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Recent developments in forage evaluation with special reference to practical applications

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Abstract

The present re-evaluation of a dataset of systematically collected laboratory analyses and in vivo digestibility information for several types of silages gives convincing evidence of the biological weaknesses of feed characterisation based on the proximate feed analysis. The problems include intrinsic failures of the analysis in describing cause-response relationships between forage composition and digestibility, and heavy dependency of the equations on forage specific and environmental factors. It is concluded that proximate analysis is not suitable for characterisation of neither forages nor concentrate feedstuffs. In vitro pepsin-cellulase solubility of organic matter (OMS) and concentration of indigestible neutral detergent fibre (iNDF) predicted forage organic matter digestibility (OMD) with an acceptable accuracy for practical feed evaluation purposes provided that forage type dependent correction equations were employed.

The revised detergent system dividing forage dry matter (DM) into almost completely available neutral detergent solubles (NDS), and insoluble residue (neutral detergent fibre, NDF) shows potential for future development. The combined use of long-term in situ ruminal incubation and NDF fractionation can be used to divide forage DM into three biologically meaningful fractions: NDS, iNDF and potentially digestible NDF (pdNDF). The summative models can then be used to predict forage D-value, i.e. apparently digestible organic matter in forage (g kg-1 DM). The models sum digestible NDS, which can be determined by Lucas equation, and digestible NDF (dNDF), which is the amount of pdNDF that is actually digested during any specific fermentation or retention time. Forage type specific summative models were as good as regression equations based on OMS or iNDF in predicting forage D-value and general summative models gave better results than general equations based on iNDF and especially OMS.

If the goal is to reduce prediction error of D-value below 15 g kg-1 DM, forage type specific prediction equations should be used regardless of whether they are based on OMS, iNDF or summative models. Another option in the future may be dynamic models, which can incorporate simultaneously the two important dynamic processes constraining feed digestion in ruminants: the rates of NDF passage and degradation (kd). However, a vital prerequisite to employ dynamic models in practical feed evaluation is that iNDF and kd can be easily and reliably determined from on-farm forages. Although a NIRS prediction equation for iNDF will be adopted in practical use in the near future in Finland, the methodology for estimating kd warrants further research.

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