Compositionalanalysis by NIRS diode array instrumentation on forage harvesters

ANDREASHAEUSLER, MICHAEL RODE* AND CHRISTIAN PAUL

Instituteof Crop and Grassland Science, Federal Agricultural Research Institute (FAL), Bundesallee 50, D-38116 Braunschweig, Germany

Ourwork aims to assess the content of dry matter, protein, cell wall parameters and water soluble carbohydrates in forages without having to handle samples, transport them to a laboratory, dry, grind and chemically analyze them. For this purpose, the concept of fresh forage analysis under field conditions by means of compact integrated NIRS InGaAs-diode array instruments on small plot harvesters is being evaluated for plant breeding trials.

This work was performed with the world first commercial experimental forage plot harvester equipped with a NIRS module for the collection, compression, and scanning of forage samples (including automatic referencing and dark current measure ments). It was used for harvesting and analyzing a number of typical forage grass and forage legume plot trials. After NIRS measurements in the field each sample was again analyzed in the laboratory by means of a conventional grating spectrometer equipped with Si-and PbS-detectors. Conventional laboratory analysis of the samples was restricted to dry matter (DM) content by means of oven drying at 105 . Routine chemometric procedures were then employed to assess the comparative accuracy and precision of the DM assessments in the spectral range between 950 and 1650nm by the NIRS diode array as well as by the conventional NIRS scanning instrument.

The results of this study confirmed that the type of NIRS diode array instrument employed here functioned well even in rugged field operations. Further refinements proved to be necessary for optimizing the automatic filling of the sample compartment to adjust for the wide variation in forage material under conditions of extremely low or high harvest yields.

The error achieved in calibrating the apparatus for forages of typical DM content proved to be satis factory (SECV < 1.0). Possibly as a consequence of higher sampling errors, its performance in atypical forages with elevated DM contents was less satisfactory. The error level obtained on the conventional grating NIR spectrometer was similar to that of the diode array instrument for both types of forage.