

RESEARCH NOTE DISAPPEARANCE OF PROCESSED MAIZE GRAIN IN THE RUMEN

Receipt of Ms 01-05-1979

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(Key words: Rumen, maize-grain-form, disappearance, dacron bag)
(Sleutelwoorde: Rumen, mielievorm, verdwyning, dacronsak)

For efficient use of grain in cattle feeding some processing may be necessary (Ørskov, 1973; Chalupa, 1977; Ørskov & Greenhalgh, 1977; Ørskov, 1978; Ørskov, Soliman & Macdearmid, 1978). Feeding grains without any processing can lead to very slow rates of disappearance from the rumen and lower digestibility of maize (Macleod, Macdearmid, & Kay, 1972; Orskov, 1976, Galyean, Wagner & Johnson, 1976; Ørskov *et al.*, 1978; Toland, 1978). Processing can lead to high rates of fermentation, the suppression of cellulose digestion, a cause for ruminal dysfunction and a difference in carcass quality (Fell, Kay, Whitlaw & Boyne, 1968; Andrew & Ørskov, 1970; Garton, 1976; Ørskov, 1978). The rate of fermentation plays a very important part in the voluntary intake of ruminants (Balch & Campling, 1962).

The object of this trail was to obtain an indication of whether the form of maize grain used as supplement for cattle would result in efficiency differences in maize grain utilization.

In this study the rate of disappearance of maize grain from dacron bags in the rumen of sheep as influenced by various processing techniques, both chemical and physical, was examined.

Five mature S.A. Mutton Merino sheep each fitted with a large ruminal cannula were used. All the animals were on a diet of medium quality lucerne hay, offered *ad libitum*.

The rate at which dry matter (DM) and organic matter (OM) disappeared from a dacron bag inside the rumen was measured (Mehrez & Ørskov, 1977). The dacron bags were placed in the rumen simultaneously and were removed after different time intervals. All the bags of a particular treatment were placed in the same sheep. Sheep were randomly allotted to each treatment.

Yellow maize grain of the dent variety was used. Flaked maize was prepared by increasing the moisture content of maize grain to 16 - 18 per cent before being subjected to a steam flaking process. Maize grain was treated with 10, 20, 30, 40 and 50 per cent ($\frac{W}{V}$) NaOH

concentrations to obtain 1, 2, 3, 4 and 5 per cent caustic soda (grams NaOH/100 grams air dry grain) respectively. The NaOH treatment was executed on small scale in the laboratory by means of fine spraying onto the grain. Grain milled through a hammermill was sieved through a standard set of sieves (ASAE, 1975). The particles that were left on sieves with 150 μ , 300 μ , 600 μ , 1,8 mm and 2,36 mm apertures were chosen as experimental particle sizes. Unprocessed maize grain was used as a control. DM was determined at 90 °C in a forced draught oven. OM was determined according to the AOAC procedure (AOAC, 1975).

Results were statistically analysed by regression and covariance analysis where possible. Graphical presentation of the results indicate observed values. Nearest fit lines were drawn by free hand.

Figure 1 shows the DM disappearance of flaked maize and unprocessed maize from the dacron bags.

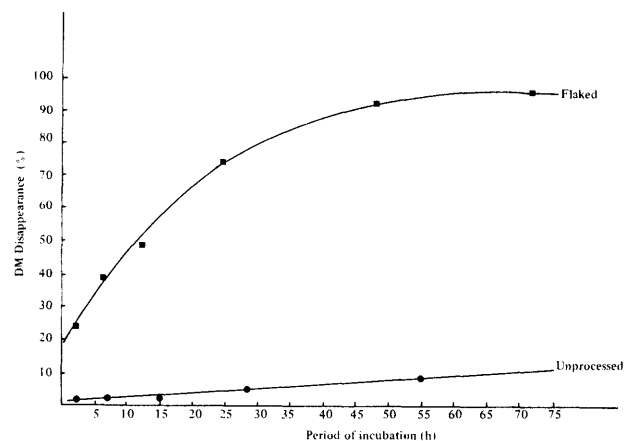


Fig. 1 DM disappearance of flaked and unprocessed maize in the rumen

From Figure 1 it is clear that about 75 per cent of the DM of flaked maize disappeared from the bags within 24 hours. By comparison only 5 per cent of unprocessed maize grain disappeared within 24 hours and after six days about 80 per cent of the original DM of unprocessed maize were still left in the dacron bags. These results are in agreement with the results of Orskov *et al.* (1978) who used barley as grain source.

Figure 2 indicates the rate of disappearance of the OM of maize grain treated with different concentrations of NaOH.

