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Post-grazing sward height imposed during the first 10 weeks of lactation: Influence on early and total lactation dairy cow production, and spring and annual sward characteristics

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ABSTRACT

Increasing the proportion of grazed grass in the diet of the dairy cow is the main target of grass-based milk production systems. Imposing a severe post-grazing sward height (PGSH) in early lactation is one strategy to increase grass utilisation. A grazing experiment was undertaken to investigate the direct and carryover effects of PGSH imposed in early lactation on sward and dairy cow lactation performance. Ninety Holstein–Friesian dairy cows (mean calving date: February 13) were randomly assigned to one of three target PGSH treatments: 2.7 cm (severe; S), 3.5 cm (low; L) and 4.2 cm (moderate; M) from February 14 to April 24, 2011 (period 1; P1). This was followed by a carryover period (period 2; P2) during which cows were randomly re-assigned within their P1 treatment across two PGSH treatments: 3.5 or 4.5 cm until November 13. Sward utilisation (> 2.7 cm) during P1 was significantly improved by decreasing PGSH from M (0.74) to L (0.82) and further to S (0.94). At the end of the entire grazing season, the M treatment swards had produced +1.4 t dry matter (DM)/ha than the S and L treatment swards which had similar total DM yields (14.1 t DM/ha). Treatment had no immediate or carryover effect on the proportions of leaf, stem and senescent material in the sward or the quality of herbage selected by the animals. During P1 the cows in S had greater bodyweight loss (−18 kg), reduced milk (−2.1 kg/day) and milk solids yields (−0.21 kg/day) as well as lower grass DM intake (−1.7 kg DM/day) compared with the cows in L and M, which performed similarly (−5 kg, 24.1 kg/day, 1.94 kg/day, and 13.0 kg DM/day, respectively). There was no carryover effect of early lactation PGSH on milk and milk solids yields, fat and protein concentrations during P2. This indicates that cows restricted in P1 were able to adjust production in accordance with the higher PGSH imposed during the remainder of the lactation. The S treatment had numerically lower, though not significantly lower, total lactation milk and milk solids yields, reflecting their significantly reduced yields in early lactation. It was concluded that grazing to 2.7 cm in early lactation is too restrictive for dairy cows. Cows in L and M had very similar total cumulative production performance. As a result, grazing to 3.5 cm during the first 10 weeks of lactation contributes to achieving both high milk output from pasture and high grass utilisation.

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1. Introduction

Milk quotas have constrained dairy production within the European Union since 1984; however, from 2015 onwards dairy producers will be operating in a more competitive no quota environment and will face increased milk price volatility (Shalloo et al., 2007). In such an environment, dairy enterprises must minimise input costs to maximise profit per litre of milk produced. The proportion of grazed grass in the diet of the dairy cow is highly related to farm profitability: a 2.5% increase in grazed grass in the cow's diet reduces average cost of milk production by 1 €cent/l (Dillon et al., 2005). The most profitable grass-based systems are those that will have seasonal compact calving patterns and achieve high utilisation of grazed grass (Dillon et al., 2008).

Grazing to a low post-grazing sward height (PGSH) in spring has reportedly increased grass utilisation (O'Donovan et al., 2004) and improved herbage nutritive value due to increased sward leaf content (Lee et al., 2007; McCarthy et al., 2012) thereby improving herbage quality for subsequent grazing rotations (Kennedy et al., 2007a; Peyraud and Delagarde, 2013). Emphasis must be placed on the long-term impact of low PGSH on the nutritive value of offered pasture and how this may affect animal production.

Sward defoliation severity has previously been shown to influence grass growth (Parsons and Chapman, 2000; Lee et al., 2008; Tuñon, 2013), but the literature is inconsistent, with most studies undertaken over a short period (Lee et al., 2007) or with PGSH reported that are the result of the stocking rate (SR) imposed (McCarthy et al., 2012) thus PGSH may have fluctuated throughout the grazing season. Therefore, it is essential to assess the effect of PGSH in early spring on immediate and annual pasture productivity.

