Evaluating the contribution of soil organic carbon to improved water-holding capacity through increased compaction resistance

Summary of BIOAG Project Progress

Our project seeks to determine how soil organic matter may indirectly impact plant available water through its potential to affect compaction resistance and recovery. This project relies on a long-term research site that has replicated treatments consisting of three application rates for biosolids, a conventionally fertilized control, and an unfertilized control, which have led to significant differences in soil organic matter content. On April 27th, 2020, a water truck was used to simulate a 0.27 inch rainfall event over approximately 2.5 hours with a distribution uniformity of 70% in two strips across all plots. This was followed by three passes with an 8-wheeled John Deere 9300 tractor approximately one hour later in one of the two strips (randomly chosen). Intact soil cores were taken in triplicate from the compacted and uncompacted strips in each replicate of the 0, 2, and 4.5 dry t acre^{-1} treatments. A preliminary analysis of air-dry bulk density was done on all cores (figure below), and they are currently being used for measurement of lab saturated hydraulic conductivity (a proxy for infiltration) and the development of full soil moisture release curves. Preliminary data suggests that while in-field compaction efforts were successful (a significant difference in air-dry bulk density between compacted and uncompacted soils) and treatments amended with biosolids has a significantly lower bulk density, our hypothesis that soils with higher organic matter would be more resistant to compaction was not supported (no significant interaction between biosolids treatments and compaction treatments). Nevertheless, it will be interesting to determine whether soil organic matter content as a result of biosolids amendment may influence changes in pore geometry and connectivity with compaction, and thus saturated hydraulic conductivity and plant available water, even if those changes aren't reflected in air-dry bulk density.