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BRIEF COMMUNICATION: The effect of palm kernel expeller as a supplement for grazing dairy cows at the end of lactation

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INTRODUCTION

Palm kernel expeller (PKE) is a solid by-product from the palm oil. In New Zealand it is used as a supplementary feed on dairy farms to fill short term pasture deficits and according to MAF (2007), over 350,000 tonnes of PKE was imported into New Zealand during 2007.

Despite its growing use as a feedstuff for ruminants in New Zealand, information is scarce about the nutritional value of PKE and its effects on milk production when it is incorporated into the diet of pasture grazing ruminants. Overseas research has shown that PKE has a variable nutritional value (O'Mara *et a*l., 1999), and has no effect on milk production when fed to grazing cows fed corn silage and a concentrate (Davison *et al*., 1994), or cows fed a total mixed ration (Carvalho *et al*., 2006). The aim of this research was to evaluate the effect of different amounts of PKE on the milk production of dairy cows grazing pasture in late lactation.

MATERIALS AND METHODS

An experiment was conducted at Massey University's No. 4 Dairy Farm using 60 Friesian cows over a period of 28 days during autumn 2007. At the beginning of the experiment, the cows were 272 ± 17 days in milk (mean ± standard deviation) and were producing 10.4 ± 2.3 kg milk/cow/d.

After a covariate period of five days, when all the cows grazed as one single group, the animals were allocated to one of four treatment groups balanced for their pre-treatment live weight, milk yield, days in milk and age. Treatments were composed of an *ad libitum* pasture allowance (40 kg DM/cow/d; HG0P) or a restricted pasture allowance (20 kg DM/cow/d) plus either 0 (RG0P), 3 (RGLP) or 6 (RGHP) kg of PKE per cow per day on as-fed basis.

Each treatment group was offered a new break of pasture in the same paddock every 24 hours, positioned in a different sequence across the paddock. Cows were milked twice a day at 06:30 and 15:00 h. Following milking, PKE was offered in two equal amounts for about 40 minutes to cows in the RGLP and RGHP treatments.

Individual milk yields were recorded daily and a pooled sample from two consecutive milkings was taken from each cow twice a week for determination of milk composition using near infrared spectroscopy (FT 6000; Foss Electric, Hillerød, Denmark).

The amount of PKE left in the bins by the treatment groups was measured daily while the amount of PKE spilt on the ground was measured when conditions allowed. Samples of PKE offered were taken and bulked for wet chemistry analyses (AOAC, 2005).

A rising plate meter was used daily to estimate pre- and post-grazing pasture masses. These measurements were used to calculate the size of the breaks. Up to 80 height measurements were taken in every treatment break, and pre- and post-grazing quadrats (0.245 m^2) were cut to ground level from all treatments and paddocks and dried for conversion of meter readings to herbage mass. The amount of pasture eaten by each treatment was assessed from the difference between the pre- and post-grazing pasture masses of the areas grazed each day. Five samples of pasture from each break were taken for each treatment and paddock, oven dried and bulked by treatment for laboratory analyses. Pasture samples were analysed using a near infrared reflectance spectrometer (FeedTech, AgResearch Grasslands, Palmerston North).

Statistical analysis

Data were analysed using the PROC MIXED in SAS (2003). Fixed effects consisted of treatment and day. Daily yield of milk and milksolids were treated as repeated measurements with cow nested within treatment. Variances and covariances within the repeated measurements were fitted using a first order antedependance structure, selected based on Akaike and Bayesian information criteria. Grass composition data were analysed as repeated measurements using chemical composition records per paddock, nested within treatment.

RESULTS AND DISCUSSION

Pasture composition did not differ ($P < 0.05$) between paddocks, or between or within treatments throughout the experimental period (Table 1). The

TABLE 1: Least square mean ± standard error of the nutritive characteristics of palm kernel expeller (PKE) and pasture offered to cows in this study.

