Silicon Status of Louisiana Soils Grown to Different Field Crops

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INTRODUCTION

- Louisiana is one of the few states in the nation where rice and sugarcane (both Si accumulating crops) are produced; little is known about the Si status of the different agricultural soils of the state.
- The application of Si-rich material increases plant biomass production, cell wall strength, disease resistance and lodging resistance.
- The information generated in this survey will be used for the adsorption study of soil Si and facilitate soil selection for a series of greenhouse experiments for calibration and categorization of plant available Si of agricultural soils of Louisiana.

OBJECTIVES

- Survey the extractable Si in the agricultural soils of different parishes of Louisiana.
- Relate and categorize soil Si levels based on soil textural class, soil pH, Mehlich-3 extractable P and cropping systems.

MATERIALS AND METHODS

- More than 10 samples were collected from each of the agrarian parishes along the banks of the Mississippi, Arkansas and Red Rivers, and areas in the Gulf Coast Prairies and Marsh (Figure 1).
- Soil pH, extractable P, K, Ca, Mg, S, Cu and Zn, and soil Si extracted using seven extractants (Table 1) were determined in each of these samples.
- Statistical Analysis: Regression analysis on total acetic acid extractable Si as effected by different soil properties.

Table 1. Extraction procedures for quantification of soil silicon.

Extractants	Soil, g	Solution, ml	Procedures
0.5 M Acetic Acid	1	10	1hr
0.01M Calcium Chloride	1	10	1hr
1M Sodium Acetate	1	10	1hr
Deionized water	1	10	1hr
0.5M NH_4 Acetate	1	10	1hr
0.1M Citric Acid	0.5	25	2hr; 24hrs rest; 1hr
0.5 M Acetic Acid	1	10	24hrs rest; 2hr

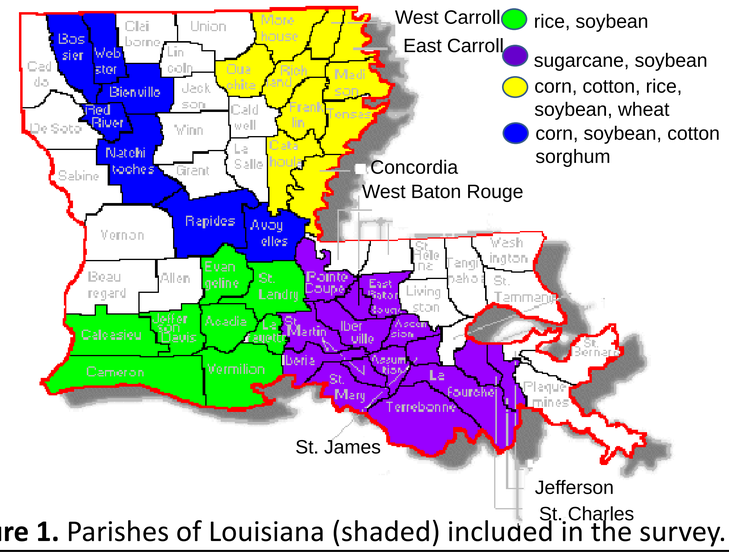

Figure 1. Parishes of Louisiana (shaded) included in the survey.

