Conclusions and recommendations

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Conclusions and recommendations

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SUMMARY - The most relevant results obtained from the co-operation work of the project are reviewed and commented. It is concluded that one can choose between treating and not treating fibrous feeds. In this latter case, attention must be paid to the correct association with a protein feed, both qualitatively and quantitatively.

Key words: Fibrous feeds, treatments, associative effect.

RESUME - *"Conclusions et recommandations". Les résultats les plus importants obtenus à partir du travail en collaboration dans le cadre du projet sont considérés et commentés. On conclut que l'on peut choisir entre traiter ou non les aliments fibreux. Dans ce dernier cas il faut faire attention à bien les associer avec un aliment protéique, soit qualitativement soit quantitativement.*

Mots-clés : *Aliment fibreux, traitements, effet associatif.*

Introduction

The environmental climatic conditions of the areas that surround the Mediterranean basin are the major factors responsible for the very poor nutritional quality of local fibrous feeds (cereal straws and maize stover) resources. This means: important levels of lignin encrusting cell walls and very low contents of crude protein. In other words, the forage or roughage available are characterized by the presence in their composition of undegradable or very slowly degradable carbohydrate fractions on one side, and of too low amounts of nitrogen, insufficient to allow the rumen microbes to grow and become acceptably active, on the other side. But this feed material is available and abundant and must be used in ruminant nutrition. Since it is well known that something can be done to upgrade poor fibrous feeds (chemical and physical treatments, associations with other feeds), the questions we have tried to answer are: "what is the degree of improvement that can be attained with the most common practices?", "is it really useful to perform these upgrading practices?" and, if yes, "is it worth while?"

Chemical treatments

Since the major obstacle to microbial attack to cellulose of the cell wall of straws and stover is represented by the lignin encrusting it, if the ligno-cellulosic bonds are cleaved by means of basic chemicals, the nutritive value is improved.

The use of alkali, such as NaOH or KOH, is not to be recommended because if it is true that the cell wall structural carbohydrates are more easily degradable, it is also true that the animal must cope with the problem of getting rid of large amounts of alkaline ions.

The use of anhydrous gaseous ammonia doesn't put this problem and, in addition, extra nitrogen is introduced, which can be utilized by the rumen microbes. If ammonia is not anhydrous, but in the form of water solution, the amount of nitrogen which is fixed to the straw fibre is much higher. In any case, ammonia results to be toxic and therefore not easily handled by the operators. But there is an alternative that eliminates this kind of problems: the treatment of the fibrous material with urea as the source of ammonia, when hydrolysed by natural ureases. The results are the same as with ammonia and the starting chemical is to be considered non toxic.

Experimental results from chemical treatments

The experimental results obtained with the chemical treatments also include some physical aspects, because the conditions of moisture content and temperature were studied as well. The main aspects which were defined (Cañeque *et al.*, this volume; Muñoz *et al.*, this volume) and which may also represent some recommendations can be summarized in the following points:

(i) The optimum moisture content of the fibrous mass of both straws and maize stover to be utilized for the treatment with urea is between 30 and 40%. Moisture content below 25% impairs the urease activity. And over 40% there is no improvement. It was demonstrated that the maximum solubility of hemicelluloses is reached between 30 and 40% moisture.

(ii) The optimum temperature range is quite large. For the maximum urease activity it must be at least 35°C and can reach as high as 60°C. These temperatures can be easily reached within the plastic covered stack in the sun during the Mediterranean summer.

(iii) The concentration of urea must not exceed 6% of the fibrous mass dry matter (DM). The concentration of 4% is recommended. Less is not enough, more may be toxic.

(iv) The duration of storage of the sealed mass before use must be at least 3 to 4 weeks, in order to allow urea to be hydrolysed into ammonia and ammonia to be fixed and retained within the fibrous mass.

(v) If necessary, depending on the expected production level, concentrates must be properly supplemented.

Associative effect with other feeds

In previous experiments (Antongiovanni, 1993) it was confirmed that the energy content of the cell wall carbohydrates of wheat straw can be exploited by introducing it in complete balanced diets for growing ruminants. In successive experiments different protein feeds and protein sources were tested *in vivo* with lambs in order to get clear information on the different protein value in relation to the rumen degradation characteristics of wheat straw. A confirmation of the *in vivo* findings was looked for with *in vitro* trials.

Experimental results from *in vivo* trials

Three growth trials with weaned lambs were carried out with the aim of testing the most common protein feeds and a protected protein in isonitrogenous diets based on 40% wheat straw (Antongiovanni *et al.*, this volume). The relative results can be summarized in a few very clear points:

(i) The feed associated with wheat straw must contain slowly degradable protein fractions.

(ii) Soya bean meal resulted the best protein feed of plant origin as compared with sunflower cake, coconut cake and brewers yeast. Coconut cake was the worst.

(iii) The protein feeds of animal origin meat meal, fish meal, blood meal were comparable with one another and with soya bean meal.

(iv) A protected blood protein enriched with lysine and methionine was equally comparable with the best protein feeds of animal origin.

(v) The optimum crude protein level of the diets must be at least 18% on the DM basis with the quickly degradable proteins, but can be lowered down to 13% with the ruminally protected proteins.

Experimental results from *in vitro* trials

Samples of the diets that were tested *in vivo* were also studied *in vitro* by means of a semi-continuous fermentation system (Moreira and Ribeiro, this volume). The most relevant results were:

(i) The diet containing soya bean meal resulted the most degradable in the long term.

(ii) The diet with coconut cake gave the highest C_2/C_3 ratio, and that with blood meal gave the lowest one.

(iii) The highest microbial yield was achieved with the diet with meat meal as the major protein source.

(iv) The best results in terms of degradation and C_2/C_3 ratio were those with 30% protected protein and 18% crude protein.

Conclusion

As a conclusion and a general recommendation, it can be stressed that if treatments are of use in upgrading straws and other fibrous feeds, it is also true that untreated straws can produce body weight gains equally good, provided that straws are associated with the proper nitrogen source. Soya bean meal is an as good nitrogen source as a protein feed of animal origin. The introduction of a certain amount of a protected protein and protected amino acids (30% of the crude protein content of the diet) may be of some help.

References

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