Nutritive characteristic	PKE	Pasture
Crude protein (g/100g DM)	16.6	18.9 ± 1.33
Neutral detergent fibre (g/100g DM)	73.6	47.2 ± 0.89
Acid detergent fibre (g/100gDM)	40.9	26.9 ± 0.76
Fat (g/100g DM)	9.3	3.0 ± 0.10
Soluble sugars & starch (g/100g DM)	-	13.6 ± 0.44
Starch (g/100g DM)	0.3	-
Ash (g/100g DM)	4.6	10.3 ± 0.15
Organic matter digestibility (g/100g DM)	-	77.4 ± 1.54
Metabolisable energy (MJ/kg DM)	-	11.7 ± 0.23

TABLE 2: Least square mean (± standard error) for estimated dry matter intake (EDMI) of pasture and palm kernel expeller (PKE), and milk and milksolid yield from cows fed *ad libitum* pasture allowance (HG0P) or a restricted pasture allowance offered either 0 (RG0P), 3 (RGLP) or 6 (RGHP) kg of fresh PKE /cow/d.

Parameter	Treatments			
	RG0P	RGLP	RGHP	HG0P
EDMI of pasture (kg/cow/d)	8.8 (± 1.2)	8.3 (± 1.3)	7.1 (± 1.4)	12.5 (± 1.9)
EDMI of PKE (kg/cow/d)	-	2.55 (± 0.12)	3.63 (± 0.80)	-
Milk yield (kg/cow/d)	7.3 (± 0.3)[a]	8.3 (± 0.3)[b]	9.1 (± 0.3)[bc]	11.4 (± 0.3)[c]
Milksolid yield (kg/cow/d)	0.76 (± 0.03)[a]	0.86 (± 0.03)[b]	0.94 (± 0.03)[b]	1.06 (± 0.03)[c]

Means with the same superscript are not significantly different (P <0.05).

nutritive composition of the pasture used during the experiment was considered to be of medium quality with some paddocks being grazed at a more mature stage. This could explain the low milk yields reported in this study.

The chemical analyses of PKE samples are shown in Table 1 and are in agreement with those reported by the literature (O'Mara *et al*., 1999).

Of the 6 kg of PKE (fresh weight) offered to the RGHP treatment group, 40% was refused by the cows, while the corresponding value for the cows offered 3 kg PKE (RGLP) was only 15%. The greater refusals by cows on the RGHP treatment suggest that 6 kg of PKE could be above the maximum voluntary intake of this feed, when offered only for short periods of time, such as twice daily in this study. This could be associated with either the dry nature of PKE or its palatability.

The estimated pasture intake was greatest in the HG0P group, with a mean of 12.5 kg/cow/d (Table 2), while the mean among the restricted pasture allowance treatments was 8.1 kg/cow/d. This difference in pasture intake at different pasture allowances, in the range of 20 to 70 kg DM/cow/d, is consistent with the findings of Wales *et al*. (1998).

Milk yield increased from 7.3 to 11.4 kg/cow/d (Table 2) between the restricted and *ad libitum* pasture allowance treatments. These responses in intake and milk yield are similar to the resuts of Wales *et al*. (1998).For the treatments offered restricted pasture allowances, significant differences in milk yield were found between the RG0P and RGHP (P <0.05), while for milksolids production, RG0P was significantly different from RGLP and RGHP treatments. These results showed that PKE fed with restricted pasture allowance was able to increase the amount of milksolids produced daily. Nevertheless, the milk and milksolids yield of cows fed the restricted pasture allowance, even with the largest amount of PKE, were not as high as cows on the *ad libitum* pasture allowance alone.

Short term marginal responses to the PKE calculated from the data in Table 2 were 39 and 50 g of extra MS/kg of PKE eaten for the lower and higher amounts of PKE respectively. However, if the PKE had been fed in order to delay the date of drying off to extend the lactation period, larger responses would have been expected (Holmes & Roche, 2007).

It was concluded that PKE can be fed as an alternative supplement in late lactation to extend the lactation. However, in this study the response was less than from feeding on autumn pasture of moderate quality.

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