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Early lactation grazing management - the immediate and carryover effects on sward and animal production performance

Key external stakeholders:
Dairy farmers, milk processing companies, animal nutrition companies and consultants

Practical implications for stakeholders:
Spring grazing management and early lactation milk production performance are critical factors affecting the profitability and sustainability of pasture based dairy production systems. This project investigated autumn pasture closing strategies, spring grazing management practices and different approaches to feeding the early lactation cow to maximize milk production performance.

Main results:

- Each 1-day delay in closing from 15 October to 15 November, herbage mass was reduced by 8.6 kg DM/day.
- Offering fresh grass for at least 2-weeks prior to calving had no effect on subsequent animal performance suggesting cows can easily transition from a grass silage to fresh grass diet after calving with no requirement to feed pasture in late gestation
- Grazing to 4.5 cm will increase the availability of grass in the spring when compared to 3.5 cm
- Post-grazing height can be reduced during the first ten weeks of lactation and lower DHA offered until grass growth recovers with no reduction in cumulative milk or sward production.
- Changes to rumen function are driven not only by the characteristics of the concentrate being introduced but also by those of the forage.

Opportunity / Benefit:

These results provide valuable data on the management of pasture and cows in that critical late autumn/early spring period. Management decisions made when closing pastures will impact grass availability in spring. The project also provides beneficial information on feeding pasture based dairy cows in early lactation.

Collaborating Institutions: UCD, Ireland; INRA, France; ECODEV, Australia; Melbourne University, Australia

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1. Project background:

In Ireland, the availability of grass for early spring grazing is critical for spring calving grass-based milk production systems. Since milk quota removal in 2015 milk production has dramatically increased. Higher stocking rates have resulted in increased grass demand, particularly in early spring, a period when grass is in deficit. Consequently strategies to increase grass availability in spring through the manipulation of autumn grazing management practices are of paramount importance. Current recommendations are to turn dairy cows out to pasture directly post-calving however, this results in changes from a grass silage based diet to a grazed grass and concentrate diet. Frequently, it is not just the physiological and metabolic changes which cause a dip in DMI around parturition, there are many health problems that occur in early lactation and have been related to relatively low intakes. It is possible that some of these may result from a rapidly changing diet. Thus, it is important to investigate if offering grazed grass, for example, in late pregnancy can help improve the transition between diets for the early lactation dairy cow and increase DMI and milk yield production. During the first grazing rotation grass growth and consequently supply can be variable, reducing post-grazing sward height in early lactation can make more grass available to the calved herd. However, it is unclear what the long term effects of severe grazing on both sward and cow production performances are. Low post-grazing heights generally reduce milk production but when post-grazing heights increase in line with grass growth during the main grazing season, the question remains whether a compensatory effect in terms of milk production will take place. Similarly, challenges also exist around transitioning cows to high levels of concentrate when pasture is in short supply, investigation is required to determine the correct strategy.

2. Questions addressed by the project:

- Does autumn closing management (post-grazing height) and closing date affect over winter herbage production of perennial ryegrass swards
- Would introducing dairy cows to fresh PRG in the final weeks of pregnancy, thus eliminating a major dietary change at calving, improve the adaptation process, potentially increasing DMI and milk production in early lactation?
- Given variable spring grass growth can post-grazing sward height (PGSH) be used to impose dietary restrictions of varying duration during early lactation? If so what are the immediate and carryover effects on sward production and spring calving dairy cow performance?
- Can different adaptation strategies be used to introduce a large amount of crushed wheat grain to dairy cows previously fed forage only? What are the effects on ruminal fluid pH, volatile fatty acid (VFA) and ammonia concentrations, DMI and milk yield?

3. The experimental studies:

Experiment 1

This experiment investigated three closing dates in the autumn, 15 October (CD1), 1 November (CD2) and 15 November (CD3) and two post grazing sward heights (3.5 cm and 4.5 cm). Herbage mass, sward height, sward morphology and nutritive value were measured on four occasions over the winter, at closing, 15 December, 15 January and 15 February (opening date). Each 1-day delay in closing from 15 October (CD 1) to 15 November (CD 3), herbage mass was reduced by 8.6 kg DM/day. Grazing to 3.5 cm in the final rotation of the previous grazing season reduced the HM at opening in February by 167 kg DM/ha compared to grazing to 4.5cm (809 kg DM/ha). Grass growth was not affected by PGSH at closing, however during a prolonged cold period in year 1, paddocks grazed to 4.5 cm had a significantly (-1.2 kg DM/day) lower growth rate when compared to 3.5 cm (-0.33 kg DM/day). Leaf and stem proportions were affected by PGSH throughout the experiment, paddocks grazed to 3.5 cm had significantly higher proportion of leaf (0.08) and a lower proportion of stem (0.02) at all measurement dates than 4.5 cm paddocks (0.82 and 0.08, respectively). Herbage quality was not affected by either CD or PGSH in the current experiment. The experiment reaffirms previous work on the importance of

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closing date on grass availability in spring; it also concludes that grazing to 4.5 cm will increase the availability of grass in the spring when compared to 3.5 cm.

