Developing a Calibrated P Fertilizer Recommendation for EAA Sugarcane: Assessment of 7 Soil-P Extraction Methods and their Correlation to Sugarcane Yields Under Variable P Inputs

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Introduction

Soil test calibration requires field research that correlates soil-test P levels to observed crop yield responses in the absence and presence of P fertilizer inputs. A calibrated soil test includes an appropriate P fertilizer recommendation to supplement deficiencies in natural soil-P supply. A majority of sugarcane growers include routine soil testing as part of their nutrient management program.

The University of Florida Everglades Soil Testing Laboratory (ESTL) uses water (Pw) and acetic acid (Pa) extractions for sugarcane P soil-tests. The Pw is used to make fertilizer recommendations, but growing evidence indicates the Pw is inappropriate for high-biomass multi-season agronomic crops like sugarcane. Meanwhile, the Pa is not calibrated, and private labs deliver conflicting fertilizer recommendations to growers using still different extraction chemistries.

Uncertainties surrounding sugarcane nutrition management in south Florida need to be addressed. The primary objective of this research is to minimize these uncertainties by comparing the utility of different soil-P extraction procedures in relation to sugar production in order to refine the calibrated P soil-test for EAA sugarcane.

Summary of Work Completed

Soil and leaf samples were collected from new tests that had been established in fall 2004. Some soil extractions have been done on the soil samples but we are waiting on performing leaf analyses until our recently purchased ICP spectrometer is connected and calibrated so that all samples can be analyzed with the same instrumentation. Statistical analysis of the field data from the first year of the new tests has been completed.

Specific activities include:

Laboratory Analyses: 7/1/2005 through 6/30/2006
  Soil test P extractions: 2136
  Soil pH determinations: 240
  Sugar (Brix/Pol) determinations: 156
Soil sampling: 696 samples
Leaf tissue sampling: 276 samples
Sugarcane harvests: 156 plots with 40 stalk weights
Sugarcane stalk counts: 276 plots in August 2005

Discussion

Two small-plot studies were established in fall 2004 to investigate the effects of P fertilizer rate (0, 9.2, 18.4, 36.6, 73.4, and 146.7 kg P/ha) and placement (band and broadcast) on sugar production. Control plot 0.5 N acetic acid-extractable soil P after plant cane harvest was 25 and 28 mg P/dm$^3$ for the Okeelanta and EREC sites, respectively. At the Okeelanta site there were increases in stalk population in the first year of the study with increases in P fertilizer rate, but there were no significant differences in sugar production/ha between P rates. At the EREC site there were no responses to P fertilizer application. Fertilizer placement was not a factor in sugar production in the first year at either location. First year results for these tests were presented at the Soil and Crop Science Society of Florida Meetings in June 2006.

Previous P fertilizer studies are being reviewed in an effort to assimilate all available data into the best soil test calibration possible. Work by Andreis and McCray (1998), Glaz et al. (2000), and Korndorfer et al. (1995) indicate that the primary sugarcane production response occurs at acetic acid-extractable P values less than 20 mg P/dm$^3$. This evaluation was done by converting all data to the same units (mg P/dm$^3$) and by estimating acetic P values from Bray 2 P values reported by Andreis and McCray (1998). Previous work has also indicated that responses in sugar production/ha at low initial soil test levels were not found to fertilizer levels greater than 36 kg P/ha (Andreis and McCray, 1998; J. M. McCray, unpublished data).

Out of 13 crop years for locations P1 through P6 in studies conducted by Ron Rice and Yigang Luo, there have been 2 crop years with small responses of sugar/ha to P fertilizer application. These locations have all had initial acetic acid-extractable P values greater than 20 mg P/dm$^3$. These data need to be evaluated for level of economic response and combined with previous work in evaluation of extractants and response levels.

It appears that there are two primary questions remaining to be answered regarding soil-test P calibration for sugarcane on organic soils. First, the extractant best related to crop P availability and sugar production response needs to be selected. Second, the soil-test P value at which no P fertilizer is required for a 3 year period for optimum sugar production needs to be determined. The current P fertilizer tests in addition to results from previous tests will be used to answer these questions and to compare with previous publications.
2006/2007 Scope of Work

Data from sites P1-P6 are being evaluated to determine if continued rate studies are needed at any of these locations. The new tests at Okeelanta and EREC are each in the first ratoon crop and P fertilizer applications have been made for the second year.

As part of the effort to upgrade the EREC Soils Research Laboratory we have ordered a new digestion hood and 2 new digestion blocks. These should be installed soon and this will greatly expand our ability to analyze leaf tissue. A new inductively coupled argon plasma spectrometer has been purchased with other funds and should allow us to better handle leaf analyses in our own laboratory.

Good progress is being made in our effort to improve the P soil-test for sugarcane on organic soils. I have included a budget request for year 3 of our study. We thank FDACS for supporting sugarcane P research and BMP development initiatives.

Sincerely,

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