

PROTEIN ECONOMIES IN LACTATING DAIRY COWS FED IRRIGATED HERBAGE WITH OR WITHOUT GRAIN

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Rumen degradation and rate of passage of herbage protein is often too rapid to enable the efficient incorporation of rumen degraded protein (RDP) into microbial crude protein (MCP; Beever 1993). Substantial improvements in production may be made by optimising the conversion of RDP to MCP, through the inclusion of fermentable carbohydrates such as in cereal grains. This was investigated using crushed barley grain as a supplement to ensiled white clover (*Trifolium repens*) fed to lactating dairy cows.

Six rumen fistulated cows were adapted to diets for 14 days and then housed in metabolism stalls for 10 days on 3 occasions, in a balanced cross-over design. Cows were fed either white clover silage alone (WCS) or white clover silage plus 4.6 kg DM of crushed barley grain. The grain was offered in equal amounts twice daily (WCS+2B) or on an hourly basis (WCS+24B). The rumen degradability of crude protein (CP) in the WCS and barley feeds was estimated in these cows, using the nylon bag technique (Orskov and McDonald 1979). From nylon bag and intake data, estimates of the contributions of RDP to MCP, and the contributions of MCP and undegraded dietary protein to metabolisable protein available for production, were made, as outlined in the UK metabolisable protein system (AFRC 1992). Measurements were also made of faecal and urinary CP losses.

In grain-fed animals, a higher incorporation of dietary protein into MCP, resulted in more metabolisable protein available to the animal for production (Table 1). This was possibly attributed to fermentable carbohydrates provided by barley increasing microbial activity and MCP production in the rumen, coupled with lower amounts of protein excreted in the urine. Slightly higher faecal losses of protein (of 4 % units) were observed in cows consuming the supplemented diets, but total (faecal and urinary) protein excreted was lower than for cows fed WCS alone.

Table 1. Crude protein intake (g/day), calculated protein supplies (% of intake), and milk yields (kg/cow/day) of cows fed white clover silage alone (WCS) or white clover silage supplemented with crushed barley grain twice daily (WCS+2B) or on an hourly basis (WCS+24B)

	WCS	WCS+2B	WCS+24B	s.e.d
Crude protein intake	3419 ^a	3275 ^a	3269 ^a	80
Rumen degraded protein (RDP)	72	73	73	-
Microbial crude protein (MCP)	45	56	55	-
Undegraded dietary protein (UDP)	28	27	27	-
Metabolisable protein (MP)	54	60	59	-
Crude protein excreted in urine	27	17	18	-
Crude protein excreted in faeces	19	23	23	-
Total crude protein excreted	46	40	41	-
Milk yield	19.6 ^c	21.9 ^b	22.9 ^a	0.30

^{a,b,c} Different letters within rows indicate significant differences between treatments at $P < 0.05$

Substantial improvements in milk production (of 2-3 kg/cow/day) were noted for animals fed WCS+2B or WCS+24B compared with WCS alone. The metabolisable protein system could not describe the 1 kg difference in milk yield between treatments WCS+2B and WCS+24B. Cows on the WCS+24B diet presumably produced more milk because of a more uniform supply of nutrients to rumen microorganisms and/or the tissues, but the problem of feeding supplements more frequently especially under grazing is not easily resolved.

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