**Application**

When autumn-calving, late-lactation, grazing dairy cows were offered low concentrate supplementation levels, concentrate crude protein concentration had no effect on milk production. However, when cows were offered higher supplementation levels, reducing the concentrate crude protein concentration reduced milk protein concentration, milk protein yield and milk solids yield.

**Introduction**

Reducing the crude protein concentration of the diet of dairy cows has been shown to decrease nitrogen excretion, lowering the potential for negative environmental impact (Hynes et al., 2016). However, there is a concern that reducing dietary crude protein may lead to a limitation in the supply of specific amino acids and therefore affect milk production. Previous experiments have demonstrated no effect of reducing the concentrate crude protein concentration on milk production when fed to grazing spring-calving cows during early-mid lactation (Mulligan et al., 2004; Hynes et al., 2016), during late-lactation (Doran et al., 2022) or autumn-calving cows during mid-lactation (Burke et al., 2008). These experiments reported a range in pasture crude protein concentration typically higher than the cows’ requirement (180-240 g/kg DM); however, during the summer period, pasture crude protein concentration can be quite lower. When evaluating the effect of low crude protein concentrates, it is important to consider the supplementation level as greater supplementation levels will have a greater effect on overall dietary crude protein concentration. It is also critical to quantify the milk response and economic viability of concentrate supplementation to late-lactation cows within pasture-based systems. Therefore, the objective of this experiment was to investigate the effect of concentrate crude protein concentration and supplementation level on the milk production of autumn-calving, late-lactation, grazing dairy cows.

**Materials and Methods**

This experiment was conducted at the Teagasc Johnstown Castle Farm (Co. Wexford, Ireland) from May to July, over 2 grazing seasons (2023 and 2024). Sixty-four multiparous and 20 primiparous autumn-calving, late-lactation (211 ± 23 days in milk) Holstein-Friesian dairy cows were enrolled in a 2-wk covariate period. At the end of the covariate period, cows were blocked based on pre-experimental milk production and parity and were randomly assigned to 1 of 4 dietary treatments (*n*=21). The data collection periods lasted 8 and 7 weeks during 2023 and 2024, respectively. The dietary treatments were pasture supplemented with; 1) 0.89 kg of dry matter (DM)/cow per day of concentrate with a crude protein (CP) of 95 g/kg DM (**LL**); 2) 0.89 kg DM/cow per day of concentrate with a CP of 170 g/kg DM (**LH**); 3) 2.67 kg DM/cow per day of concentrate with a CP of 95 g/kg DM (**HL**); and 4) 2.67 kg DM/cow per day of concentrate with a CP of 170 g/kg DM (**HH**). Individual daily milk yields were recorded. Weekly milk samples were analysed for composition using a MilkoScan 7 (Foss Electric). All data were analysed in a repeated measures model using the MIXED procedure of SAS (version 9.4). The model included the fixed effects of diet, week, their interaction and parity, with an appropriate covariate adjustment applied for each cow. Experimental week was included as a repeated effect and cow was included as a random effect. Multiple comparisons between treatment means were made using the Tukey–Kramer method. Significance was considered if *P* ≤ 0.05.

**Results**

Cows fed HH had greater milk yield when compared with cows fed LL and LH (*P* < 0.01) but were similar to cows fed HL. There was no effect of diet on milk fat concentration; however, milk protein concentration was greater for cows fed HH when compared with cows fed HL (*P* = 0.045). Cows fed HH had greater milk fat yield when compared with cows fed LL but were similar to cows fed LH and HL. Cows fed HH had greater milk protein yield and milk solids yield when compared with cows fed LL, LH and HL (*P* < 0.01). Cows fed LL, LH and HL had similar milk production and composition (Table 1).

**Table 1**. Effect of concentrate crude protein concentration and supplementation level on milk production and milk composition of autumn-calving, late-lactation, grazing dairy cows

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Diet1 | | | |  |  |
| Item | LL | LH | HL | HH | SEM | *P*-value |
| Milk yield, kg/d | 17.3b | 17.8b | 18.0ab | 18.8a | 0.30 | <0.01 |
| Fat, g/kg | 45.5 | 45.9 | 45.0 | 44.6 | 0.69 | 0.23 |
| Protein, g/kg | 39.0ab | 38.6ab | 38.4b | 39.1a | 0.29 | 0.05 |
| Fat yield, kg/d | 0.78b | 0.81ab | 0.80ab | 0.83a | 0.02 | 0.02 |
| Protein yield, kg/d | 0.67b | 0.68b | 0.69b | 0.73a | 0.01 | <0.01 |
| Milk solids yield, kg/d | 1.45b | 1.49b | 1.49b | 1.56a | 0.02 | <0.01 |

1LL = pasture + 0.89 kg of DM/day of a 95 g/kg of DM CP concentrate; LH = pasture + 0.89 kg DM/day of a 170 g/kg of DM CP concentrate; HL = pasture + 2.67 kg DM/day of a 95 g/kg of DM CP concentrate; HH = pasture + 2.67 kg DM/day of a 170 g/kg of DM CP concentrate

a-bMeans within row with different superscripts are significantly different (*P* < 0.05)

**Conclusions**

During the summer period, when autumn-calving cows were in late-lactation, lowering the crude protein concentration of the concentrate reduced milk production performance when cows were offered 2.67 kg DM/day of concentrate. There was no effect when cows were offered 0.89 kg DM/day of concentrate. Further analysis is required to determine the nutritive value of the pasture offered, as well as, the metabolic nitrogen status of the cows.

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