RESULTS AND HIGHLIGHTS

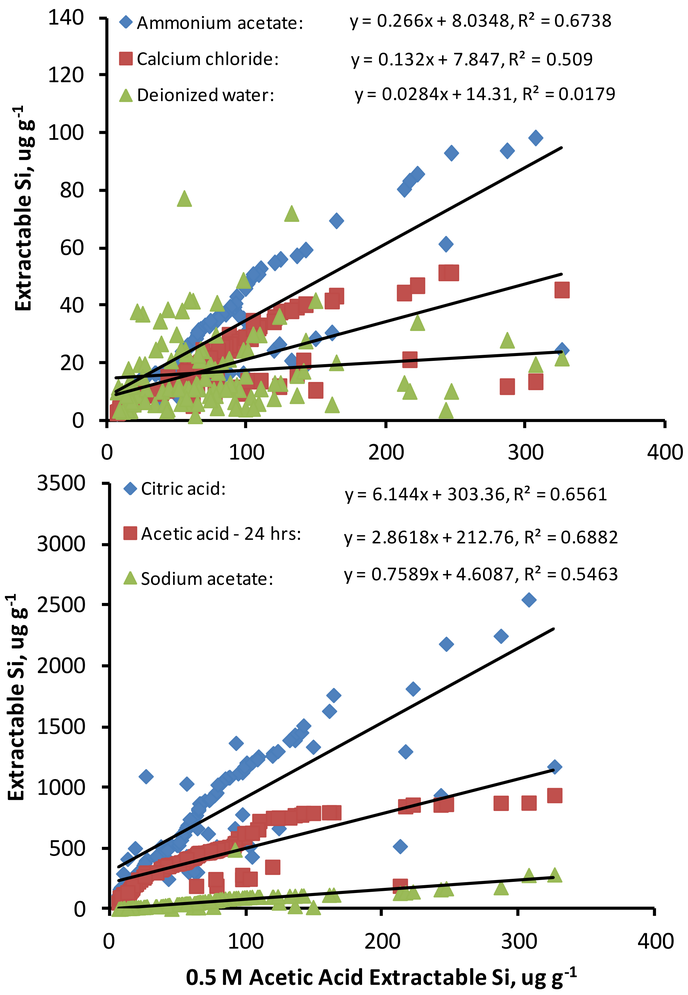

Figure 2. Relationship of 0.5 M Acetic acid (reference procedure) extractable silicon with soil silicon extracted using different procedures.

Figure 3. Average acetic acid extractable silicon of soils grouped according to textural classes.

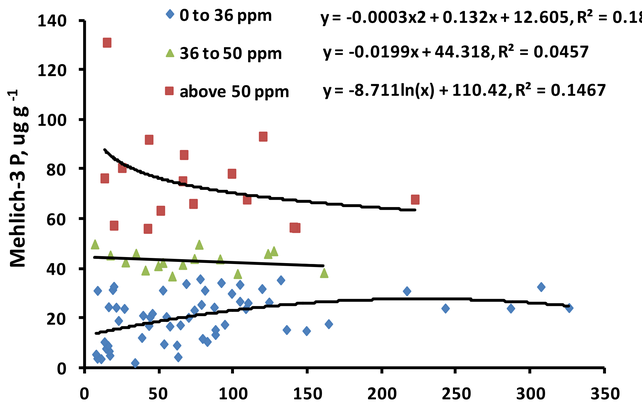

Figure 4. Acetic acid extractable silicon values grouped according to Mehlich -3 P.

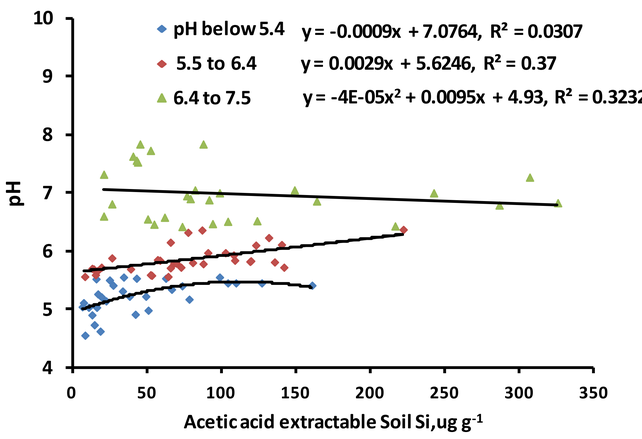

Figure 5. Acetic acid extractable silicon values grouped according to soil pH.

The amount of extractable Si obtained from the use of different extraction procedures was in the order citric acid > acetic acid (24 hrs shaking > 1 hr shaking) > sodium acetate > NH_4OAc > calcium chloride> deionized water. Except with deionized water, the amounts of soil Si extracted all of the procedures were generally in good agreement (r^2>0.51; Fig. 2). Categorization of soil Si levels was attempted based on soil textural class (Fig. 3), Mehlich-3 P (Fig. 4) and soil pH (Fig. 5). There was no clear cut trend between soil Si level and Mehlich-3 P nor with soil pH. However it is important to note that the maximum extractable Si values being recorded were from soils with pH ranging from 6.4 to 7.5. Soil with coarser texture had the lowest average acetic acid extractable Si while the highest was obtained for silty clay soils with an average extractable Si of 150 ug g^{-1} (Fig. 3).

Overall, the Si content in the soils that we collected so far ranged between 3 to 300 ug g^{-1}. It is interesting to note that a good number of these soils had values below 10 ug g^{-1}. Soils collected from select parishes are alluvial soils and generally characterized as fertile soils. The relatively low Si values of these soils can be attributed to: 1) severe and frequent soil erosion and sediment transportation in these areas owing to high rainfall and coarse texture of soil, and 2) continuous cropping system and cultivation of Si accumulating crops like rice which take in considerable amounts of Si. The nature of parent materials in these areas could also explain the low Si levels in these soils. As such, areas where these soils were collected from can potentially benefit from Si fertilization.

ACKNOWLEDGEMENTS

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