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| **Title:** | Assessment of Leaf Phosphorus for Multiple Crop Species using an Electrical Impedance Spectroscopy Sensor | | | |
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| **Abstract:** |  |
| Phosphorus is an essential nutrient and plays a critical role in energy reactions in the plant. Deficits of the phosphorus nutrient can influence essentially all energy requiring processes in plant metabolism. Phosphorus stress early in the growing season can restrict crop growth, which can carry through to reduce final crop yield. In this work, the leaf phosphorus levels for multiple crop species like canola, wheat, soybeans, and corn are assessed using an electrical impedance spectroscopy (EIS) sensor in vegetative growth stage. A non-destructive, in-situ, and less complex impedance measurement method is used which is cheaper than other available spectrophotometry, spectral imaging, and optical sensor technologies. EIS sensor is used to develop a binary and multiclass classifier for the assessment of leaf phosphorus based on different machine learning algorithms like K-Nearest Neighbor (KNN), Support Vector Machine (SVM), and Bagged Trees. An average accuracy of more than 82% of the models is obtained. A maximum accuracy of 95.4% for Canola and 94.8% for soybeans is obtained using EIS as a binary and multiclass classifier. The precise measurements using a low-cost EIS sensor with high accuracy performed well in the diagnosis of phosphorus deficiencies in multiple crops. | |