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Urea as a source of effective rumen degradable protein for high-yielding dairy cows

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Introduction

The Agricultural and Food Research Council (ARFC, 1992) suggests that the ratio of effective rumen degradable protein (ERDP) to fermentable metabolizable energy (FME) should be at least 11·5 g/MJ FME for dairy cows yielding above 40 kg/day. The work reported here was carried out to determine the effect of increasing the calculated ERDP : FME ratio on dry-matter (DM) intake and milk production.

Material and methods

Twenty freshly calved Holstein cows were allocated to one of two complete diets (control (C) or test (T)) both based on maize and grass silage (0·75 : 0·25 DM basis). The diets were formulated to meet the metabolizable energy (ME) requirements (AFRC, 1990) for 45 kg milk per day and to supply metabolizable protein (MP) at proportionately 0·1 above current recommendations (AFRC, 1992). Silage analyses for the grass and maize silages respectively were: corrected dry matter (CDM) (oven dry matter +1·9 units) 281, 320 g/kg; pH 3·9, 3·7; crude protein (CP) 148, 75 g/kg CDM; neutral-detergent fibre (NDF) 534, 548 g/kg CDM, estimated ME 11·3, 11·0 MJ/kg CDM and estimated FME 8·6, 8·6 MJ/kg CDM. The starch content of the maize silage was 256 g/kg CDM.

Diet T differed from diet C in that molasses was replaced with 2·0 l proprietary urea/molasses supplement containing 390 g/l CP, 124 g/l urea and 330 g/l sugars. Both diets contained an estimated 12·6 MJ ME per kg CDM, and supplied a theoretical 3135/3502 g MP per day at a calculated ERDP : FME ratio of 8·5/10·8 for diets C and T respectively. DM and nitrogen degradability of diet C were measured in non-lactating dairy cows *in situ* using the polyester bag technique.

Table 1 *Dry matter and nitrogen degradation characteristics of diet C*

	a(%)	*b*(%)	*c*(per h)
Dry matter	46·7	41·6	0·059
Nitrogen	47·3	46·3	0·064

Results

The degradation characteristics of diet C were determined using the method of Ørskov and McDonald (1979). The values are given in Table 1. Diet C had a large immediately soluble fraction for both DM and nitrogen, the *b* fraction was extensively degraded in the rumen and the ERDP and digestible undegraded protein (DUP) values of the complete diets at an outflow rate of 0·08 per h were 116 and 34·9 g/kg DM respectively.

The effects on DM intake, milk yield, milk composition and milk component yields are shown in Table 2. There were no significant differences between diets in silage intake, milk yield, milk composition or milk component yields.

Blood urea levels, measured on days 4 and 11 were 5·2 and 8·1 mmol/l (s.e. 0·38) and 6·5 and 7·7 mmol/l

Table 2 *Total intake (kg dry matter per day), milk yield (kg/day), milk composition (g/kg) and milk component yields (kg/day)*

	Diet		
	C	T	s.e.
Total intake	22·9	22·8	0·85
Milk yield	40·6	39·4	0·83
Fat	34·1	33·9	1·87
Protein	28·6	29·7	0·57
Lactose	47·4	46·8	0·69
Fat yield	1·39	1·27	0·10
Protein yield	1·15	1·10	0·06
Lactose yield	1·93	1·74	0·10

(s.e. 0·34) for diets C and T respectively and were significantly higher on both occasions for cows given diet T compared with diet C ($P < 0·001$).

Conclusions

For dairy cows giving 40 kg milk per day, the addition of urea to a diet with a theoretical ERDP : FME ratio below the optimum did not improve DM intake, milk yield, milk composition or milk constituent yield but tended to increase blood urea levels.

References

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