Theme 3

Impacts of soil nutrient management on the environment and climate change

Available Cd mitigation through elevation of soil base saturation using lime and gypsum

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INTRODUCTION

The presence heavy metals (HM´s) in soil has a direct relationship to their presence in food, raising the awareness to several governments and institutions globally. Due to HM´s capacity to be easily absorbed by plants and translocated into the tissues. Soil pollution is related to human activities as mining, industry, and agriculture. Highly contaminated soils are not likely usable for agricultural activities. In this context the objectives of this research was to evaluate the mitigation of Cd by using $CaCO_3$ and $CaSO_4$, which are products that growers can obtain easily in the local market and elevating the soil base saturation, which promotes a better soil nutrition state.

MATERIALS AND METHODS

Soil sampling

It was studied a Lixisol collected from 3°53'54"S 38°26'34" W, Ceará, Brazil with sandy-loam texture, pH=5.22, organic matter = 4.5 g/kg, Ca and Mg ≤1.5 $cmol_c$/kg and low metal concentrations (except Fe). Soil base saturation (V%) of 62.29% and cation exchange capacity (CEC) of 2.48 $cmol_c$/kg.

Experimental design

A completely randomized design (CRD) was established with a unique dose of Cd (30 mg/kg) via solution from $CdCl_2.H_2O$ in bags containing 1 kg of soil previously air-dried and sieved (2 mm) sealed until analysis 30 days later. Three levels of soil base saturation (control, 80% and 100%), 4 conditioners being them lime 100% (L), 2 limestone/gypsum mixtures (75 + 25% and 50 + 50% respectively) and gypsum 100% (G) in a 3X4 factorial arrangement with 3 replications, totaling 36 experimental units. Samples were analyzed according to EMBRAPA (2009, 2017).

RESULTS

Soil pH

- Treatments utilising correctives to elevate soil base saturation to 100% elevated pH levels to 6.64 (100% Lime) and 6.46 (75+25%).
- Gypsum did not produce any significant differences ($p>0.05$) in soil pH levels.

Available Cd

- Treatments containing 100% Lime produced reductions of 46.9 % in Cd availability, 75+25% ratio produced a reduction of 46.23%.
- Treatments with lower CaCO3 proportions and 100% Gypsum did not present significant differences even when soil base saturation was elevated to 100%.

Fig. 1: Soil sampling from grass use land (**Eusébio**)

Fig. 2: Soil incubating process with Cd (**Fortaleza**)

