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Relationship between bulk milk urea nitrogen and reproductive performance of New Zealand dairy herds

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ABSTRACT

New Zealand dairy cows grazing lush spring pasture have relatively high plasma urea nitrogen levels as a consequence of the high soluble crude protein content of this rapidly growing pasture. The elevated plasma urea levels have been implicated as a cause of poor reproductive performance in dairy herds. The aim of this trial was to determine if the bulk milk urea nitrogen levels (BMUNs) collected during the period from calving and through mating were related to the reproductive performance of the herds. Bulk milk samples were collected twice a week from 127 farms during the spring of 1998. The farms were suppliers of the NZ Dairy Group and Kiwi co-operatives. Reproductive performance data was collected from all herds. BMUNs were determined spectrophotomically using Sigma blood urea nitrogen kits. The twice-weekly BMUNs were averaged for each farm and these weekly mean values were centred on the nominated week of mating (W=+1) for the individual farms. There were significant among-farm differences in BMUNs with individual weekly farm values ranging from 5.4 to 26.8 (mg/dl) and the mean (W-3 to W+5) value for farms ranging from 9.6 to 18.8 (mg/dl). There were significant between farm differences in reproductive performance. The percentage of cows submitted for AI in first 3 weeks of mating (%SR21) ranged from 29.9 to 95.3%. The percentage of SR21 cows conceiving to that AI (%Preg1) ranged from 39 to 98.6% and the percentage of all cows in the herd pregnant by the end of mating (%Pregall) from 44.9 to 98.4%. There was some indication of a relationship between reproductive performance and BMUNs in that the change in BMUN level from W-3 to W+5 was significantly correlated within geographic zones with %SR21 and %Pregall, correlation coefficients being 0.36 (P=0.013) and 0.37 (P=0.010) respectively. The corresponding correlation for %Preg1 was only 0.21(P = 0.15). Thus farms for which BMUNs rose over the period W–3 to W+5 had higher reproductive performance than those in the same zone, which showed a fall. However, this accounted for very little of the overall variability. Farms were ranked on their reproductive performance and the average weekly BMUNs for the farms in each quartile calculated. There was no difference in the pattern of BMUNs for the different quartiles of each reproductive parameter. Thus, the measurement of BMUNs would appear to be of little value as an indicator or predictor of reproductive performance.

Keywords: Milk urea nitrogen; dairy cows; fertility.

INTRODUCTION

New Zealand dairy cows grazing lush spring pasture have relatively high plasma urea nitrogen levels as a consequence of the high soluble crude protein content of this rapidly growing pasture (Kolver & Macmillan, 1993; Moller *et al*., 1993). The elevated plasma urea levels have been implicated as a cause of poor reproductive performance in dairy herds (Moller *et al*., 1993; Butler, 1998; Larson *et al.*, 1997; Westwood *et al.*, 1998). Milk urea levels are well correlated with plasma urea levels (Roseler *et al*., 1993) and the use of bulk milk measurement has been proposed as a technique for monitoring the nutritional status of herds (Verkerk, 1999). The measurement of bulk milk urea nitrogen levels has been advocated in some quarters as a tool for reproductive management in New Zealand dairy herds.

The aim of this trial was to determine if the bulk milk urea nitrogen levels (BMUNs) collected during the period from calving through mating were related to the reproductive performance of the herds.

METHODS

The 127 selected farms on which complete data was obtained were suppliers of the NZ Dairy Group and Kiwi co-operatives and were participants in the LIC's "fertility monitoring project" (Xu & Burton, 2000).

Reproductive performance data was collected from all herds. Submission rate for the first three weeks of mating was recorded. Conception rate during the first three weeks and overall pregnancy rates were calculated using pregnancy status information. This was obtained by pregnancy diagnosis using palpation per rectum or ultrasonography. Dates of conception were further confirmed from calving information in the following season for cows that remained in the herd (Xu & Burton, 2000).

Bulk milk samples were collected twice a week from farms for a period of 10 weeks during the spring of 1998. The sampling spanned a period from about 4 weeks before the nominated start of mating up to about 6 weeks of mating.

Immediately prior to assay using Sigma blood urea nitrogen kits (# 535) the bulk milk samples were deproteinised using 3% TCA. The urea nitrogen levels (BMUNs) were determined spectrophotomically (530nm wavelength) on a Shimadzu UV –1201 spectrophotometer.

Statistical analyses

Because of possible environmental effects on pasture quality and thus BMUNs, the 'Kiwi' farms were divided into Taranaki (T) & Manawatu (M) zones , and the 'NZDG' farms into Waikato (W), Hauraki Plains (H), Bay of Plenty (B) and Rotorua (R) zones.

BMUN data was analysed using REML to model the variation between and within farms. Reproductive data was analysed using log-linear regression. The relationship of reproduction to BMUN was investigated by stepwise regression of reproductive parameters on weekly average BMUN values, centered on start of mating on individual farms.

