A rapid screening technique for effects on microbial degradation of feed additives

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Background: Increased production, better health and welfare and reduced environmental impacts are important drivers of innovation in cattle production. This is increasing the number of feed additives being marketed to improve feed efficiency and reduce methane emissions. Validation of the impact of these on rumen function and their efficacy is often difficult to obtain. Full herd or research station testing of these products is extremely costly and need only be undertaken when preliminary results are encouraging. A rapid laboratory screening technique, that can address a wide range of effects from feed additives, is warranted and such a method has been developed at the UCPH department of Veterinary and Animal Sciences. Our lab provides an opportunity for research collaboration with industry partners, where we also can involve students in relevant research to create solutions to the challenges facing the cattle industry.

Laboratory techniques: In-vitro gas production techniques are based on the fact that degradation of feed in the rumen is a major factor determining feed digestibility. Rumen microbes degrade feed by anaerobic fermentation and gas is the main by-product of this fermentation. The greater the fermentation of feed, the greater the volume of gas produced. Our lab uses a system that can both release and measure gas pressure automatically with chosen settings. A gas production curve is generated from the data, illustrating the kinetics of degradation. Degradation parameters can be extracted and a mathematical prediction of degradation derived that can be used for feed evaluation. It is possible to can screen 75 samples at a time and this allows for many combinations of additives, dose responses or replication. All of the gas produced during fermentation can be collected and the gas composition, including methane, can be measured by gas chromatography. One of the challenges with many "climate-friendly" feed additives is that there is a simultaneous loss of fiber degradation when methane emission is reduced. Therefore, fiber determination of non-fermented samples is compared to the fermented samples to follow fiber degradation. Incubation can be stopped at different time points and the fluid filtered to separate the undegraded material from the liquid. Dry matter, fiber and/or organic matter degradation, short chain fatty acids (SCFAs) as well impact on rumen microbiota can be determined at these different time points and related to the kinetics of gas production.

Perspectives: Application of these techniques will enable identification of the most promising combinations of feeds, processing methods and additives whereby unnecessary and costly testing of inappropriate feeding strategies in practice can be avoided. This method can be an important tool to ensure an economically and environmentally sustainable development of dairy cattle feeding.