

RUMEN DEGRADABILITIES OF SOME CEREAL GRAINS AND BY-PRODUCTS

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High energy concentrates are used to increase animal production. Cereal grains provide fermentable metabolisable energy (FME) and digestible carbohydrate for rumen microbial protein synthesis, and their rate and extent of degradation in the rumen could influence feed utilisation. The *in sacco* technique was used with three rumen fistulated Holstein Friesian steers fed lucerne hay (20% CP), to describe rumen degradation of some cereal grains and by-products available in northern Australia. Disappearance of dry matter (DM) and protein (P) were determined and degradation constants calculated for the equation $P = a + b(1 - e^{-ct})$ (Orskov *et al.* 1980). Quickly degraded (QD), slowly (SD), effective rumen degradation (ERD) and undegraded P (UDP) (g/kg DM) fractions of metabolisable DM and P were calculated using the equation $P = a + (b \cdot c)/(c + r)$ assuming a rumen outflow rate $r = 0.08$ per hour for high production (AFRC 1993) (Table 1).

Table 1. Degradabilities of dry matter (DM) and protein (P) in cereal grains and by-products

Feed	CP (%)	a	b	c	QD	SD	ERD	UDP	ERDP (% CP)
(g/kg DM)									
Dry matter									
Barley (2mm)		16.9	69.4	0.234	169	517	687		
Barley (rolled)		0.0	90.6	0.123	0	549	549		
Maize (2mm)		19.1	78.2	0.073	191	372	563		
Maize (rolled)		9.8	80.4	0.040	98	268	367		
Sorghum (2mm)		18.0	72.2	0.045	180	259	438		
Sorghum (rolled)		1.0	92.8	0.051	10	362	373		
Sorghum (1% HCHO)		3.1	57.6	0.006	31	43	74		
Wheat pollard		46.5	31.2	0.165	465	210	675		
Rice pollard		33.1	57.1	0.087	331	297	628		
Hominy (pellet)		43.1	47.0	0.109	431	270	701		
Protein									
Barley (2mm)	12.0	3.6	91.0	0.157	4	72	76	43	64.0
Barley (rolled)	12.8	0.0	93.7	0.081	0	61	61	67	47.3
Maize (2mm)	10.7	30.0	84.9	0.015	32	15	40	60	43.6
Maize (rolled)	10.9	11.1	69.7	0.016	12	13	23	84	22.9
Sorghum (2mm)	10.4	6.2	82.2	0.035	6	26	31	72	31.2
Sorghum (rolled)	11.8	0.0	85.8	0.031	0	28	28	90	23.6
Sorghum (1% HCHO)	12.3	0.0	11.0	0.031	0	0.4	0.4	122	0.3
Wheat pollard	20.4	55.8	40.1	0.245	114	62	153	28	86.1
Rice pollard	14.1	35.7	55.4	0.106	50	45	85	46	67.3
Hominy (pellet)	13.7	44.7	46.6	0.178	61	44	93	32	76.9

Although initial DM and P solubilities were similar for the grains, other degradation characteristics differed, with only 44% of DM (ERDDM) and 31% of P (ERDP %CP) in sorghum degraded in the rumen, compared with 69% DM and 64% P for barley. Maize was intermediate with 56% DM and 44% P. By-products (hominy, wheat pollard, rice pollard) were more rapidly and completely digested than the cereals, although ERDDM and ERDP (%CP) were similar for rice pollard and barley (2mm). Sorghum potentially may provide more bypass starch and bypass protein (UDP) in ruminant rations, though the practical value of this would require study. At moderate levels of supplementation animal responses to different grains are similar, but at higher feeding levels there is greater potential for incomplete digestion of starch with sorghum. Faecal starch levels $\geq 20\%$ of faecal DM are common for lactating dairy cows fed sorghum (Ehrlich and Davison 1997). Formaldehyde treatment (1% HCHO) of sorghum (2mm) further reduced degradability. Particle size (rolled vs fine milled 2mm) had a negative influence on all *in sacco* measures of rumen degradation. Finer grinding is recommended for uniformity in the *in sacco* evaluation and comparison of feeds.

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