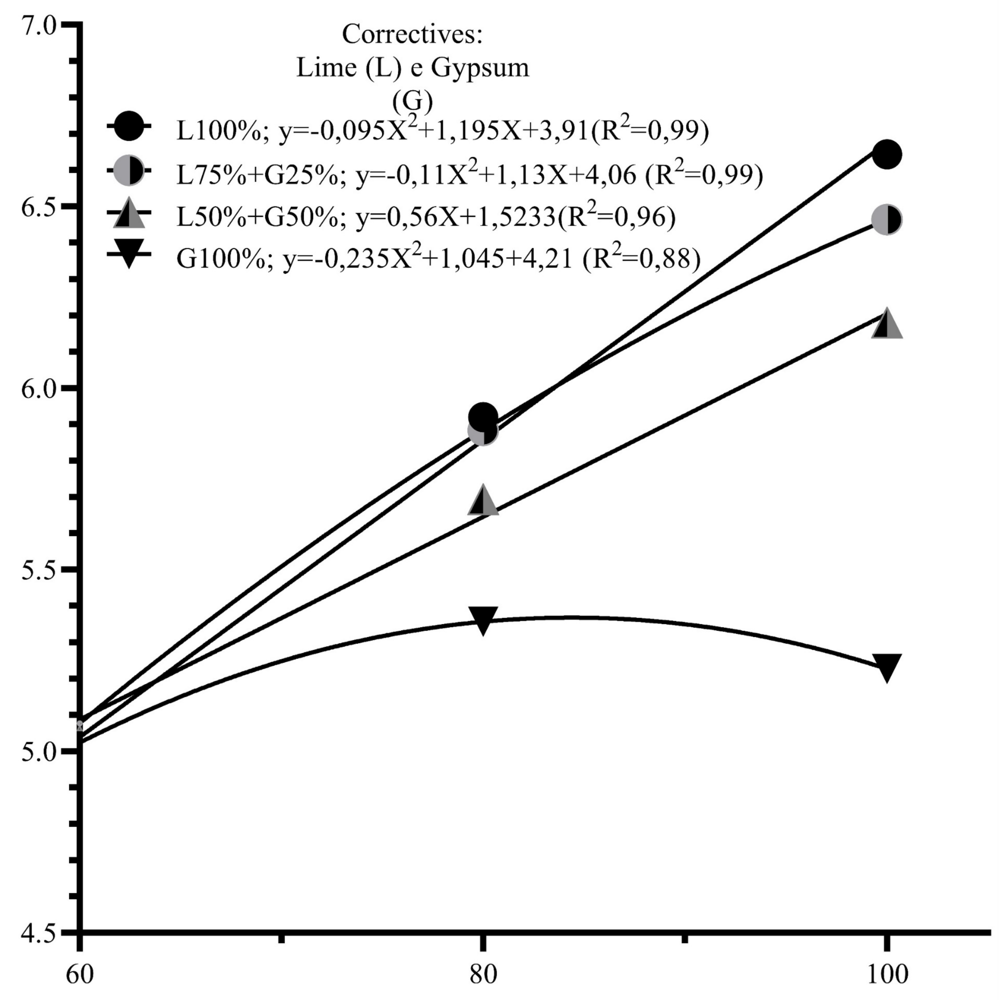

Fig. 3: Linear regression analysis for Soil pH mean values after 30 days of incubation with 30 mg Cd/kg.

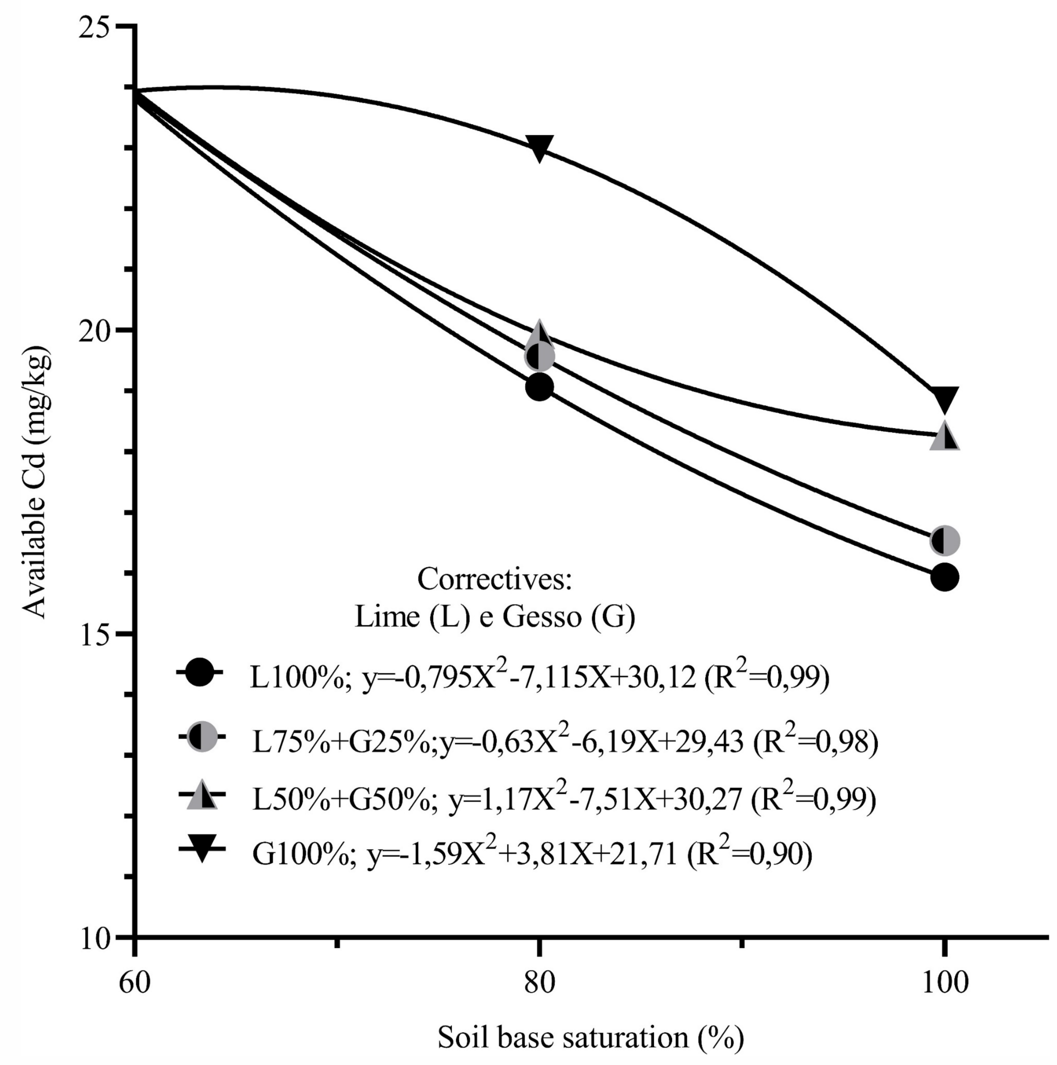

Fig. 3: Linear regression analysis for available Cd mean values after 30 days of incubation with 30 mg Cd/kg.

CONCLUSIONS

- Lime mitigates available Cd in greater proportions than gypsum because of its effects on soil pH and elevations in soil base saturation.
- Gypsum has less influence on soil pH and affects Cd availability related to H+ and Al3+ substitution by Ca2+.

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