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Fast and Reproducible Aggregate Water-Resistance Index Determination Using Laser Diffraction

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Soil aggregate stability is a measure of the resistance of soil aggregates to degradation and breakdown. It is a major factor influencing the soil health and fertility. The aggregates stability also affects soil erosion rates and water retention. Several factors can influence the stability of soil aggregates, including the type and amount of soil organic matter, the presence of soil biota, and the type and intensity of land management practices. Soil management practices that promote the incorporation of organic matter, such as cover cropping and reduced tillage, can increase soil aggregate stability. The aggregate stability is commonly measured using a variety of techniques, such as the water drop penetration test, in which the penetration of a water droplet is used to assess the strength of soil aggregates, and the wetting and drying method, in which the stability of soil aggregates is measured after they have been subjected to alternating wetting and drying cycles. A common method for measuring soil aggregate stability is the wet sieving method. Within this contribution we present a newly developed procedure based on the equation of Kemper & Rosenau that utilizes laser diffraction to estimate the aggregate water resistance index (AWRI). In developing this new method, emphasis was placed on comparability with the standard sieving procedure carried out with the Eijkelkamp wet sieving apparatus. The water resistance of the soil aggregates was tested for five different soil types (Haplic Luvisol, Chernozem, Regosol, Fluvisol, and Cambisol) sampled in the Czech Republic. The AWRI value determined by the laser diffraction procedure is based on an average particle size of the disturbed aggregates recorded for each fictitious sieve size. The results from a limited number of soil samples show promising agreement between the standard wet sieving and the laser diffractometer procedures. The main advantage of the method is the much faster processing of many samples and their replicates with less variability in the results. However, further measurements are needed to validate the procedure.

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