Experiment 2.
Three weeks prior to their expected calving date, 14 first lactation spring calving dairy cows were assigned to one of two treatments: grass silage prepartum followed by fresh cut PRG postpartum (SG), or fresh PRG both pre and postpartum (GG). For both treatments, DMI increased postpartum, but there was no difference between treatments, pre or postpartum (5.9 and 8.6 kg DM/cow.day, respectively). Numerically the GG cows were producing 2.3 kg more energy corrected milk per day more than the SG cows (20.0 vs 17.7 kg/cow.day), however, this difference was not significant. Body condition score declined following parturition but was not different between the treatments either pre or postpartum. Plasma non-esterified fatty acids, glucose and BHB were also unaffected by treatment but did indicate a state of negative energy balance in early lactation. The results of this experiment suggest that prepartum adaptation to fresh PRG would not benefit milk production in early lactation Irish dairy cows.

Experiment 3.
Eighty spring-calving (mean calving date – 6 Feb s.d 1.2 days) dairy cows grazed to either 2.7cm (S) or 3.5cm (M) from 13 February to 18 March 2012 (P1). For the subsequent five week period (P2: 19 March to 22 April, 2012), half the animals from each P1 treatment remained on their treatment, while the other half of the animals switched to the opposing treatment. Following P2 all cows were managed similarly for the remainder of the lactation (P3: 23 April to 4 November) to measure the deferred effect. Milk production, bodyweight (BW) and body condition score (BCS) were measured weekly and grass dry matter intake (GDMI) was measured on four occasions – approximately weeks 5, 10, 15 and 20 of lactation. Sward utilisation (above 2.7 cm; P1 and P2) was significantly improved by reducing the PGSH from 3.5 cm (0.83) to 2.7 cm (0.96). At the end of the grazing season, there was no effect of PGSH on cumulative grass DM production, the average grass DM production in this study was 15.6 t DM/ha. Grazing to 2.7 cm reduced grass intake by 1.7 and 0.8 kg DM/cow in P1 and P2, respectively, when compared to 3.5 cm (13.3 and 14.0 kg/cow/day, respectively). Cows which grazed to 2.7 cm for both P1 and P2 tended to have reduced cumulative milk yield (-105 kg) and milk solids yield (-9 kg) when compared to cows grazing to 3.5 cm for both periods (1608 and 128 kg/cow, respectively) while both treatments which alternated treatments at the end of P1, had intermediate results. There was no interaction between P1 and P2 treatments. There was also no carryover effect of early lactation grazing regimes on milk and milk solids production in P3. The results of this experiment provide dairy farmers with a strategy to overcome periods of low grass growth at different times during early spring: PGSH can be reduced during the first ten weeks of lactation and lower DHA offered until grass growth recovers with no reduction in cumulative milk or sward production.

Experiment 4.
The effects of a major dietary change on ruminal fluid pH, volatile fatty acid (VFA), lactate and ammonia concentrations, dry matter intake (DMI) and milk yield were measured in 32 dairy cows in late lactation. All cows were initially fed 100% alfalfa hay cubes and were then gradually introduced to a diet with wheat comprising 40% of total dry matter (DM) and alfalfa hay cubes, the remainder. Wheat was gradually substituted for alfalfa via one of four strategies, (1) in 6 small increments (each 6.7% of total DM) over 6 days; (2) in 6 small increments (each 6.7% of total DM) over 11 days; (3) in 3 large increments (each 13.3% of total DM) over 6 days; or (4) in 3 large increments (each 13.3% of total DM) over 11 days. The introduction of wheat in 6 small increments resulted in a lower daily minimum ruminal fluid pH (pH 5.95) when compared to using 3 large increments (pH 6.05). Despite this difference none of the treatments exhibited a ruminal fluid pH that would have compromised ruminal function, nor were there differences in DMI (19.7 kg DM/cow.day) or milk yield (16.0 kg/cow.day). Additionally, there were no differences between ruminal fluid VFA, lactate or ammonia concentrations. It is speculated that the properties of the alfalfa cubes, including a high buffering capacity, helped the ruminal contents resist the pronounced declines in pH often seen with the fermentation of large amounts of wheat. Under the conditions of this experiment the different wheat adaptation strategies did not show any critical differences to rumen parameters. These results suggest that changes to rumen function are driven not only by the characteristics of the concentrate being introduced but also by those of the forage.

4. Main results:

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5. Opportunity/Benefit:

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6. Dissemination:

The primary stakeholders for this research are Irish dairy farmers, animal nutrition companies and consultants. The results of this project have been disseminated through the popular press and at the Teagasc Moorepark Open Days, as well as at scientific conferences and in scientific peer-reviewed publications.

Main publications:

Crosse M. 2007. Grazing management practices to increase spring herbage availability: the effects of post-grazing sward height on sward and animal production characteristics. Masters thesis. UCD.

Crosse, M., M. O'Donovan, T. M. Boland, L. Delaby, E. Ganche, and E. Kennedy. 2015. Using post-grazing sward height to impose dietary restrictions of varying duration in early lactation: its effects on spring-calving dairy cow production. Animal. 9(4):592–603.

Russo V., Leury B., Kennedy E., Hannah M., Auldist M. and Wales B. (submitted) Effects of different wheat adaptation strategies on rumen parameters and dry matter intake of late lactation dairy cows. Animal Production Science.

7. Compiled by: Emer Kennedy

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