Towards truly "global" near infrared calibrations for protein and neutral detergent fibre in dried ground forages

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Introduction Over the past five years, Foss and DeLaval have sponsored the activities of a group of forage analysts with the aim of developing "global" Near Infrared (NIR) calibrations for parameters that are important in ruminant nutrition. The approach adopted has been based on the amalgamation of historical databases from centres worldwide and calibrations for protein and neutral detergent fibre (NDF) in dried ground forages have been developed based on databases that currently comprise approximately 30,000 records. Protein and NDF, while not the most important parameters in ruminant nutrition, were chosen for the initial calibration development exercise because of the amount of data available and because the methodologies adopted by different laboratories worldwide were relatively uniform. The aim was to create calibrations that would work for any forage type in any area of the world. Over the past two years, several trials have been carried out worldwide comparing the performance of "global" calibrations with the performance of locally developed calibrations for indigenous forages and based on reference values from local laboratories.

Materials and methods Standard methods were used to generate reference values for protein and NDF. Equations were developed by customer using PLS (partial least squares analysis) were compared to the global models based on artificial neural network (ANN) technology using a database that included spectra from all parts of the world and representing harvests for the last twenty years. Some tropical forages and all the major types of temperate forages, including legume and maize silages, were contained in the database.

Results In Table 1 we can see that the global model for protein gave similar statistics (standard error of prediction corrected for slope effects (SEP(C))) to those for the customer model while the global model for NDF was slightly worse than the customer model. It should be noted that the number of samples where the customer had suitable models for particular forages was 64 and 65 respectively while the global models predicted all forage samples available.

Table 1 Comparison of prediction statistics for Swedish data. Reference is customer wet chemical values

	Protein		NDF	
	PLS	ANN	PLS	ANN
n	63	111	64	111
RMSEP	0.56	0.95	3.09	3.62
SEP	0.54	0.58	2.55	3.08
SEP(C)	0.50	0.58	2.57	3.03
R	0.99	0.99	0.93	0.96

Where: PLS = model from partial least squares analysis; ANN = model from artificial neural network; RMSEP = root mean squared error of prediction (without bias correction); SEP = standard error of prediction (corrected for bias); SEP(C) = standard error of prediction corrected for slope effects

Conclusions The global calibrations would require slope and/or bias corrections before being used. This was because Scandinavian forages were not represented in the calibration database and local laboratories generated the reference values. The global models had poorer performance than the locally developed regional calibrations, but were able to handle a much wider range of samples with acceptable performance than could the regional calibrations. The benefits of having to maintain a single universal calibration rather than many species-specific calibrations are important to the economics of managing forage networks.