

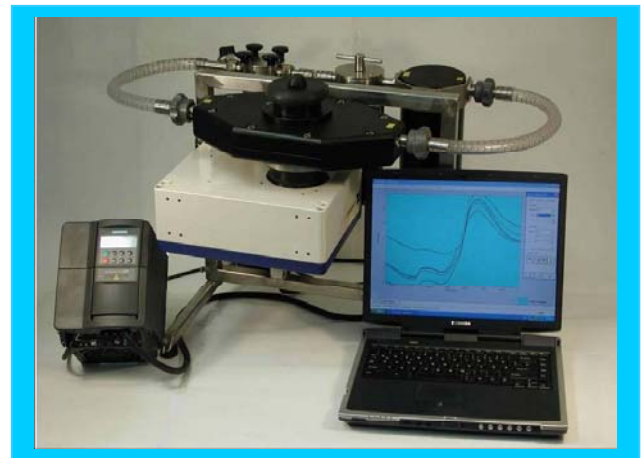
Real-Time Hog Manure Nutrient Sensor: Proof of Concept

Summary Hog manure is highly variable in composition when pumped from a raw manure store onto agricultural land. To assist in management of the valuable nutrients and to allow a dollar value to be placed on manure, real-time, continuous measurement of composition during land application is desirable. A prototype consisting of a near-infrared spectrometer and a sample cell through which hog manure flowed demonstrated that inorganic and organic nitrogen and phosphorus can be accurately measured in-stream in real time.

Near-infrared spectroscopy is a rapid, non-destructive technology used globally for determining organic constituents in commodities, environmental samples, and medical applications. The technology requires the prior development of calibrations. These are mathematical models between spectra from a representative set of samples and physical or chemical analytical results on the same samples. These models are loaded into the instrument's computer. Multiple constituents are predicted on future samples instantly as the samples are scanned.

Hog manure was sampled from 11 representative hog operations in Manitoba during application to land. Samples were analyzed by chemical methods for moisture and total solids content, ammonium-nitrogen, particulate (organic) nitrogen, phosphate-phosphorus, and particulate (organic) phosphorus.

In composition, the 128 samples contained 89.6 to 99.6 % water, 5.2 to 40.4 lbs/1000 US gal ammonium-nitrogen, 6.2 to 58.6 lbs/1000 US gal total nitrogen, and 0.14

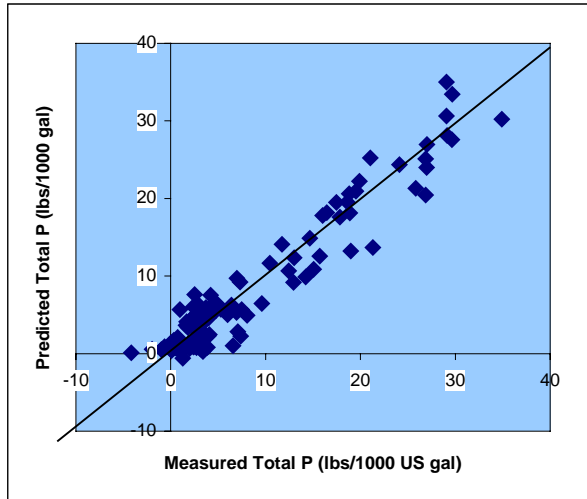


The flow-through cell (top center) fits on a Zeiss Corona NIR 45 High Resolution spectrometer (white instrument) operated with CORA software on the notebook computer. The closed system circulates 1 litre of manure (pump is to the right of the cell). Spectra are recorded from a sample over 7 seconds.

to 34.5 lbs/1000 US gal total phosphorus. Nitrogen:phosphorus (molar basis) ranged from 3 to 175.

Calibrations were successful for moisture, total solids, both forms of nitrogen and phosphorus. The predicted values from the calibration models agreed 88 to 93 % with the

chemical analytical results on the same samples. The figure below shows the performance of the calibration for total phosphorus



Predicted total phosphorus agrees 93 % with the chemically-measure values

In conclusion, the concept of analyzing hog manure in real-time by near-infrared spectroscopy as it flows across the sensor head of the spectrometer has been proven successful.

References

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Authors

Dr. Diane Malley¹, Dr. Phil Williams¹,
Dr. Helga Andree², Michail Dolud², and
Michael Rode³

¹PDK Projects, Inc., Winnipeg MB and
Nanaimo B.C. Canada

²University of Kiel, Germany

³Carl Zeiss Jena GmbH, Jena, Germany



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PDK Projects, Inc. is incorporated in Manitoba and registered in B.C.

Business Office: 5072 Vista View Crescent, Nanaimo B.C. Canada

Tel: 250-751-8890 Fax: 250-751-8225

Laboratory: #2 – 12 McGillivray Place, Winnipeg MB R3T 1N4

Email: dmalley@pdkprojects.com

www.pdkprojects.com