Trends in agricultural geophysics

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A rover equipped with a cosmic-ray neutron sensing system for soil moisture mapping, represe

A rover equipped with a cosmic-ray neutron sensing system for soil moisture mapping, representing one of several geophysical tools applied in agriculture. Photo courtesy of Trenton E. Franz, University of Nebraska-Lincoln.

Understanding soil patterns and processes enhances agricultural productivity and sustainability. Geophysical tools gather soil data quickly and non-invasively, which drives interest in their agricultural applications (agrogeophysics). The numerous geophysical tools and agronomic variables of interest make it difficult to summarize the progress and adoption of agrogeophysics technology. In such a complex and expansive field of study, researchers and practitioners need to better understand which tools are being used, where they are most effective, and what challenges and opportunities exist for broader application.

Researchers at the University of Nebraska-Lincoln summarized the trends in agrogeophysics within peer-reviewed literature, patents, and land-grant university extension literature. The analysis tracked publication trends over time, identified the

most prominent geophysical tools, and synthesized major themes related to challenges and opportunities.

Electrical conductivity–based measurements and visible and near–infrared spectroscopy (Vis–NIR) were the most prevalent methods, as extensive evidence exists for their reliable soil management zone delineation and soil property prediction. The review identified five focus areas for future research: environmental covariates, scale, usability, profitability, and soil organic carbon stock accounting. Together, these findings highlight where geophysical tools already provide value and where strategic effort could increase their integration into agricultural management.

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Becker, S. M., Franz, T. E., Ge, Y., Luck, J. D., & Heeren, D. M. (2025). Geophysical tools for agricultural management: Trends, challenges, and opportunities. *Vadose Zone Journal*, 24, e70029. https://doi.org/10.1002/vzj2.70029

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