# Determining the potential of predicting soil nutrient concentration using hyperspectral imaging

Terence Seldon Kwafo[1] and Justin M McGrath[1,2]

[1]Department of Plant Biology, University of Illinois
[2]Global Change and Photosynthesis Research Unit, USDA-ARS

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**Abstract**

Proper concentrations of several nutrients, such as iron (Fe), zinc (Zn) and potassium (K) in the soil are needed for plant growth. Thus, farmers sometimes test soils to determine fertiliser application rates. However, measuring soil and plant nutrient concentrations is relatively time-consuming and expensive. Therefore, usually, only a few samples are collected and analysed. This limits the scale of research but also poses some limitations on farming practices, as farmers cannot sample fields at high density in order to customize application rates. Cheap, fast, and high spatial resolution methods to measure soil nutrient concentrations would alleviate some of these limitations. This work aimed to determine the potential of hyperspectral imaging (HI) to predict the concentration of some soil nutrients. Soil samples were scanned by visible and near-infrared imaging systems with a total wavelength range of 450-1700 nm. Fe, Zn, and K were analyzed. Partial least-square regression models (PLSR) were used to correlate the relative reflectance of total Fe, Zn and K in the soil samples. The PLSR models could highly predict Fe concentration ($R^2$ 0.81, RMSE% 16.6) and performed moderately well for Zn ($R^2$ 0.30, RMSE% 0.9) and K ($R^2$ 0.47, RMSE% 5.58) concentrations. The overall results indicated that the hyperspectral technique coupled with PLSR could be an accurate and reliable method for determining soil nutrient concentrations.

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# Determining the potential of predicting soil nutrient concentration using hyperspectral imaging

***Terence Seldon Kwafo*[1]**, *Justin M. McGrath*[1,2]

[1]*Department of Plant Biology, University of Illinois, Champaign, USA*

[2]*Global Change and Photosynthesis Research Unit, USDA-ARS, Champaign, USA*

**ORCiD:** [https://orcid.org/0000-0002-9384-9980]

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