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# DEGRADABILITY OF FORAGES IN THE RUMEN OF CATTLE GRAZING LUSH AUTUMN PASTURES AND SUPPLEMENTED WITH MAIZE

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## SUMMARY
The experiment investigated rumen degradability of forages and rumen pH in Hereford steers grazing high quality pastures in autumn with no supplement or supplemented daily with whole (WM) or ground (GM) maize grain (1% of body weight). Forage allowance was adjusted each week to provide approximately 5% body weight on a DM basis. Six steers with rumen cannulas were allocated to one of three treatments. Forage dry matter degradability was measured using the nylon bag technique. Supplementation with maize did not affect (P>0.05) degradation rate of forage in the rumen or rumen fluid pH. Rumen fluid pH was more affected by the time of the day by supplementation or type of concentrate offered. It is concluded that neither supplementation nor grinding the maize had a negative effect on the rumen environment of cattle grazing lush pastures during autumn.

*Keywords:* cattle, autumn, maize grain, degradability, pH

## INTRODUCTION
During autumn, animal production on lush pastures including oats, grasses and legumes is lower than expected based on apparent digestibility and protein content. . It has been suggested that poor growth rates are a result of nutrient imbalance associated with relatively low levels of water-soluble carbohydrates and high levels of rapidly degradable protein (Rearte 1999). Cereal grain supplementation can provide additional fermentable energy, improving $NH_3$ capture and microbial synthesis (Elizalde 1999). However it is well documented that high inputs of rapidly fermentable starch can decrease rumen pH, resulting in a lower rate of forage digestion, which in turn can restrict feed intake (Van Soest 1994). Rapid fermentation of starch, and the effect that this has on rumen pH and fibre digestion may be accelerated by fine grinding and may be reduced by feeding whole grain. .

The objective of this study was to determine the effect of supplementation using maize grain offered whole or ground on rumen pH and on forage degradation in steers grazing high quality pastures during autumn.

## MATERIALS AND METHODS
The experiment was conducted at the Experimental Station of the Agronomy Faculty, in Paysandu, Uruguay, over the period 31 May to 23 August 2001. The experiment was divided in two periods: 31 May to 15 July (Period I), and 15 July to 23 August (Period II), corresponding to grazing oats and mixture pasture, respectively. The mixed pasture consisted of fescue and red clover in approximately equal proportions. Animals were managed in rotational grazing system with grazing strips allocated each day to provide forage at a rate equivalent to 5% bodyweight on a DM basis. Grain supplements were fed to provide an amount equivalent to 1% of bodyweight each day and fed in individual pens constructed adjacent to the paddock. Grain was offered daily at 0800 hs and refusals measured at 0900 h to determine actual intake. Six Hereford steers weighing 318 (± 14 kg, sd), and 18 months of age, surgically fitted with rumen cannula were random allocated to the three treatments. The treatments were as follows:

1) **Control**: No supplement
2) **Whole maize (WM)**: Supplemented with whole maize grain
3) **Ground maize (GM)**: Supplemented with ground maize.

Animals were treated against internal parasites with ivermectin, before starting the experiment. Steers were weighed fortnightly, at 0800 h following a period of 12 hours without food and water. Forage availability was measured weekly using the double-sampling method (Gardner 1967), and forage

allowance was adjusted varying the strip area for each treatment. The quantity of supplement and forage allowance were adjusted for BW changes fortnightly.

Six sampling periods (3 days each) were distributed uniformly during the whole experimental period. Hand clipped samples of forage were collected for control and supplemented treatments before each sampling period and analysed for dry matter, nitrogen, and soluble and insoluble non starch polysaccharides content (Englyst et al, 1993; Theander et al, 1993). At 0900 h on day 1 of each sampling period, prior to supplementation and before being moved to a new pasture strip, nylon rumen bags containing samples of fresh forage, hand-clipped from the pasture being grazed, were placed in warm water 39ºC for 15 minutes. Of the 18 bags prepared for each animal, two bags were taken as time 0 samples and the rest placed in the rumen. The nylon bags (40 µm pore size, 8 cm x 40 cm) were attached to a 1 m cord with a 750 g weight tied to the end. Two bags were removed following 3, 6, 9, 12, 24, 36, 48, and 72 hours incubation in the rumen. The bags were immediately washed in cold water using a conventional automatic top-loading washing machine with a 30 minutes cycle. The bags were then dried at 60$^{o}$C for 48 h and weighed.

Samples of rumen fluid (100 ml) were collected at 3-h interval during the last day of each sampling period and strained through two layers of cheesecloth. Rumen pH was measured immediately with a portable pH meter.

The model described by Orskov and McDonald (1979) was used to analyse the nylon bag data. Data from the two bags removed at each time were averaged. The parameters for nylon bag forage degradation derived from the model of Orskov and McDonald (1979) and rumen pH were subjected to analysis of variance using a completely random design with repeated measurements. The model included treatment, period, sampling date nested within period, and the interaction between them. The cannulated steer effect was considered as a random factor nested within treatment. SAS software was used for all statistical analysis.

## RESULTS

The chemical composition of the hand-clipped samples of forage for supplemented and non-supplemented steers is shown in Table 1.

