**Application**

Red clover has the ability to produce high herbage yields at reduced chemical nitrogen application, and to maintain dairy cow performance.

**Introduction**

The European Green deal set a target to reduce greenhouse gas emissions by 55% and to reach a 20% reduction in inorganic nitrogen (N) fertiliser use by 2030. Perennial ryegrass (Lolium perenne L.; PRG) monocultures are highly dependent on inorganic N to maintain high herbage production. The inclusion of red clover (Trifolium pratense L.) into PRG silage swards without inorganic N application maintained herbage production, similar to PRG monocultures receiving 412 kg of inorganic N/ha/year (Clavin et al., 2016). In grass-based systems, increasing the proportion of grazed pasture in the diet of dairy cows was shown to improve farm profitability (Dillon et al., 2005). During restricted grazing conditions or low pasture supply, cows typically graze by day and are supplemented with silage at night. In indoor feeding systems, dry matter (DM) intake and milk production were improved when red clover silage was fed to dairy cows, when compared to PRG silage (Steinshamn, 2010). The objective of this study was to investigate the effect of silage species and silage feeding rate on the milk production of late lactation dairy cows, within a pasture-based system.

**Materials and Methods**

This study was conducted from mid-September to the end of November 2023. Eighty Holstein-Friesian and Jersey x Holstein-Friesian crossbred dairy cows in late lactation were blocked based on pre-experimental milk production, parity and breed. Cows were then randomly assigned to one of four dietary treatments in a 2×2 factorial design including two silage species (PRG silage (GS) vs. PRG-red clover silage (GRCS)) and two silage feeding rates (restricted to 8 kg of DM/cow (L) vs. ad libitum (H; targeting 5% refusals)). All groups grazed separately by day and received silage at night along with 2.68 kg of DM of a concentrate comprising 166 g of crude protein/kg of DM. The experiment consisted of a 2-wk covariate period, followed by eight weeks of data collection. Individual milk yields were recorded daily, and milk composition weekly. Milk samples from two consecutive evening and morning milkings were collected and analysed using a Milkoscan 7. Weekly milk solids yields (fat yield + protein yield) were then calculated. Data were analysed using a mixed model in R. The fixed effects included in the model were silage species, silage feeding rate, week, their interaction, parity and breed. Cow was included in the model as a random effect and a covariate adjustment was applied for each cow. The repeated effect of the model was based on week. Statistical significance was considered at P ≤ 0.05 and statistical trends at 0.05 < P ≤ 0.10.

**Results**

Cows fed GRCS tended to have higher milk yield than cows fed GS (P = 0.07; Table 1). Cows fed GS had higher milk protein and fat concentrations when compared with cows fed GRCS (P < 0.01), leading to similar milk solids yield among treatments (P = 0.57). Cows fed H silage rates had higher milk protein concentration, when compared to cows fed L silage rates (P = 0.03). There was no effect of silage feeding rate on milk yield, milk fat concentration and milk solids yield (P = 0.48, P = 0.30 and P = 0.89, respectively). There was no interaction between silage species and silage feeding rate.

Table 1. Effect of silage species and silage feeding rate on the milk production and milk composition of grazing dairy cows in late lactation

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Diet1 | | | |  | *P*-value | | |
| Item | H-GS | L-GS | H-GRCS | L-GRCS | SEM2 | Silage | Rate | Silage\*Rate |
| Milk yield, kg/d | 13.5 | 13.7 | 13.9 | 14.2 | 0.26 | 0.07 | 0.48 | 0.94 |
| Protein, g/kg | 44.9 | 44.4 | 43.8 | 43.2 | 0.27 | < 0.01 | 0.03 | 0.84 |
| Fat, g/kg | 62.3 | 60.8 | 59.7 | 59.9 | 0.70 | < 0.01 | 0.30 | 0.19 |
| Protein yield, kg/d | 0.60 | 0.60 | 0.60 | 0.61 | 0.01 | 0.67 | 0.98 | 0.88 |
| Fat yield, kg/d | 0.83 | 0.81 | 0.82 | 0.84 | 0.02 | 0.53 | 0.88 | 0.35 |
| Milk solids yield, kg/d | 1.43 | 1.42 | 1.42 | 1.45 | 0.03 | 0.57 | 0.89 | 0.54 |

1H = *ad libitum* silage; L = 8 kg DM of silage/cow; GS = grass silage; GRCS = grass-red clover silage;

2SEM = standard error of the mean.

**Conclusions**

Feeding grass-red clover silage maintained animal performance, irrespective of the feeding rate. Future research should investigate the environmental impact of feeding red clover silage within a pasture-based system, along with a more in depth study of the physiological mechanisms occurring to explore the reduction in milk protein and fat concentrations from cows fed PRG-red clover silage.

**References**

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