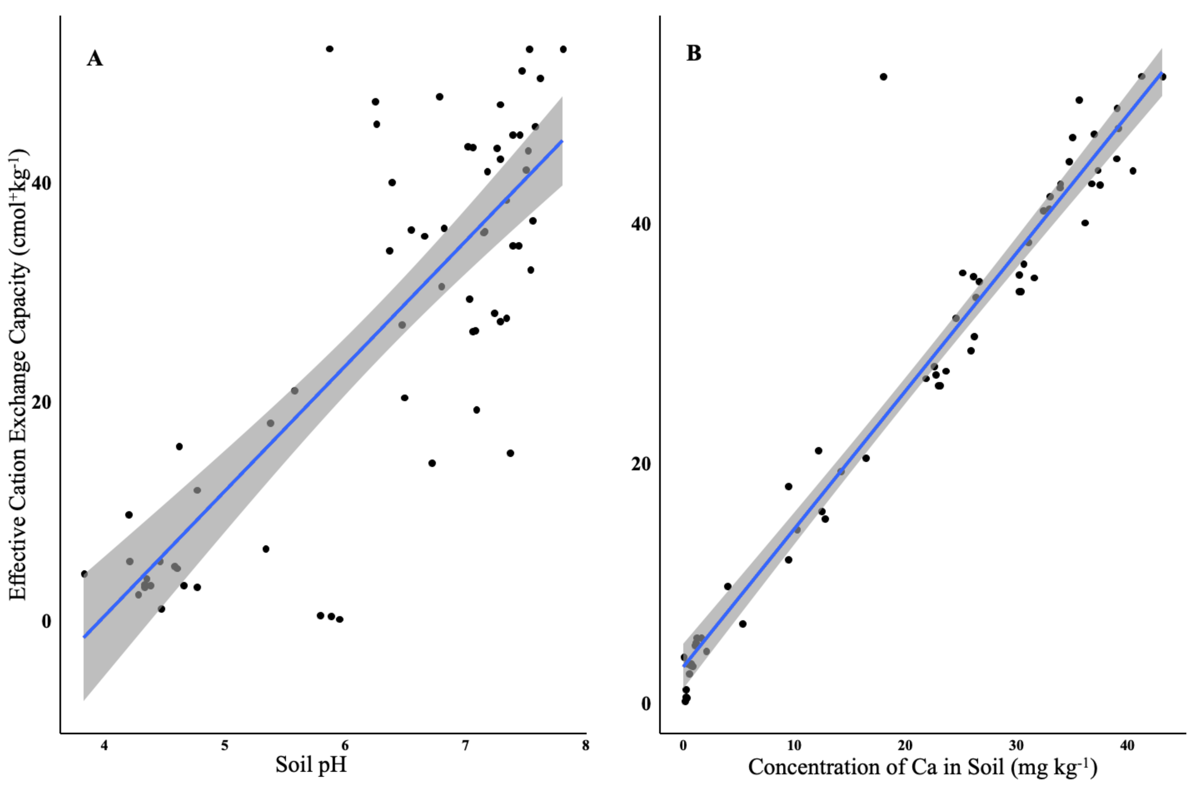

Fig. 3: Scatter plot and prediction line between pH (A), calcium concentration (B) *versus* the effective cation exchange capacity of the soil.

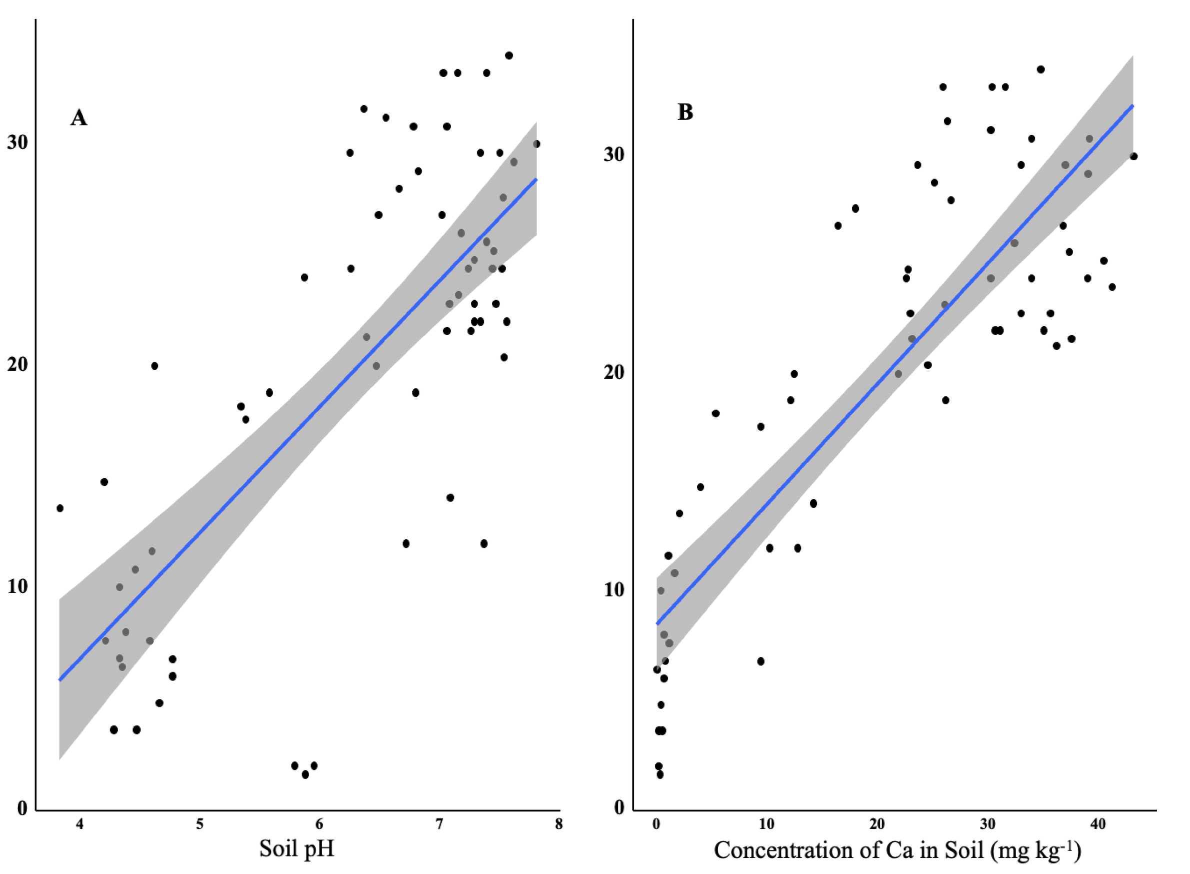

Fig. 4: Scatter plot and prediction line between pH (A), calcium concentration (B) *versus* soil cation exchange capacity.

Similar results are mentioned by Ross and Skyllberg, (2023) that it is possible to predict the exchange capacity of a soil if the values of the pH and calcium concentration of a soil are known.

CONCLUSIONS

With the data obtained, it is concluded that both methods are statistically predictable using the pH and Calcium data of soils from the north and west of Honduras.

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