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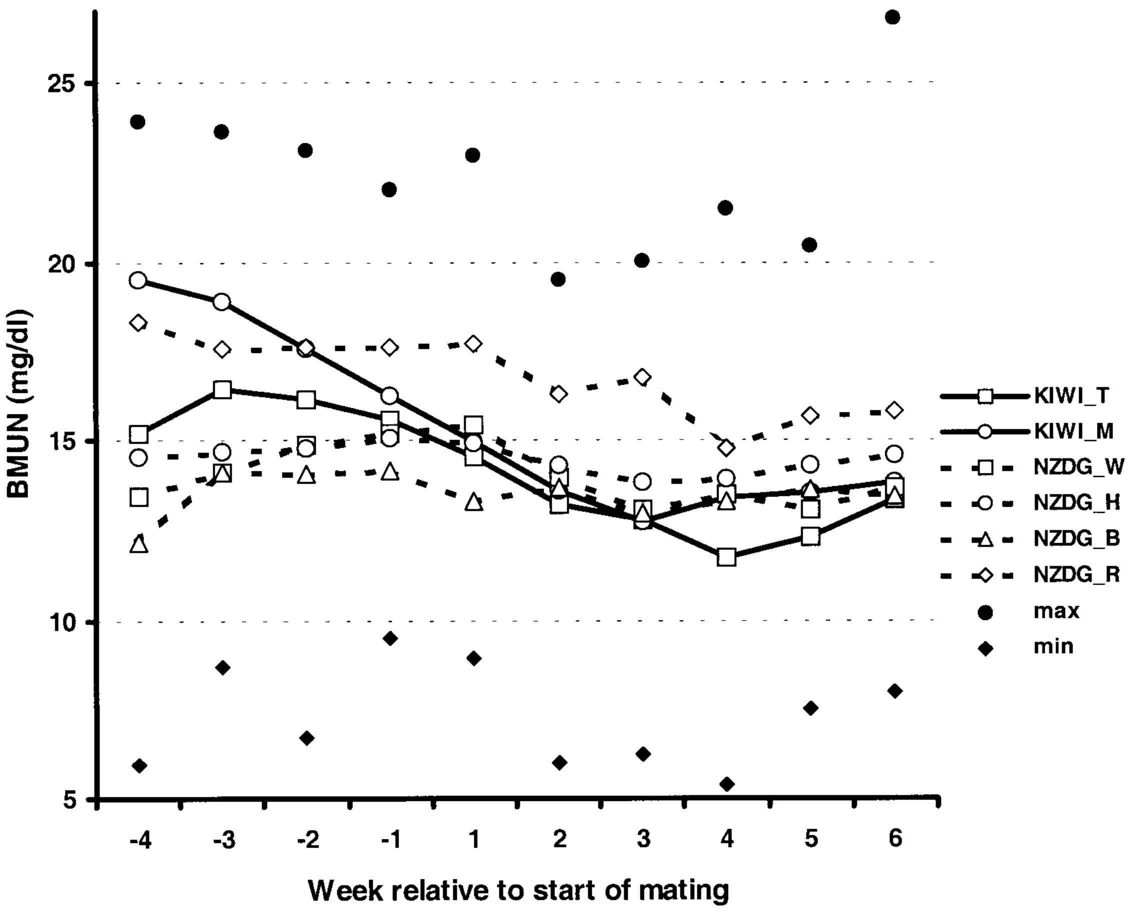
FIGURE 1: Mean weekly bulk milk urinary nitrogen levels (BMUN mg/dl) relative to the start of mating for the six different regional zones and the overall range (max. and min.) for the individual farms in those weeks.



RESULTS AND DISCUSSION

There were significant between-farm differences in BMUNs with individual weekly farm BMUNs ranging from 5.4 to 26.8 (mg/dl) and the farm mean values over the period (W-3 to W+5) for farms ranging from 9.6 to 18.8 (mg/dl). There was a difference between companies in pattern of BMUN relative to start of mating but large within zone effects in the NZDG farms (Figure 1).

There were significant residual between-farm differences in reproductive performance even after company and zone effects were accounted for.

The percentage of cows submitted for AI in first 3 weeks of mating (%SR21) ranged from 29.9 to 95.3%. The percentage of SR21 cows conceiving to that AI (%Preg1) ranged from 39 to 98.6% and the percentage of all cows in herd pregnant by the end of mating (%Pregall) from 44.9 to 98.4%. These values highlight the large variation in reproductive performance that occurs in NZ dairy farms and, thus, the potential for marked improvement on some farms.

There was some indication of a relationship between reproduction performance and BMUNs in that the change in BMUN level from W-3 to W+5 was significantly correlated within zones with %SR21 and %Pregall, correlation coefficients being 0.36 (P=0.013) and 0.37 (P=0.010) respectively. The corresponding correlation for %Preg1 was only 0.21(P=0.15). That is, farms for which BMUNs rose over the period W–3 to W+5 had higher reproductive performance than those in the same zone, which showed a fall. However, this accounted for very little of the overall variability.