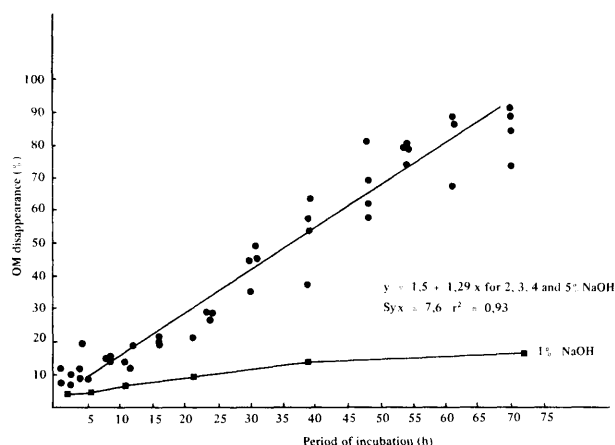


Fig. 2 OM disappearance of NaOH treated maize grain in the rumen.

The disappearance of OM was used in this instance because of the possible effect of DM addition by NaOH. No significant ($P > 0.05$) differences between OM and DM disappearance were found. From the points shown in figure 2 it is clear that the rates of disappearance of 2, 3, 4 and 5 per cent NaOH treated maize grain lie between that of flaked maize (Figure 1) and untreated maize, with about 35 per cent OM disappearance from the dacron bag after 24 hours incubation in the rumen. It is also shown that 1 per cent NaOH treatment was unsuccessful in drastically changing the rate of disappearance from the rumen. These results are also in agreement with the results of Ørskov *et al.* (1978) when barley was used. If the values between 0–4 hours of incubation are omitted, all the observations for 2, 3, 4 and 5 per cent NaOH treatment can be described by one regression line (covariance analysis) ($y = 1.5 + 1.29x; r^2 = 0.93; s_{yx} = 7.6$ per cent where $y =$ per cent OM disappearance and $x =$ period of incubation (h)).

Figure 3 indicates the influence of particle size of maize grain on the rate of DM disappearance from dacron bags in the rumen.

From Figure 3 it is clear that a decrease in particle size increased the rate of DM disappearance from the dacron bag. If these rates are compared to the rates of DM disappearance of flaked maize and NaOH-treated maize it is evident that grain particles smaller than 600μ have a disappearance rate which is faster than that of flaked maize since more than 80 per cent DM disappeared within 24 hours of incubation. Particles larger than 600μ have a slower rate of DM disappearance since 70 and 40 per cent of DM disappeared within 24 hours from 1,18 mm and 2,36 mm particles, respectively. The DM disappearance rate of 2,36 mm particles is closest to that of maize grain treated with NaOH.

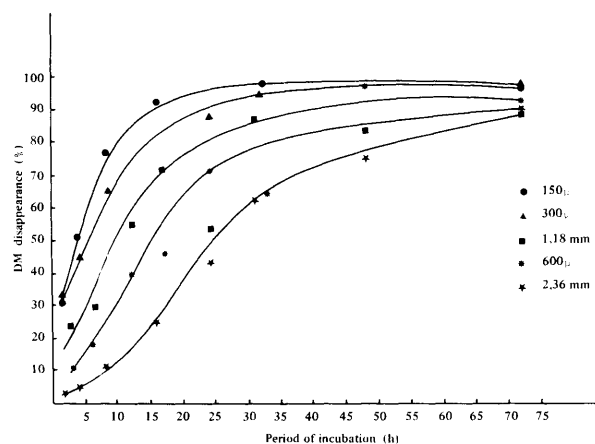


Fig. 3 DM disappearance of maize grain with different particle sizes

Milled grain particles disappear very rapidly from dacron bags placed in the rumen of sheep. Particles between 600μ and 1,18 mm have the same pattern and rate of DM disappearance as flaked maize or rolled barley (Mehrez & Ørskov, 1977; Ørskov *et al.* 1978). Particles smaller than 600μ have a faster rate of DM disappearance from dacron bags in the rumen than flaked maize. From the results it seems possible that the rate of fermentation of maize grain in the rumen, might be changed by changing the particle size of the grain. Milling maize grain by hammermill, however, produces a whole range of particle sizes as indicated in Table 1.

Table 1

Particle size distribution of maize grain hammermilled through a 6 mm of 13 mm sieve

	% Retained on sieve	
	6 mm	13 mm
4,75 mm	0	2,5
2,36 mm	0,4	17,3
1,18 mm	20,0	34,3
600μ	42,8	27,4
300μ	32,0	16,2
150μ	4,8	2,3

Commercial procedures of sieving and cutting maize grain to obtain more homogeneous and specific particle sizes are in use.

The chemical treatment of maize grain with NaOH leads to a rate of DM disappearance about halfway between the rate of very fine particles and unprocessed maize grain. A treatment of 2 per cent of NaOH (grams NaOH/100 grams air dry grain) by spraying with a

20 per cent ($\frac{W}{V}$) solution of NaOH appears to break the pericarp of the grain sufficiently for the rate of DM disappearance from the dacron bag in the rumen to be increased from 5 per cent for untreated whole maize to 32 per cent within the first 24 hours of incubation. From the results one can only assume that differently processed maize grains used as supplement for cattle might produce differences in the efficiency of utilization.

Acknowledgement

The statistical assistance of Dr. C.Z. Roux and technical assistance of Brenda Botha and R. de Jager are gratefully acknowledged. The valuable criticism of Dr. H.S. Hofmeyr is greatly appreciated.

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