Effect of potato pulp silage supplementation on milk production in cows grazing temperate pasture

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Introduction In a dairy farming system based on pasture in Japan, maize grain is generally used as an energy source for milking cows, with almost all grain been imported. Potato-pulp is one of the agricultural by-products derived from the starch industry in the northern island of Japan. In our previous study (Aibibula *et al*., 2004), it was demonstrated that potato pulp could be preserved for a long time by ensiling without additives, and that the digestible energy value of potato pulp silage (13 MJ/kg DM) was almost the same as beet pulp. From these results, it is possible that some part of the maize grain fed to grazing cows could be substituted with potato pulp silage (PPS). The objective of this study was to compare PPS with rolled-maize as an energy source for cows grazing on temperate pasture.

Materials and methods Potato pulp silage ensiled in Oct. 2003 was used. From 14 May 2004, twelve primiparous Holstein cows were rotationally grazed on temperate pasture for 20 h a day. During first 34 d (preliminary period), all cows were supplemented with a concentrate, rolled-maize and maize silage. After the preliminary period, the cows were divided into two groups (CG and PP) according to milk yield. In the experimental period, the cows in CG were supplemented with concentrate, rolled-maize and maize silage and the cows in PP were supplemented with concentrate, PPS and maize silage for 28 d. The supplementation level of rolled-maize and PPS was equivalent to 17.5% of the digestible energy requirement of the cows. Throughout the trial, the supplements were offered before and after milking in restricted quantities., Herbage, supplements, milk, blood and rumen fluid samples were collected in the last seven days of the preliminary and experimental periods.

Results Herbage mass before grazing in the preliminary and experimental periods were 222 and 136 g DM/m^2 respectively. Sward heights before grazing in the preliminary and experimental periods were 49.8 and 21.5 cm respectively. The crude protein (CP) content in herbage was higher in the experimental period (21%) than in the preliminary period (11%). Dry matter (DM) intake of the supplement was higher in PP than in CG (Table 1), because the feeding level of supplement in PP was slightly higher compared with CG to meet the digestible energy supply from the supplement. Milk yield did not differ between CG and PP (Table 1). Milk composition was not influenced by PPS supplementation, but milk urea nitrogen concentration (MUN) in the experimental period was lower in PP than in CG ($P<0.05$). Serum urea nitrogen concentration (SUN) in CG was higher than in PP ($P<0.05$). This result suggested that the cost for urea excretion was lower in PP than in CG. Although MUN and SUN in the experimental period were higher in CG than in PP, there was no significant difference in ruminal ammonium nitrogen concentration between CG and PP. Total cholesterol concentration in the serum did not differ between CG and PP, though Hanada *et al*. (2004) showed that total cholesterol in serum was depressed when maize grain was replaced with PPS in the diet of growing steers.

Conclusions These results suggest that maize grain fed to grazing cows as an energy source can be substituted with PPS without decrease in milk production, and that PPS may be an effective energy source for decreasing milk and serum urea levels in cows grazing temperate pasture.

Table 1 Milk yield, urea nitrogen in milk and serum, ruminal ammonium nitrogen and total cholesterol in serum

	Preliminary period		Experimental period	
	CG	PP	CG	PP
DM intake of supplement, kg/d	10.2	10.2	9.7[b]	11.7[a]
Milk yield, kg/d	31.3	31.7	29.0	29.2
Milk composition, %				
Milk fat	3.08	3.16	3.33	3.38
Milk protein	3.21	3.28	3.15	3.26
Lactose	4.84	4.72	4.74	4.61
Milk urea nitrogen, mgN/dl	13.3	13.9	18.4[a]	13.7[b]
Serum urea nitrogen, mgN/dl	12.8	12.5	20.5[a]	15.7[b]
Ruminal ammonium nitrogen, mg/dl	9.7	9.9	10.0	8.2
Total cholesterol in serum, mg/dl	218	227	214	198

[a,b]:$P<0.05$

References

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