Farms were ranked on their reproductive performance and the average weekly BMUN for the farms in each quartile calculated (Figure 2). There were no differences in the pattern of BMUNs for the different quartiles of each reproductive parameter. In fact, examination of the data indicated that farms in the top quartile for reproductive performance were positioned at both extremes of the BMUN levels and a similar picture was seen for farms in the poorer quartiles for reproductive performance. This would indicate that management practices other than those that influence the BMUN levels are responsible for the variation in reproductive performance. Thus, the measurement of BMUNs would appear to be of little value as an indicator or predictor of reproductive performance.

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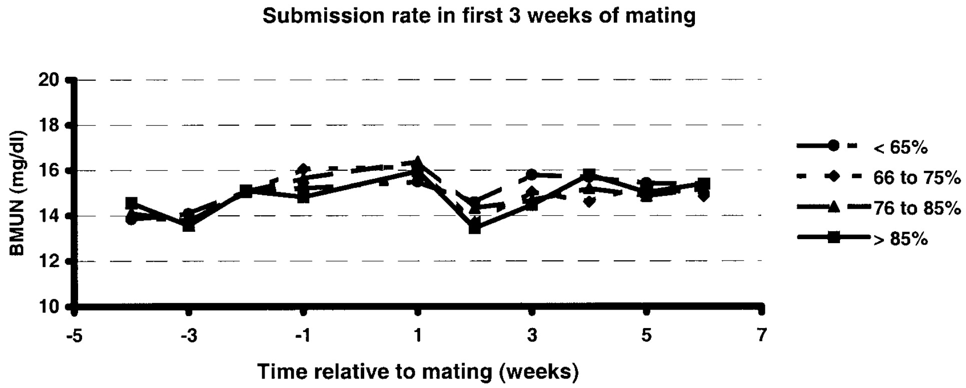
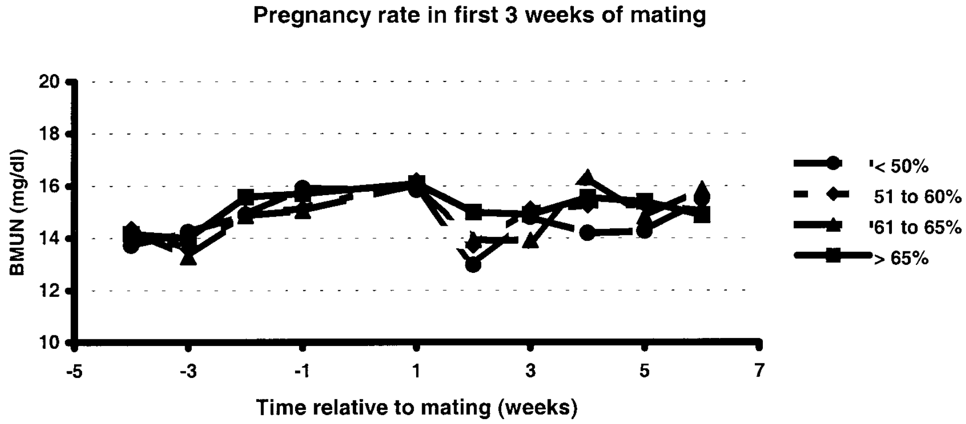
FIGURE 2: Mean bulk milk urinary nitrogen levels (BMUN mg/dl) relative to the start of mating for the farms in the various quartiles of reproductive performance:
2a) Submission rate in first three weeks of mating; 2b) Pregnancy rate in first three weeks of mating and 2c) Overall pregnancy rate.

2a



2b



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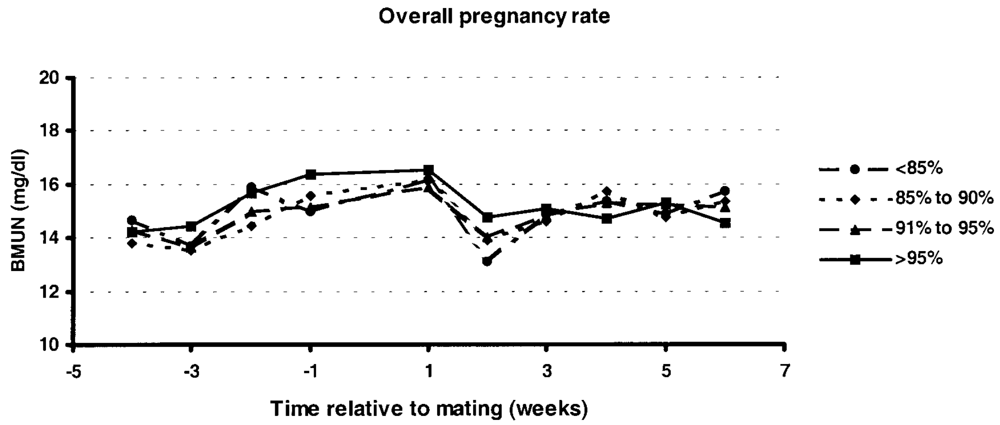

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