Trend of Soil and Leaf Potassium Content of Sugarcane: Impact of Soil Type, Fertilizer Source and Application Timing.

Samuel Kwakye, Joseph Garrett, Marilyn Sebial Dalen, Daniel Forestieri, Wooiklee Paye, Flavia Agostinho, Maryam Shahrtash, Brenda Tubana
School of Plant, Environmental and Soil Sciences, Louisiana State University, Baton Rouge, LA. *Contact*: skwakye@lsu.edu

INTRODUCTION

- The availability of right levels of plant essential nutrients in soil is one of the requirements to maximize crop productivity.
- Sugarcane (*Saccharum officinarum*) demand for potassium (K) is larger compared to other field crops.
- Potassium is an activator of large number of enzymes required in photosynthesis, protein synthesis, starch formation and translocation.
- Muriate of potash (MOP) is the main source of K in Louisiana sugarcane production system; it is soluble and could lead to K losses during heavy rainfall in coarse-textured soil.
- A possible route of improving nutrient use efficiency in sugarcane is the use of a controlled release fertilizer (CRF).

OBJECTIVE

To document the changes in soil and leaf K at different critical growth stages of sugarcane grown on a light and heavy-textured soil.

MATERIALS AND METHODS

- This study was established in 2015 at two sites at the LSU AgCenter Sugar Research Station in St. Gabriel, LA. Treatments included combinations of nitrogen (N) and K sources applied at different time (March and April) using straight fertilizer source and CRF arranged in randomized complete block design on the first site (Sharkey clay) and complete randomize design on the second site (Commerce silt loam) soil with four replications. Cane variety L 01-299 was planted in September 2015 (Photo 1a).
- For this study, data were collected from selected plots only: control, and those treated with 90 Kg K ha^{-1} as MOP (60% K) and 45 Kg K ha^{-1} as MOP + 45 Kg K ha^{-1} as a controlled release polymer coated K (Agrocote KCl®, 51%) for both application timing, March and April (Photos 1b, 1c).

Photo 1a

Photo 1b

Photo 1c

MATERIALS AND METHODS

- Sixteen cores soil samples were collected every two weeks (following March application) from each plot at two depths (0 -15 and 15 - 30 cm), oven dried at 60° C for three days, processed and analyzed for K based on Mehlich-3 extraction procedure followed by ICP spectrophotometry (Photo 2a).
- Four weeks later (following March application), 18 leaf samples were collected from each plot every 2 weeks (Photo 2b), oven dried, processed, and digested using HNO_3-H_2O_2 followed by ICP analysis for K content determination.
- Soil and leaf K content were averaged across replicates and graph against sampling times using Excel software. The standard error was also computed for each treatment or data point.