**Table 1. Chemical composition (% of dry matter) of the hand clipping samples of forage for the two periods**

| Forage mass (t of dry matter/ha) | Fresh oats (Period I) 2.63 (SD=0.52) | | Mixture pasture (Period II) 3.36 (SD=0.32) | |
|---|---|---|---|---|
| | Control | Supplemented | Control | Supplemented |
| Dry matter | 15.3 | 14.7 | 12.9 | 11.3 |
| Free sugars (FS) | 6.23 | 7.29 | 8.75 | 9.63 |
| Soluble NSP (SNSP) | 1.13 | 1.15 | 1.50 | 1.57 |
| Non Soluble NSP (NSNSP) | 31.0 | 31.6 | 18.3 | 20.2 |
| Fructans (FR) | 3.72 | 4.06 | 1.59 | 1.85 |
| Crude Protein (CP) | 20.3 | 17.8 | 28.0 | 25.0 |
| a: Instantly degradable fraction (g/kg) | 185 | | 183 | |
| b: Total degradable fraction (g/kg) | 635 | | 696* | |
| c: Degradation rate (per h) | 0.0595 | | 0.0847** | |
| Rumen pH | 6.53 | | 6.41** | |

*, ** Significant (P< 0.05 and 0.01 respectively) difference between values in the same row.

There was a significant effect of period on the degradation rate of forage dry matter (Table 1) but no effect of supplementation with maize grain on rate of forage degradation or rumen pH (Table 2). There was an interaction between treatment and period (P<0.01), for the instantly degradable forage fraction and for the total degradability. However that interaction did not affect (P=0.56), the degradation rate of the forage dry matter.

**Table 2. The effect of supplementation with whole or ground maize on forage dry matter degradability and rumen pH**

| | Supplementation | | |
|---|---|---|---|
| | Control | WM | GM |
| A: Instantly degradable fraction (g/kg) | 226 | 155 | 170 |
| B: Total degradable fraction (g/kg) | 652 | 707 | 637 |
| C: Degradation rate (per h) | 0.0820 | 0.0670 | 0.0674 |
| Rumen fluid pH (Mean value) | 6.28 | 6.45 | 6.33 |

Although there was no significant effect of supplementary feeding on rumen fluid pH all the other effects included in the model were significant (P<0.01). There was a diurnal pattern of rumen pH with the lowest value occurring between six and twelve hours after concentrate feeding (P<0.001; Figure 1). Rumen pH was higher in cattle grazing oats than during the period when they grazed mixed pasture period (Table 1).

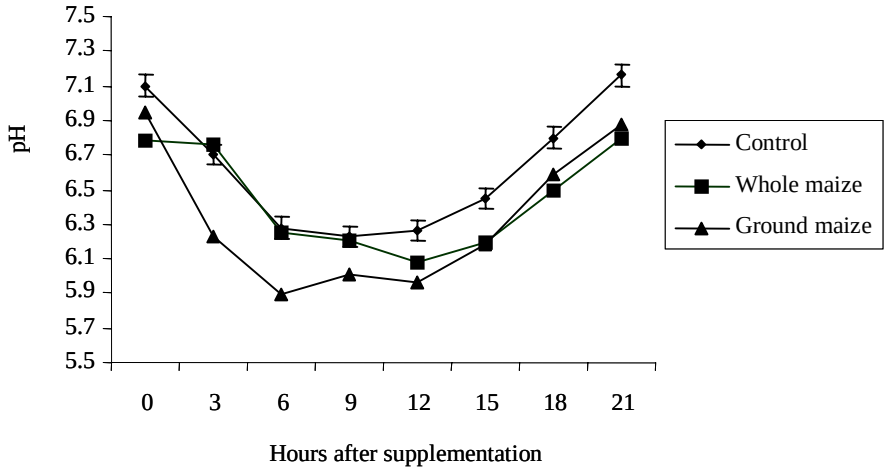


**Figure 1. Effect of supplementation with whole or ground maize on daily changes of rumen pH of steers grazing high quality pastures during autumn. Bars represent ± standard error of the mean.**

## DISCUSSION

In our study dry matter forage degradability was influenced more by type of pasture than by feeding a supplement of maize. The degradation rate of forage dry matter and the total degradable fraction were greater for the mixed pasture than for the oats. The chemical composition of the forages (Table 1) indicates that the oats had higher concentration of insoluble NSP than the mixed pasture and it is likely that this was responsible for its lower rate of dry matter degradation.

There was no evidence that supplementation with maize at the levels used in this experiment significantly reduced rumen pH even when the grain was ground. It is therefore not surprising that maize supplementation also had no significant effect on the rate of forage dry matter degradation.

Rumen fluid pH was significantly affected by the time of the day with the lowest pH values of between 5.9 and 6.3 occurring between 6 and 12 hours after the cattle started grazing new daily pasture strip. Low rumen pH values for animals grazing on oats were previously reported by Favre *et al* (1992) who also did not find any additional effect on pH when supplementing these animals under similar conditions. It has been suggested that cattle grazing oats can suffer sub-clinical acidosis (Rearte and Santini 1989 cited by Favre 1992), and that this could impair fibre digestion. For the control treatment it is probable that a higher forage intake rate when they were moved to a new strip could generate a reduction in rumen pH similar to that of animal receiving supplement.

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