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Technology for the treatment of straw with urea in Mediterranean climates

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SUMMARY - The following treatments were carried on 4 barley straw stacks, 1 ton each:

1) untreated (U);
2) treated with 4% urea solution at 25% humidity and covered with plastic film (UC)
3) the same treatment but with stack uncovered (UD);
4) treated with 4% solid urea at 25% humidity, covered (USC).

These 4 treatments were valued in digestibility and voluntary ingestion tests carried out on castrated sheep, which received a diet of straw and 200 g/day of concentrate. The results achieved showed that the treatments UC and USC were better ($P<0.05$) than the others, both in organic matter digestibility (OMD) and in voluntary ingestion. The UD treatment was only superior ($P<0.05$) to untreated in OMD, without any difference ($P<0.05$) involuntary ingestion.

RESUME - "Technologie pour le traitement des pailles avec de l'urée dans les climats méditerranéens"

Les traitements suivants sont réalisés sur 4 lots de paille d'orge d'une tonne chacun:
1) non traité (U)
2) traité avec une solution à 4% d'urée à 25% d'humidité sous film plastique (UC)
3) même traitement mais non couvert (UD)
4) traité à 4% d'urée solide à 25% d'humidité sous film plastique (USC)

L'ingestibilité et la disgestibilité des 4 traitements est mesurée sur des béliers castrés recevant la paille complémentée avec 200 g de concentré par tête et par jour. Les résultats montrent que les lots UC et USC s'avèrent les meilleurs pour l'ingestion et la disgestibilité de la matière organique. Le traitement UD est seulement supérieur à la paille non traitée pour la digestibilité de la matière organique mais pas pour l'ingestion.

Introduction

The treatment with alkalis, particularly NH3, is used to enhance the nutritional value of ligno-cellulosic residues. When anhydrous NH3 is short and/or expensive, urea can be a good alternative, especially in hot countries (GREENHALGH, 1984). The urea application technique is very simple and requires a plastic film cover. This increases the treatment cost. SUNDSTOL and COXWORTH (1984) quote some references from tropical countries where other kinds of simpler cover materials have been tested. This way, plastic can be eliminated and the treatment cost lowered.

The aim of the present paper is to simplify the urea application technique, a) using it in solid form and b) studying the effect of plastic elimination in the treatment performance.

Material and methods

On 4 stacks of barley straw, 1 ton each, the following treatments were carried out:

1) Untreated (U).

2) 4% of urea aqueous solution. 25% humidity, covered with a transparent polyethylene film. 0.70 mm. thickness, (UC), following the technique described by HADJIPANAYIOTOU (1982).

3) 4% of urea aqueous solution and 25% humidity, leaving the stack uncovered (UD).

4) 4% of urea in solid form, adding water later to reach 25% humidity and covered with plastic (USC).

After a mininum period of two months the straw was cut to a length of 5-10 cm. and the treatments were eva-

luated by ingestion and digestibility tests on castrated sheep. The diet offered was composed of straw and 200 g. of concentrate. When untreated straw was offered, 9 g. of urea per sheep were added to the feed. During the digestibility phase, the diet was restricted to a maintenance level (INRA. 1978), while in the ingestion phase straw was supplied ad libitum, allowing a maximum of 15% refusal. Chemical determinations were carried on samples of offered food, refused food and faeces: ash and total nitrogen (TN) (AOAC, 1980); neutral detergent fiber (NDF) (GOERING and VAN SOEST, 1970); and nitrogen-residual urea (UN) (WATT and CHRISP, 1954). The degree of ureolysis was the ratio between the ureic N added minus the ureic N found and the ureic N added. The results underwent a single-variable variance analysis following the recommendations of STEEL and TORRIE (1980) using the statistical pack SAS (1985).

Results and discussion

Table 1 shows the chemical composition of the different straws. The urea treatment had a significant effect (P<0.001) on the TN content, causing an increase varying between 0.86 and 1.32 in comparison with the untreated. The treatment without plastic (UD) presented an acceptable N content, and so, it looks as if the stack characteristics and the self-insulating effect of the straw had prevented excessive N losses. On the other hand, the NDF content of UC and USC were slightly less (P<0.05) than U, while NDF content in UD was very similar to the one in U.

The effect of the treatment on the organic matter digestibility (OMD) of the straw was significant (P<0.001), UC and USC treatments stood out with values of 58.8 and 57.2% respectively, superior to UD which presented an OMD of 53.9% (Figure I).

The voluntary ingestion (Figure I) increased only (P<0.01) in the UC and USC treatments with values of 61.5 and 56.9 g. DM/kg0.75 respectively, while the UD and U treatments presented respective ingestions of 49.5 and 46.8 g. DM/kg0.75. There was no significant difference (P<0.05) between the last two. The studied modifications to the urea application (USC) can be, in practice, efficient enough. It is recommenable to carry out the treatment during the high temperature season with a humidity of over 20% (Joy, 1991).

Table 1. Chemical composition (%) of barley straw, untreated and treated with urea under different application conditions (dry basis)

	U	UC	UD	USC	Significance
Organic matter OM	90.5	90.4	90.3	90.5	NS
Neutral detergent fiber NDF	76.9	74.2	76.1	75.3	NS
Total nitrogen TN	0.70	2.02	1.64	2.00	***
Residual urea UN	–	0.70	0.61	0.86	NS
Hydrolized urea (%)	–	62	67	53	NS

U: Untreated; UC: Treated with dissolved urea and covered with plastic; UD: Treated with dissolved urea, uncovered; USC: Treated with solid urea and covered with plastic; NS: P>0.05; ***: P<0.001

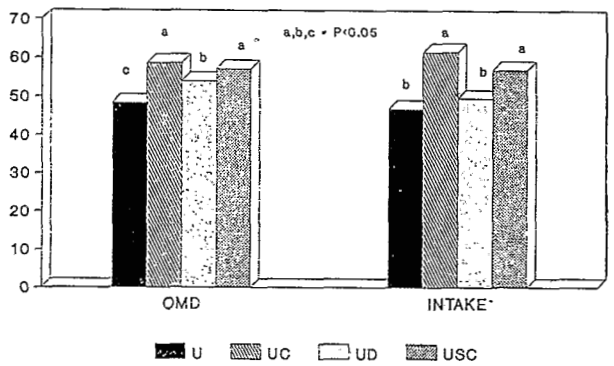

Fig. 1. Organic matter digestibility (OMD) (%) and intake (g/kg^{0,75}) of untreated and urea treated barley straw.

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