Photo 2a

Photo 2b

RESULTS AND HIGHLIGHTS

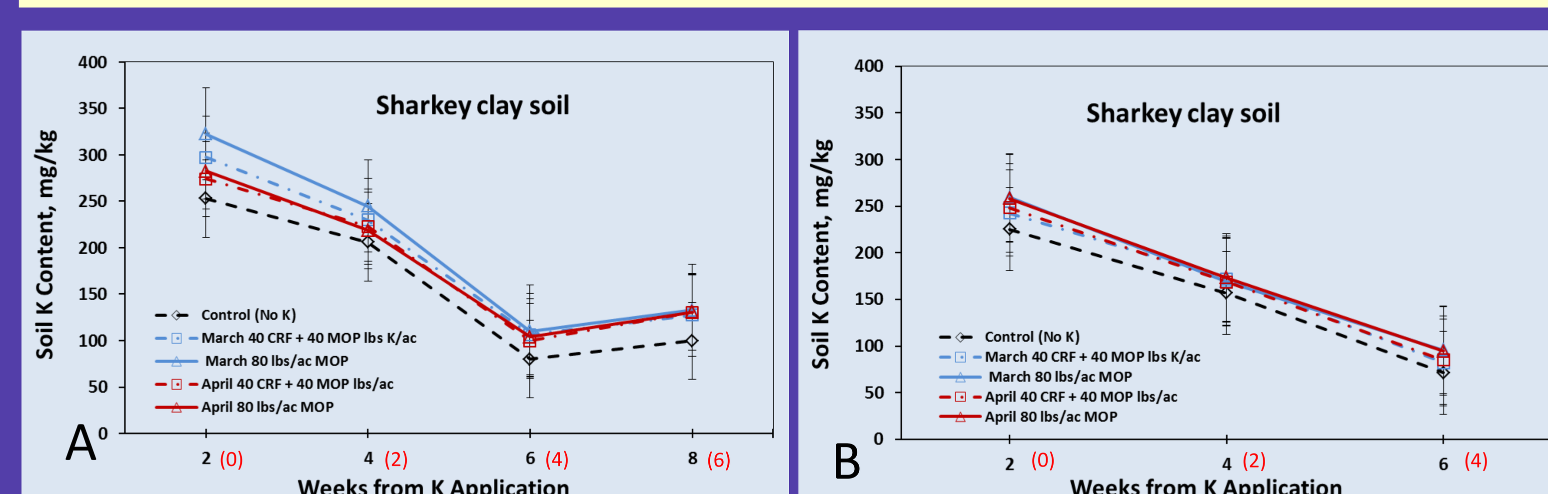

Figure 1. Potassium content of Sharkey clay soil treated with 90 kg K ha^{-1} from two sources (CRF+MOP, MOP only) in March at 0-15 cm (A) and 15-30 cm (B) depth in St. Gabriel, LA. Values in red font on the x-axis are number of weeks from K application done in April.

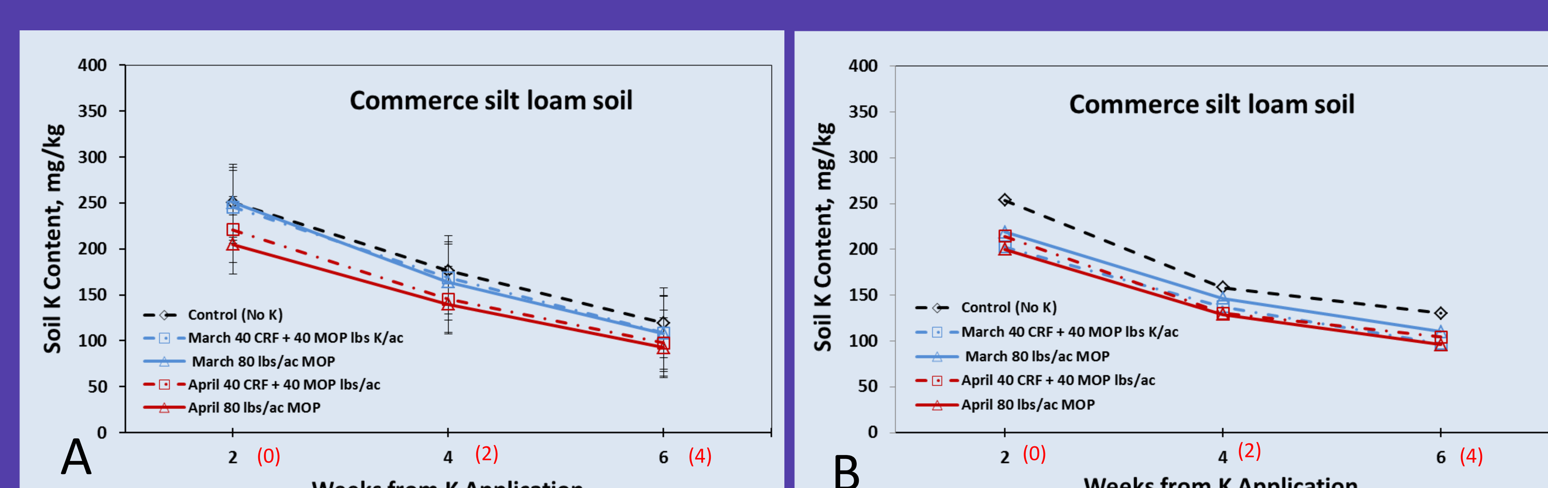

Figure 2. Potassium content of Commerce silt soil treated with 90 kg K/ha from two sources (CRF+MOP, MOP only) in March at 0-15 cm (A) and 15-30 cm (B) depth in St. Gabriel, LA. Values in red font on the x-axis are number of weeks from K application done in April.

