

Chemometric Modeling for Biomass Determination

Application

NIR spectroscopy is a perfect tool for the non-destructive determination of biomass. After creation of an applicable calibration model, the measurements can be performed directly in the field.

One main advantage of non-destructive measurements is the possibility of monitoring selected parameters (e.g. biomass, protein, N-nutritional status etc.) during all phases of growth.

The Spectrometer System

The **tec5** AgroSpec system is an IP-65 protected system for mobile use, based on **tec5** standard components. Key components are fast, compact and robust diode array spectrometer modules from Carl Zeiss. These modules are maintenance-free, top-quality optical components with no moving parts.

AgroSpec offers the possibility to connect a variety of measuring heads and probes to the basic measurement system by means of optical fibers and standard SMA connectors.

The software is especially designed for the demands of outdoor measurements and displays the raw data of sample- and reference channel measurements as well as calculated reflection spectra. All data can be automatically saved in predefined time intervals.

The **tec5** HandySpec Field, a portable spectrometer system, is perfectly suited for precise data acquisition in laboratory, green house and in the fields. Measurements are either initiated by one single push of a button or automatically in predefined intervals.

tec5 spectrometer systems have been used for years now - in well-known agricultural research institutes as well as in the already legendary Yara N-Sensor. Because of their high performance they become more and more wide-spread in this demanding area.



Fig. 1: tec5 AgroSpec



Fig. 2: In-situ measurements of maize



- Spectrometer Systems
- Instrument Design and Development
- OEM Electronic Components

Creation of Chemometrical Calibration Model

The first step to create a calibration model is to measure the spectra of many different samples. In a second step the used samples are analyzed in the laboratory to determine the parameters of interest, like certain concentrations. Spectra as well as the parameter results are imported into a chemometrical software (e.g. SL Calibration Workshop, Unscrambler, Grams etc.), which creates a so-called calibration model representing the correlation of spectral behavior and chemometric parameters. This model can now be imported into the **tec5** spectrometer software MultiSpec Pro where it allows to determine the wished parameters directly from any recorded spectrum.

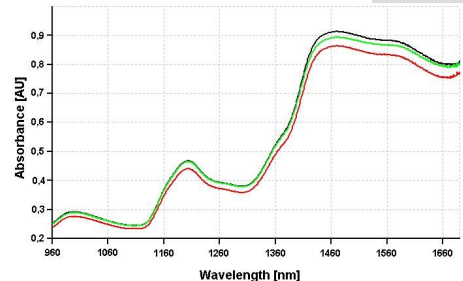


Fig.3: Absorption spectra of winter wheat

The created model can continuously be improved by importing further data sets - for example from different locations or stadiums of growth.

The shown sample calibration was created on base of silo-maize spectra (chaffed plants on a band-conveyor) The PLS model shows a good correlation of 0.96. The biomass could be predicted with a standard deviation of approx. $\pm 1\%$ TM, which is typical for biomass calibrations.

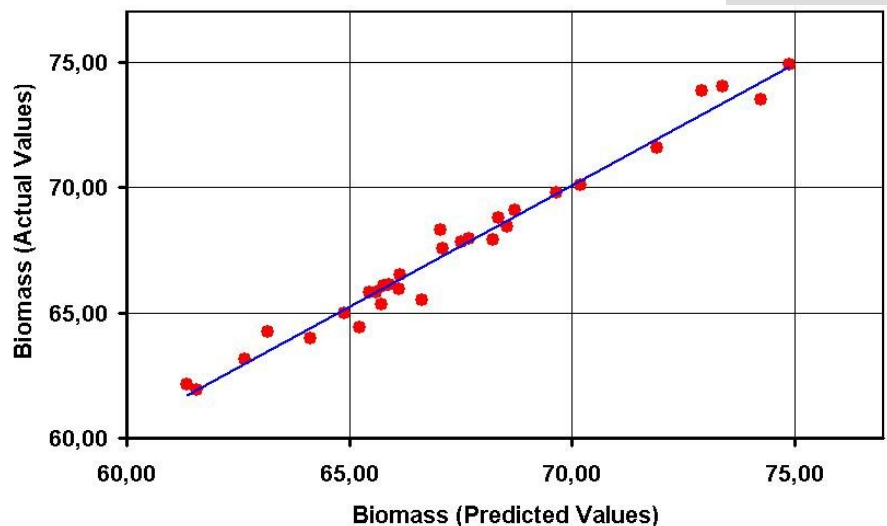


Fig.4: Predicted biomass versus actual biomass

Your Partner for Spectrometer Systems

Since 1993 **tec5** has specialized in the development of fiber-optic spectrometer systems based on modern detector array technology and acquired a wide horizon of experience with numerous applications.

In agriculture, the company is well known as partner of Yara GmbH & Co.KG, Dülmen, for the development and production of the Yara N-Sensor, the tractor based system for site-specific N-fertilization.



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Technology for Spectroscopy