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Optimizing Soil Grinding to Measure Soil Manganese Content

There are many environmental factors that contribute to plant growth; including climate and resource availability. The project I am assisting with measures resource availability, specifically manganese availability in soil and its uptake by the plant. Varying levels of this resource can have many different effects such as chlorosis of the leaves, plant mortality, and increased decomposition of leaf litter. Red maple saplings were planted in different soil types and grown in a greenhouse in order to measure manganese uptake into the tree leaves. My objective for this project was to analyze soil samples from the different treatments, containing either manganese dissolved in water, manganese oxides, manganese in pyrite-containing shale, or a control group with sand and peat. My role in this project is to grind the samples with a SPEX 8000M mixer/mill, press them into pellets, and analyze them using an X-Ray Fluorescence (XRF) spectrometer to measure soil chemistry, including the total Mn concentration. Before chemical analysis, the soil needed to be ground for an unknown amount of time pass through a 75-µm sieve. I hypothesized that 15 minutes should be sufficient, but upon experimenting on quartz sand, the ash-like remains after being ground proved to be too big to fit through the sieve. I then tested grinding times spanning from 5 minutes to 30 minutes to determine the optimal length of time needed to grind the soil. I discovered grinding for less than 20 minutes resulted in too coarse of soil to fit through the sieve, while grinding for more created too fine of a powder that easily became airborne. An optimal grinding mass of $\mp$15g needed a grind time of no more or less than 20 minutes. The next step after soil grinding will be pressing the ground soil into pellets and completing chemical analysis with the XRF. I will determine how much Mn is in each of the different soils, to investigate how much this key element affects the growth of plants.