RESULTS AND HIGHLIGHTS

- The amount of K extracted from soil decreased with time across treatments including the control for both Sharkey clay and Commerce silt loam soil (Figures 1-2).
- The effect of K source was observable on the Sharkey clay soil for both depths; soil K extracted was consistently higher than the control. However for the Commerce silt loam, control plot had higher level of K extracted from the soil than plots treated with K (both sources) (Figures 2A and 2B).

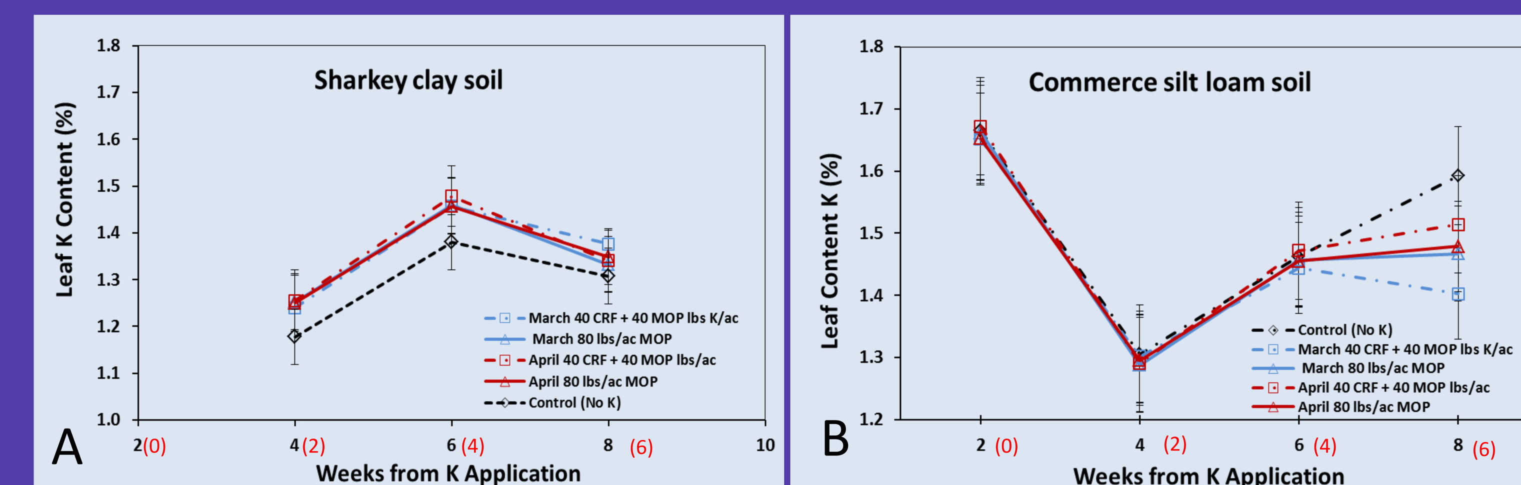

Figure 3. Leaf K content of sugarcane on Sharkey clay (A) and Commerce silt loam soil (B) treated with MOP and CRF in March and from 2 to 10 weeks after K application in St. Gabriel, LA. Values in red font on the x-axis are number of weeks from K application done in April.

- Leaf K content was higher in control plot across sampling time in Sharkey clay soil. For Commerce silt loam, leaf K content was similar until 6 weeks after K fertilization in March. The higher separation of leaf K at 8 weeks after K application may be due dilution effect brought about by the commencement of active growth and biomass accumulation (Figures 3A and 3B).
- Based on soil and leaf K content, the application of K regardless of source had impacted Sharkey clay soil more than the Commerce silt loam soil.

SUMMARY

- The effect of source was not evident on both leaf K and soil K content for both Sharkey clay and Commerce silt loam.
- The soil and leaf K from the control plot was consistently lower than K-treated plots for Sharkey clay indicating a possible positive response of cane to K fertilization. This was not evident in Commerce silt loam.
- Sampling at later growth stage may provide a better overview of K source effect of K status on both soil and sugarcane.

Acknowledgement: Everris and American Sugar Cane League for funding support.