Prediction of Red Clover Content in Mixed Swards by Near-Infrared Reflectance Spectroscopy

B. Deprez
Catholic University of Louvain, Belgium

D. Stilmant
Walloon Centre of Agricultural Researches, Belgium

C. Clément
Walloon Centre of Agricultural Researches, Belgium

C. Decamps
Catholic University of Louvain, Belgium

A. Peeters
Catholic University of Louvain, Belgium

The XX International Grassland Congress took place in Ireland and the UK in June-July 2005. The main congress took place in Dublin from 26 June to 1 July and was followed by post congress satellite workshops in Aberystwyth, Belfast, Cork, Glasgow and Oxford. The meeting was hosted by the Irish Grassland Association and the British Grassland Society.

Proceedings Editor: D. A. McGilloway

Publisher: Wageningen Academic Publishers, The Netherlands

Prediction of red clover content in mixed swards by near-infrared reflectance spectroscopy

B. Deprez[1], D. Stilmant[2], C. Clément[2], C. Decamps[1] and A. Peeters[1]
[1]Laboratory of Grassland Ecology, Catholic University of Louvain, Place Croix du Sud 5 bte 1, B-1348 Louvain-la-Neuve, Belgium, Email: deprez@ecop.ucl.ac.be, [2]Farming System Section, Walloon Centre of Agricultural Researches, Rue du Serpont 100, B-6800 Libramont, Belgium

Keywords: red clover, legume percentage, NIRS

Introduction Because of the legume fixation capacity, their high protein content, digestibility and intake characteristics, more and more attention is paid to grassland clover content. In field experiments, clover content must often be determined, for example to quantify nitrogen flux or the best practices to manage such species (Stilmant *et al*., 2004). However hand sorting of clover and grass, even if accurate, is time-consuming and has a high labour cost. In comparison, accuracy of visual estimation of clover content, directly in the field, varies according to training and experience. Near-infrared reflectance spectroscopy (NIRS) has been proposed as a method for the rapid determination of sward botanical (Petersen *et al.*, 1987; Pitman *et al.*, 1991) and morphological composition (Leconte *et al*., 1999; Stilmant *et al*., 2005). This paper describes the performance of a NIRS calibration developed to characterise red clover (*Trifolium pratense*) content when associated to different grass species and this at different phenological stages.

Materials and methods Plant material used to set up NIRS calibration was collected in three swards, located on loamy soil. In each sward red clover (cv. Merviot) was associated to different grass species : perennial ryegrass (*Lolium perenne*) cv. Merlinda, hybrid ryegrass (*Lolium hybridum*) cv. Barsilo and cocksfoot (*Dactylis glomerata*) cv. Lupré. The samples were taken in May, July, August and October by cutting the sward 7 cm above ground level. Samples were hand sorted into clover and grass fractions. These fractions were dried, weighed (G %) and then ground and remixed before being submitted to NIRS analysis (NIRSystem monochromator 5000). Spectral data, in the range of 1100–2500 nm scanned at 2 nm steps, were correlated to red clover content. Calibrations were developed according to the Partial Least Square procedure with cross validation using the ISI (Infrasoft International) software. The spectra of 647 samples were used for calibration and cross validation, while 45 samples were kept for independent validation.

Results and conclusions Among the 647 samples, the red clover content ranged from 0 to 100%, with a mean of 59.5%. The R^2 was 0.99 in calibration (Standard Error of 2.74%) as in cross validation (Standard Error of 2.87%) and the ratio of the standard deviation of the initial sample set on the standard error in cross validation (SD/SECV) was 9.4 (Williams, 2004). The performance of this calibration is sufficiently precise and reliable to quantify red clover content in a wide range of situations. This was confirmed by the results obtained on the independent validation set (Table 1).

Table 1 Statistics of the independent validation, including number of samples (N) and standard error of prediction (SEP)

N	Mean	SEP (%)	Bias	Slope	R^2
45	67.18	2.88	0.73	0.99	0.98

References

Leconte, D., P. Dardenne, C. Clément, & Ph. Lecomte (1999). Near infrared determination of the morphological structure of ryegrass swards. In: Davies A.M.C. and Giangiacomo R. (eds) *Near Infrared Spectrometry : Proceedings of the 9th International Conference*. NIR Publications, 41-44.

Petersen, J.C., F.E. Barton, W.R. Windham & C.S. Hoveland (1987). Botanical composition definition of tall fescue-white clover mixtures by near-infrared reflectance spectroscopy. *Crop Science*, 27, 1077-1080.

Pitman, W.D., C.K. Piacitelli, G.E. Aikenj, & F.E. Barton (1991). Botanical composition of tropical grass-legume pastures estimated with near-infrared reflectance spectroscopy. *Agronomy Journal*, 83, 103-107.

Stilmant, D., V. Decruyenaere, C. Clément & N. Grogna (2005). The use of near infrared reflectance spectroscopy (NIRS) to follow legumes leaf/stem ratio during drying. *XXth International Grassland Congress* (accepted).

Stilmant, D., V. Decruyenaere, J. Herman & N. Grogna (2004). Hay and silage making losses in legume-rich swards in relation to conditioning. *In: Land Use Systems in Grassland Dominated Regions,* A Lüscher, B. Jeangros, W. kesler, O. Huguenin, M. Lobsiger, N. Millar, D. Suter (Eds). *Grassland Science in Europe*, 9, 939-941.

Williams, P. (2004). Near-Infrared Technology – Getting the Best Out of Light. A Short Course in the Practical Implementation of Near-infrared Spectrometry for the User. PDK Grain, Manitoba, Canada.