**Application** The increased use of low human-edible feeds in concentrates can improve the sustainability of future milk production systems

**Introduction** The study examined milk production responses of dairy cows offered concentrates differing in their human-edible fraction (HEF) and grass silages harvested at different stages of maturity.

**Materials and Methods** Four treatments (2×2 factorial design) were examined in a three-period partial changeover design experiment using 32 mid lactation dairy cows (mean of 191 days calved). Factors comprised concentrates containing either a low (LE) or high level of human-edible ingredients (HE) and silages harvested at an early (EC) or later (LC) date (4 May and 17 May 2023). The HE concentrate contained significant quantities of cereals and soya-bean meal, while these feedstuffs were replaced with by-product feeds like sugar beet pulp and distillers dark grains in the LE concentrate treatments. The HEF of the LE and HE concentrates were calculated as described by Wilkinson (2011) and were 0.18 and 0.52 respectively. Rations were offered as a partial mixed ration (PMR) comprising 55% grass silage and 45% concentrate on a dry matter (DM) basis. Cows received 0.25 kg of a commercial pellet at each milking. Feed intake, milk yield and milk composition was recorded during the fourth week of each period. Feed conversion rate (FCR) was calculated as energy corrected milk yield (ECM) per kg DM intake (DMI). Edible feed conversion rate (eFCR) was calculated as human-edible output divided by human-edible input per day. Net Food Production (NFP) was expressed as daily human-edible output minus daily human-edible input using HEF values described by Ertl et al. (2015) under current standard extraction allowances. Data was analysed using linear mixed model methodology (REML) with animal and period fitted as random effects and tested for stage of maturity, concentrate type and interactions between these factors.

**Results** The D-value of EC and LC silages were 709 and 690 g/kg DM respectively. Cows offered EC silage had a higher DM intake (P<0.001), ECM yields (P=0.018), milk fat content (P=0.016) and NFP (P=0.015) and a lower FCR (P=0.005) than cows offered LC silage. Concentrate type had no impact on DM intake, ECM yield, milk composition or FCR. Cows offered LE concentrates had a higher eFCR and NFP (P<0.001) than cows offered HE concentrate. There was an interaction between silage maturity and concentrate type for milk protein concentration, where cows offered EC silage and HE concentrate produced milk with a higher milk protein concentration than cows offered EC and LE concentrate (EC-LE, 36.7a; EC-HE, 37.8b; LC-LE, 37.2ab; LC-HE, 36.7a; SED, 0.43; P=0.005). In addition, cows offered EC silage and LE concentrate recorded a higher NFP value than cows offered the other treatments (EC-LE, 759c; EC-HE, 24a; LC-LE, 613b; LC-HE, -1a; SED, 42.8; P=0.048).

Table 1. Dairy cow response to concentrates differing in human-edible fraction and silage maturity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  Maturity |  Conc. |  | P-value |
|  | EC | LC | LE | HE | SED | Maturity | Conc. | Maturity× Conc. |
| Total DMI (kg/day) | 22.9 | 20.2 | 21.4 | 21.8 | 0.60 | <0.001 | 0.292 | 0.179 |
| ECM yield (kg/day) | 31.6 | 30.3 | 30.9 | 31.0 | 0.75 | 0.018 | 0.868 | 0.099 |
| Milk fat (g/kg) | 50.3 | 48.9 | 49.6 | 49.6 | 0.84 | 0.016 | 0.916 | 0.506 |
| Milk protein (g/kg) | 37.2 | 37.0 | 36.9 | 37.3 | 0.43 | 0.358 | 0.248 | 0.005 |
| FCR  | 1.38 | 1.51 | 1.45 | 1.44 | 0.063 | 0.005 | 0.654 | 0.127 |
| eFCR (Energy) | 1.96 | 2.00 | 2.88 | 1.08 | 0.112 | 0.388 | <0.001 | 0.948 |
| NFP(protein) (g/day) | 391 | 306 | 686 | 11 | 42.8 | 0.015 | <0.001 | 0.048 |

**Conclusions** Milk yields can be maintained and eFCR improved by offering concentrates based on low human-edible ingredients with grass silage harvested at differing stages of maturity.

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**References**

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