

Chemometric modeling exemplified for biomass determination



Fig.1: tec5 AgroSpec

Application

In the following an easy and practical procedure for the non-destructive determination of biomass by means of NIR spectroscopy is explained. After having created an applicable calibration model, the measurements can be performed in-situ, directly in the field.

The advantage of non-destructive measurements is the possibility to monitor selected parameters (e.g. biomass, protein, N-nutritional status etc.) during the whole stadium of growth.

The Spectrometer System

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

AgroSpec offers also the possibility to connect various measuring heads and probes to the measurement system via optical fibers and standard SMA connectors.

The software is especially adjusted to the demands of outdoor measurements and displays the raw data of sample- and reference channel as well as reflection spectra. All data is automatically stored in predefined time intervals.

For mobile and precise data acquisition in laboratory, green house and on the fields the portable spectrometer system **tec5** HandySpec Field is perfectly suited. The measurement is either initiated at one single push of a button or works automatically in definable intervals.

tec5 spectrometer systems have been used for years now in well-known research establishments in the agricultural field and also in the well-known Yara N-Sensor. Because of their high performance they prosper in this demanding area.



Fig. 2: In-situ measurements of maize



- Spectrometer systems
- Instrument design and development
- OEM Electronic components

Calibration Modelling

To create a calibration model the first step is to measure the spectra of many different samples. The second step is to analyze these samples in the laboratory. Spectra as well as laboratory results are imported into a chemometrical software (e.g. SL Calibration Workshop, Unscrambler, Grams etc.) where they are correlated with each other. The created model can now be imported into the **tec5** spectrometer software MultiSpec Pro where it can be directly evaluated.

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.

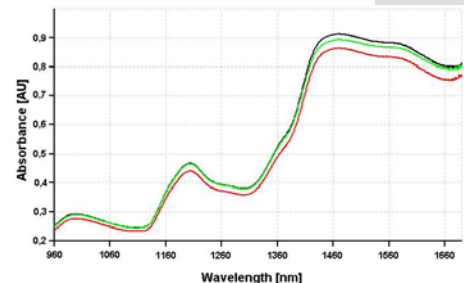


Fig.3: Absorption spectra of winter wheat

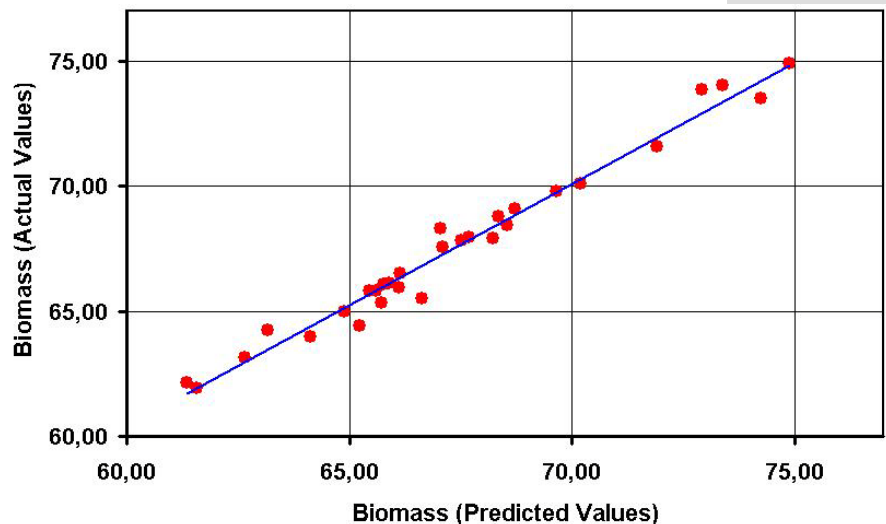


Fig.4: Predicted biomass versus actual biomass

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.