How does clay move and accumulate in sand root zones?

December, 2016

Glen R. Obear and William C. Kreuser, Ph.D.

- A column study was initiated in October 2016 and will be completed in mid-2017. The objectives of the study are to determine how water chemistry and construction practices influence clay movement in two-tiered sand putting greens.
- Preliminary baseline data are currently being collected, and leaching of the columns will begin in early 2017.
- The results from this study will improve our understanding of how soil and water chemistry interact to influence performance of engineered turf soils.

In 2014, we documented thin layers of clay that had formed in 9-year old putting greens in a Mississippi golf course (paper available here: Catena- Clay Lamellae Paper). This observation led us to study how clay moves and accumulates in two-tiered sand putting greens. We constructed columns to the recommendations of the USGA (2004), and amended them to contain 0, 1, 3, or 5% clay by weight. These ranges were selected to be above and below the recommended cutoff of <3% clay-sized particles for new putting green construction. Columns will be leached with either 0.1 or 1 pore volume of water for a series of repeated leaching events. The entire study will be replicated using two different water sources (CaCl-based or NaCl-based) to study how water chemistry influences clay movement.

After each leaching event, x-ray fluorescence (XRF) is being used to measure the clay content (using Fe as a tracer) inside columns in 2.5 cm depth increments. To take these measurements, we constructed an autosampler stand to position the columns for automated XRF analysis (see this video for more details: https://www.youtube.com/watch?v=iJzYzuITz44). The stand allows for scanning while columns are rotating, producing an extremely accurate way to measure average clay content at different depth increments inside columns (Fig. 1). This stand, which took over 10 months to construct, is the first of its kind and offers a new way to study soil formation. This provides an exciting opportunity for engineered turf soils and the USGA to revolutionize the way we study all soils of the world.

In addition to XRF measurements, air permeability will be measured to document changes in pore space resulting from clay movement. The columns will be photographed regularly to visually document clay accumulation, and at the end of the study, the columns will be split vertically and dissected to measure clay concentrations in 2.5 cm depth increments to further validate XRF clay measurements. A subset of columns with accumulations of clay will be analyzed using a micro-CT x-ray scanner, which produces 3-D models of soils and allows for calculation of pore space in 50 µm depth increments. Leachate will be collected from each column throughout the study period, and a mass balance of clay will be produced to document how clay responded to leaching treatments.

The results of this research could help aid future construction recommendations for putting greens. The findings will also improve our understanding of how soil and water chemistry interact to influence performance of engineered turf soils.

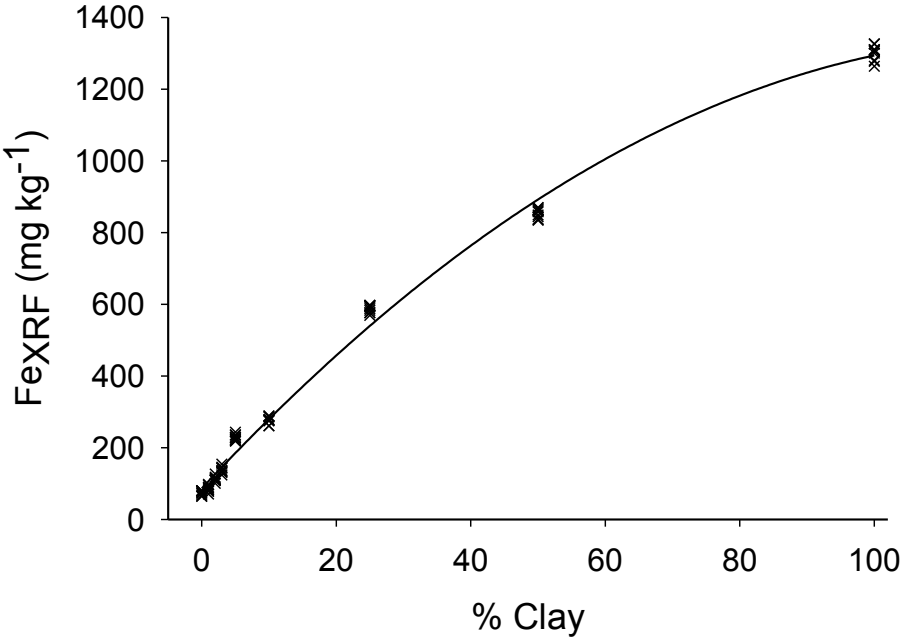

Figure 1. Calibration of an automated XRF stand with soil standards of known clay concentration. Iron is used as a tracer for clay. Each sampling cluster on the graph above actually contains data points from 10 separate scans. This robust method will allow us to track clay movement very accurately.