UNDERSTANDING WHOLE MAIZE GRAIN UTILIZATION BY BEEF CATTLE

A. SIMEONE[A], *V. BERETTA*[A], *J. ROWE*[B] *and J. NOLAN*[B]

[A]Animal Science, Universidad de la República, Ruta 3 km 363, Paysandú, Uruguay CP 60000
[B] Animal Science, University of New England, Armidale N.S.W. 2351

Cattle grazing lush autumn pastures and supplemented with maize grain perform no better when the grain is ground (Simeone *et al*. 2003). Ingestive mastication could play a major role in reducing the particle size of whole maize grain, facilitating rumen starch fermentation and digestibility within the total tract. The experiment reported here characterized the effect of mastication on the particle size of whole maize (WM) grain reaching the rumen and its relation with the rate of fermentation of starch, total tract starch digestion and faecal starch, compared to ground maize (GM) grain, when fed as part of a high forage diet.

Whole tract starch digestibility was determined in an *in vivo* trial using 6 ruminal-cannulated heifers weighing 416 kg (s.d. 33.7) in a crossover design, as described by Simeone *et al.* (2004). Animals were penned indoors and randomly allotted to 1 of 2 diets: WM or GM grain (1 kg/100 kg liveweight) plus oaten chaff *ad libitum* in 2 sub-periods of 21 days each. After the digestion trial had ended, a 600 g-sample of masticated grain (MAST, wet basis), was manually collected from the distal end of the oesophagus during an eating cycle by partly emptying the rumen and inserting an arm through the rumen cannula. A sub-sample of 200 g was taken for measurement of particle size and the rest was dried at 60^{o}C and kept for *in vitro* incubation. Samples of WM, GM and MAST were separated using 2 screens (5.5 and 2 mm mesh grain), and particles size >2 mm were manually separated into 'whole' or 'broken/damaged kernels'. Grain fractions were dried at 60^{o}C for 48 hours and expressed on a percentage basis by weight. Manual separation of grain particles >2 mm was also conducted on faecal samples, collected during the *in vivo* trial. This trial was complemented by an *in vitro* fermentation assay in each sub-period, based on the procedure developed by Bird *et al.* (1999) to simulate fermentation in the rumen. Samples of MAST and GM grain were incubated for 5 hours in buffered rumen liquor from the animals on the corresponding supplement, after which the starch were measured.

Processing maize grain increased the disappearance of starch *in vitro* (GM=15.3 *v* MAST=5.4%, s.e. 2.99, P=0.016) but the whole tract starch digestibility was unaffected when compared to WM (GM=84.4 *v* WM=83.9%, s.e. 5.8%. P=0.9405). The effect of mastication on grain particle size is presented in Table 1.

Table 1. Type of particles and particle size distribution of as fed samples of whole and ground maize grain and of masticated samples of ingested whole maize grain

Type of particle (%)	Particle size (mm)	Ground	Whole	Masticated
Whole grain	>5.5	0.0	80.3	29.3
	2 to 5.5	0.0	7.8	0.7
Damaged grain	>5.5	0.0	0.0	14.6
	2 to 5.5	19.1	11.9	45.0
Ground grain	<2	80.9	0.0	10.4

More than 70% of the grain arriving in the rumen of animals fed WM was damaged or even ground during ingestive mastication, while only 14.8% of the total grain intake appeared in the faeces as whole kernel and 3.1% as damaged grains, indicating further particle reduction during rumination. Starch content of whole kernels separated in faeces was 77.6% (s.e. 0.36) and did not differ from starch content of whole grain in the diet (76.8%). Starch content of damaged grain in the faeces was higher (83.5%, s.e. 0.29), indicating that some degree of digestion of components other than starch had occurred. It is likely that a longer retention in the rumen and intestinal digestion accounted for similar starch digestion when feeding whole or ground maize.

BIRD, S.H., ROWE, J.B., CHOCT, M., STACHIW, S., TYLER, P. and THOMPSON, R.D. (1999). *Rec. Adv. Anim. Nutr. Aust.* **10:** 53-62.

SIMEONE, A., BERETTA, V., ROWE, J., NOLAN, J. and ELIZALDE, J.C. (2003). *Rec. Adv .Anim. Nutr. Aust.* **12:** 15A.

SIMEONE, A., BERETTA, V. and ROWE, J.B. (2004). *Anim Prod. Aust.* **25:** 314.

Email: asimeone@adinet.com.uy