Project number: 5798
Funding source: Teagasc
Date: February 2012
Project dates: Nov 2007 to Oct 2011

Strategies to increase the length of the grazing season for spring and autumn calving cows

Key external stakeholders:

Dairy farmers, extension officers, dairy processors

Practical implications for stakeholders:

- Cows can be retained at pasture during periods of heavy rainfall without any poaching damage occurring due to the development of on/off grazing technologies which will lead to an increase in the number of days at grass.
- On/off grazing can also be used as a strategy to allow an earlier turnout date on farms with heavy soil.
- Grazed grass in conjunction with low levels of concentrate can be incorporated into the diet of early lactation autumn calving dairy cows for a 6 week period and cumulative milk production levels similar to TMR fed cows can be achieved.

Main results:

- No reduction in milk yield, milk solids yield, bodyweight or body condition score was observed when animals were allocated two three hour periods of access to grass compared to cows grazing fulltime.
- By adjusting their grazing behaviour (i.e. grazing bites per minute and grass dry matter intake per bite) cows given two three hour periods of access to grass grazed for 5.9 hours (98% of their time at pasture) resulting in no difference in grass dry matter intake.
- By allocating autumn calving cows herbage and a low level of concentrate (1kg DM) during the first 6 weeks of lactation there was a significant reduction in immediate milk production compared to cows offered herbage and either 4 or 8 kg DM concentrate or a TMR. However, when all cows were treated similarly after the initial 6-week period there was no difference in cumulative milk production performance.

Opportunity / Benefit:

This research caters for both spring and autumn calving herds and provides valuable information on how the grazing season can be extended and the proportion of grass in the diet of the dairy cow increased. Increasing the proportion of grass in the dairy cow's diet will reduce feed costs aiding overall farm profitability.

Collaborating Institutions:

UCD, INRA, Teagasc Knowledge Transfer

Contact Emer Kennedy Email: emer.kennedy@teagasc.ie.

Teagasc project team: Dr. Emer Kennedy (PI)
Dr. Michael O'Donovan
External collaborators: Luc Delaby, INRA
Dr. Tommy Boland, UCD

1. Project background:

Soil conditions and inclement weather are two of the biggest limitations affecting the extension of the grazing season on Irish dairy farms. Over 50% of soils in the Republic of Ireland are classified as Podzols, Gleysols or Histosols. These soils are slow draining and practically impervious thereby preventing full-time turnout to pasture in early spring and late autumn, due to a high risk of poaching damage.
Furthermore, due to frequently unfavourable climatic conditions, deteriorating herbage quality and availability, Irish winter milk producers tend to favour retaining autumn calving dairy cows indoors post-partum and offering concentrate based diets.
Currently, farm gate prices are volatile and subjected to fluctuations on world markets thus more low-cost sustainable systems of production for spring and winter milk producers are required. Grazed grass is the cheapest feed available and it has previously been shown that as the proportion of grazed grass in the diet increases costs of production decrease.

2. Questions addressed by the project:

- What is the effect of restricting pasture access time on milk production and composition, bodyweight (BW), body condition score (BCS), dry matter intake (DMI) and grazing behavior of autumn calving dairy cows in early and mid-lactation.
- What is the effect of supplementing dairy cows in early lactation with grass silage when they return indoors after a limited period of access to pasture on animal production performance and grazing behaviour.
- What is the effect of offering three levels of concentrate at pasture to autumn calving dairy cows in early lactation and to compare the milk production performance of these cows to those offered a TMR diet indoors. The study also aimed to evaluate the effect of offering ad-lib TMR during the carryover period on production performance and also total lactation performance.

3. The experimental studies:

Experiment 1 – Effect of restricted access to pasture on production performance of mid-lactation cows

Fifty-two (19 primiparous and 33 pluriparous) Holstein-Friesian dairy cows (mean calving date – 17 August) were balanced and randomly assigned to a four treatment (*n* = 13) study. The four treatments were: full-time access to pasture (22; control); 9 hours pasture access after a.m. milking (9); three hours pasture access after both milkings (2×3); four-and-a-half hours pasture access after both milkings (2×4.5). All treatments were offered a daily herbage allowance of 15.5 kg DM (dry matter)/cow/day (> 4cm) and supplemented with 3 kg DM/cow/day. Fresh herbage was allocated daily. Additional feed was not offered when animals returned indoors. Treatment groups grazed separately for the duration of the study.

