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Simultaneous Proximal Sensing of Soil EC and Organic Matter: Implications for Digital Soil Mapping, Modeling, and Management

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Proximal soil sensing using geophysical tools such as soil electrical conductivity (EC) are being used to aid soil mapping in a variety of agricultural applications. One of the characteristics of soil EC mapping technology is its integration of multiple soil properties. Soil EC is highly responsive to dissolved solids in the pore water, clay content, and other factors. While soil EC maps precisely delineate the location of soil changes, the cause of the change is not clearly evident directly from the data. The inclusion of a soil sensor that identifies changes in a second soil property, such as organic matter (OM), may be helpful not only in mapping that property, but also may suggest additional information about the nature of the soil EC measurement. As an example, high EC soils can be related to increased clay content and/or salinity. With the availability of OM and EC datasets, areas with low organic matter and high EC could be investigated for salinity, while high EC and high OM would not be expected to have as much salinity. Proximal near-infrared (NIR) spectroscopy sensors have been developed for OM and carbon mapping; however the cost and complexity of these typically exceed the needs of commercial agriculture. Single wavelength proximal sensors for OM were prototyped nearly twenty years ago, but none of these was ever fully commercialized. Veris Technologies has developed and commercialized the OpticMapper, a two-wavelength optical module that measures soil reflectance in the visible and NIR ranges. It operates under the soil surface with its depth controlled by adjacent disks and gauging wheels in order to produce a consistent soil scene. Used in conjunction with proximal EC sensors, the OpticMapper produces maps that provide additional details compared to government soil surveys and EC maps. Results from multi-field studies show the OpticMapper readings correlate well with laboratory-measured OM. Identifying OM variability and gaining a better understanding of soil EC maps can augment several applications of digital soil mapping, including selecting representative sites for model calibration, and improved site-specific management of crop inputs.