Striking the correct balance between animal performance and pasture utilisation is a key driver of efficient grass-based systems. Currently, a PGSH of 4 cm is recommended on Irish dairy farms during spring (McEvoy et al., 2008). Ganche et al. (2013) previously investigated the effects of very low PGSH (2.7 vs. 3.5 cm) on early lactation performance and reported high levels of sward utilisation but reduced milk production per cow when grazing to 2.7 cm. Comparison of the effects of low PGSH to the current recommended PGSH of 4 cm is however required. A few studies previously examined very low PGSH under strip-grazing (Stockdale, 1996: 1.6–2.6 cm; Stockdale, 1997: 1.5–3.6 cm; Pérez-Prieto et al., 2011: 2.9–3.7 cm). In the above studies, grass dry matter (DM) intake and subsequent milk production were negatively correlated with decreasing PGSH. There were however short-term experiments (less than 2 months) where PGSH was the result of variations in feed allowances. Low grass growth rates in spring result in cows grazing relatively low pre-grazing herbage mass (HM) swards (Ganche et al., 2013; McCarthy et al., 2013), for which low PGSH are more easily achievable given the dominance of leafy material in the grazing horizon (Pérez-Prieto et al., 2011; Wims, 2011). The animal response to low PGSH may vary as a result of the pre-grazing sward characteristics (Curran et al., 2010; McEvoy et al., 2009). The SR experiment of McCarthy et al. (2013) demonstrated the negative effects on milk yield, protein concentration and animal body reserves when decreasing PGSH from 4.5 cm to 3.6 cm in early lactation. In their study, the reduced herbage availability to the dairy cow compromised energy intake and subsequent milk production. Nonetheless, PGSH was the result of SR and thus fluctuated daily. Therefore there is a requirement to evaluate the immediate impact of maintaining a constant PGSH on early lactation production.

Carryover effects of early lactation nutrition on dairy cow lactation performance are varied. While previous studies have reported the absence of carryover effects of early lactation regime on milk yield, milk constituents, or body-weight (BW) and body condition score (BCS; Friggens et al., 1998; Kennedy et al., 2007b), other studies reported a persistent carryover effect from early lactation feed allowance on milk protein concentration and BCS (McEvoy et al., 2008), and milk fat and protein yields (Roche, 2007) during the subsequent weeks (minimum of 10 weeks). The adaptation of dairy cows to variations in feed supply, such as those that naturally occur in grass based systems, appear to be influenced by stage of lactation (Delaby et al., 2009) and the severity of the treatment imposed (Broster and Broster, 1984). It is critical to determine if imposing a severe PGSH on dairy cows in early lactation will compromise their lactation performance.

The objectives of this experiment were (i) to assess the effect of PGSH imposed in early lactation on immediate, subsequent, and total lactation production performance of spring calving dairy cows, and (ii) to examine the effects of early spring PGSH on sward production and utilisation.

2. Materials and methods

The experiment was conducted at the Animal & Grassland Research and Innovation Centre, Teagasc, Moorepark, Fermoy, Co. Cork, Ireland (50°16'N; 8°25'W) and formed part of a larger overall study designed to examine the effect of different post-grazing sward heights imposed throughout the entire grazing season on both animal and pasture performance. The soil type was a free draining acid brown earth of sandy loam-to-loam texture. The area used was under permanent pasture with a predominantly perennial ryegrass sward (*Lolium perenne* L.) and swards were on average 6 years old. Three late-heading diploid cultivars (Twystar, Gilford, and Tyrella) were initially sown as mixtures. Prior to the experiment, swards were grazed to a similar PGSH (4.2 s.d., 0.48 cm, on average) before closing date the previous autumn (October 27, 2010 on average). Rainfall and mean air temperature data were collected each day of the experiment on the experimental site.

2.1. Experimental design and animals

The experiment was conducted from February 14 to November 23, 2011. Ninety Holstein–Friesian dairy cows (27 primiparous and 63 multiparous) were selected and balanced for expected calving date (February 13; s.d. 17.7 days), lactation number (2.1; s.d. 1.04), dam's first lactation milk yield and composition (first 37 weeks) for the primiparous cows while multiparous cows were balanced on previous lactation milk yield (4588; s.d. 670.8 kg), milk fat