

## Organic matter digestibility – Methods used in the Nordic countries

### Sweden

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In vitro determination of organic matter digestibility for ruminants is in Sweden used for metabolizable energy estimation of forages from leys and pastures and for straw. For all other feeds, including silage of maize and other whole crop cereals, tabulated digestibility coefficients are used together with proximate analysis. Research is at present going on with the aim to establish equations for estimating ME in whole crop cereal silage from in vitro OMD.

The in vitro method is the VOS method (Våmvätskelöslig Organisk Substans = Ruminal fluid Digestible Organic Matter) according to Lindgren (1979; 1983; 1988). It is a 96 h incubation in 38° C of 0.5 g dried sample with 49 ml buffer and 1 ml rumen fluid. Incubation residues are combusted to get the digestibility coefficient of the organic matter ("VOS value") and metabolizable energy is directly calculated as:

$$\begin{array}{ll} \text{MJ ME/kg OM} = 0.160 \text{ VOS} - 1.91 & (\text{Leys with } < 50\% \text{ legumes}) \text{ (Lindgren, 1983; 1988)} \\ \text{MJ ME/kg OM} = 0.106 \text{ VOS} + 2.93 & (\text{Leys with } > 50\% \text{ legumes}) \text{ (Lindgren, 1983; 1988)} \\ \text{MJ ME/kg OM} = 0.114 \text{ VOS} + 0.47 & (\text{Straw}) \text{ (Lindgren, 1988)} \end{array}$$

The equations were developed by regression of ME values determined in vivo for sheep at maintenance level against VOS values. Regressions for in vivo digestibility of organic matter obtained at the same occasion:

$$\begin{array}{ll} \text{In vivo OMD} = 0.90 \text{ VOS} - 2.0 & (\text{Leys with } < 50\% \text{ legumes}) \text{ (Lindgren, 1983)} \\ \text{In vivo OMD} = 0.62 \text{ VOS} + 23.0 & (\text{Leys with } > 50\% \text{ legumes}) \text{ (Lindgren, 1983)} \end{array}$$

Labs using NIR usually have a calibration directly for ME and do not report the VOS value (exception: Steins DK) while labs running the VOS method reports ME and VOS value. Most of the Swedish forage samples (~80%) are analysed by NIR and the rest are analysed by the VOS method. Enzyme methods (EOS) are currently not used for in vitro OMD in Sweden.

### References

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## Denmark

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### Forages

Forages are generally analysed using NIR. NIR is calibrated against in vitro digestibility, which again is calibrated against in vivo (sheep at maintenance). Most forage samples from practice are analysed at Steins Lab., but some (10 – 15%) are analysed at Blgg Oosterbeek in Holland.

Most forage types are analysed using in vitro organic matter (OM) digestibility using the Tilley & Terry (1963) method (48 h pepsin HCl, 48 h rumen fluid) with the only main modification that residues are combusted to get OM digestibility. In vivo is calculated from in vitro using the following equation (Møller et al., 1989):

In vivo digestibility (%) =  $4.10 + 0.959 * (\text{in vitro digestibility}_{\text{T\&T}} (\%))$  [Most forages]

In vivo digestibility (%) =  $6.73 + 0.950 * (\text{in vitro digestibility}_{\text{T\&T}} (\%))$  [Maize silage]

Fresh whole crop cereals (barley, wheat, maize) are analysed using EFOS (24 h pepsin-HCl, 45 min 80°C, 24 h enzyme mix 40°C, 19 h 60°C) (Weisbjerg & Hvelplund, 1993). In vivo is calculated from in vitro using the following equation (Søgaard et al., 2001):

In vivo digestibility (%) =  $20.4 + 0.727 * (\text{in vitro digestibility}_{\text{EFOS}} (\%))$  [Fresh whole crop]

Also for straw it is not recommended to use T&T, and EFOS can be used, with the following equation (Hvelplund et al., 1999):

In vivo digestibility (%) =  $22.0 + 0.752 * (\text{in vitro digestibility}_{\text{EFOS}} (\%))$  [Straw]

A present research project is running with the aim to change all forage analysis to be based on EFOS (as calibration method for NIR).

### Concentrates

The in vitro enzymatic method EFOS is used, and is the official method for concentrate mixtures in DK. In vivo is calculated from in vitro using the following equation (Weisbjerg & Hvelplund, 1993):

In vivo digestibility (%) =  $5.38 + 0.867 * (\text{in vitro digestibility}_{\text{EFOS}} (\%))$  [Concentrates]

### References

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## Norway

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Energy values in the Norwegian feed table for ruminants are calculated in NEL (FEm) based on digestibility coefficients (DCP, DL, DCF, DNFE) from sheep fed at maintenance level.

The laboratory doing most of the routine feed analyses determines FEm by NIRS. For silage and hay the NIR-calibrations are based on samples with known in vivo digestibility.

For grass NIR-calibration are based on FEm calculated from in vitro DMD.

The in vitro method used, is the classical Tilley & Terry (1963) method.

Three standard samples with known in vivo DMD (55-75 %) are included every week. The in vitro DMD is corrected to in vivo DMD based on the in vitro results of these three samples.