

THE USE OF NEAR-INFRARED SPECTROSCOPY FOR SOIL ANALYSIS

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Near-infrared spectroscopy (NIRS) is a rapid, non-destructive analytical technique based on absorption of light in the region 780 to 2500 nm primarily by organic substances. It is widely used for the determination of organic composition and functional properties in feed, foods and other commodities. Although near-infrared (NIR) spectroscopy has been used in the research laboratory for the compositional analysis of soil for about three decades, its importance to day-to-day agriculture and land use is just emerging.

The absorption of NIR light by soil has been used in three approaches to the analysis of soil. The first uses remote sensing instrumentation in the laboratory and in the air and predates the development in the 1970's of the first laboratory, bench-top NIR instruments. Only the surface properties of soil are amenable to remote sensing because absorbance from the uppermost 50 µm of the soil is recorded. The second approach focuses on using laboratory NIR instruments to provide rapid, cost-effective alternatives for a number of laborious and time-consuming conventional soil laboratory analyses. This activity dates from the 1980's, continues today, and has almost entirely been performed on the dried, ground samples used for most conventional chemical analysis. The success and limitations of this NIR approach for the analysis of moisture, organic matter, C, N, P, pH, conductivity, cation exchange capacity, salts, other nutrients, heavy metals and physical properties will be discussed. The third approach, just emerging, is termed landscape analysis of soil. Here the focus is increasingly on the analysis of field-moist, "as is" soil either in the laboratory or on-site enabled by the development of field-portable NIR instruments. Here there is potential for NIRS to be used as a unique tool for monitoring carbon sequestration in soil and mapping soil quality and functional properties.