Experiment 2 – Effect of restricted access to pasture on production performance of early lactation dairy cows

Fifty-two (20 primiparous and 32 pluriparous) Holstein-Friesian spring calving dairy cows (mean calving date – 31 January) were balanced in a randomised block design. The animals were randomly assigned to a four treatment (*n* = 13) study. The four treatments were: full-time access to pasture (22; control); four-and-a-half hours pasture access after both milkings (2×4.5); three hours pasture access after both milkings (2×3); three hours pasture access after both milkings with silage supplementation by night (2×3S). All treatments were offered a daily herbage allowance of 15 kg DM (dry matter)/cow/day (> 4cm) and supplemented with 3 kg DM/cow/day of concentrate. The 2×3S treatment was offered an additional 3 kg DM of grass silage by night. Fresh herbage was allocated twice daily. Treatment groups grazed separate farmlets for the duration of the study so that effects on subsequent grass re-growth could be established. Pre-and post-grazing sward heights were measured daily. Effect of poaching on re-growth was measured by comparing the DM yield of paddocks grazed fulltime to those where pasture access was restricted.

Experiment 3 – Comparison of grazed grass and a TMR diet on early lactation milk production performance

Forty eight (18 primiparous and 30 pluriparous) autumn calving Holstein-Friesian dairy cows (mean calving date – 12 September; s.d. 15 days), were balanced and randomly assigned to a four treatment study (*n* = 12) at 10 days in milk. The four treatments were: outdoors full-time offered fresh herbage + 1 kg DM concentrate

Contact Emer Kennedy Email: emer.kennedy@teagasc.ie.

(G1); outdoors full-time offered fresh herbage + 4 kg DM concentrate (G4); outdoors full-time offered fresh herbage + 8 kg DM concentrate (G8); indoors full-time offered a total mixed ration (TMR). Fresh herbage was allocated daily to the G1, G4 and G8 treatments. Treatment groups grazed separately for the duration of the study yet were offered similar swards. Each animal was assigned to her respective treatment for a 6-week period; following this 6-week experimental period, cows were housed on a full-time basis and offered *ad-lib* TMR for 13 weeks to monitor carryover effects. The composition of the TMR was on average 4.1 (s.d. 0.55) kg DM/cow/day grass silage, 8.2 (s.d. 0.98) kg DM/cow/day maize silage, 0.7 (s.d. 0.07) kg DM/cow/day straw, 10.4 (s.d. 0.99) kg DM/cow/day concentrate and 1.5 (s.d. 0.133) kg DM/cow/day molasses.

4. Main results:

Experiment 1

The pre-grazing herbage mass of swards offered to all treatments was 1282 kg DM/ha and sward organic matter digestibility was 864 g/kg, indicating high quality swards conducive to high DMI. Swards where animals had 22 hours and 2×4.5 hours access to pasture had the lowest post-grazing sward heights (3.6 cm) reflecting greatest levels of sward utilisation. During the experimental period there were no differences in most milk production parameters (Table 1). However reducing access time to 2×3 hour periods significantly reduced milk protein concentration (-1.3 g/kg) compared to the 22 hour treatment. Furthermore, restricting pasture access time to one period of 9 hours reduced DMI compared to the control treatment. Restricting pasture access time resulted in much greater grazing efficiency as animals from the 9, 2×3 and 2×4.5 treatments spent a greater proportion of their time at pasture grazing (80, 97 and 78%, respectively) than control animals (41%).

Table 1. Effect of restricting access time to pasture for 31-days on milk yield, milk composition, bodyweight change, dry matter intake and grazing time

Treatments (pasture access time)	22	9	2×3	2×4.5	SED	Sig
Milk yield (kg/cow)	22.0	22.6	21.4	21.7	0.30	NS
Milk fat content (g/kg)	41.2	41.8	41.8	40.4	0.61	NS
Milk protein content (g/kg)	35.5a	34.2ab	33.2b	34.3ab	0.29	*
TDMI (kg/cow/day)	17.4a	15.7b	16.6ab	16.3b	0.20	*
Grazing time (mins/day)	540a	431b	349c	425b	8.7	***

NS= Non significant, ***=P<0.001, *=P<0.05. ^{abc} values in the same row not sharing a common superscript are significantly different
TDMI – Total Dry Matter Intake

Experiment 2

The pre-grazing herbage mass of swards offered to all treatments was 1739 kg DM/ha. Supplementing cows with silage significantly increased (+0.7 cm) post grazing height compared to the 3 other treatments (4.1 cm) which will impact on sward quality in subsequent grazing rotations. Full-time access to pasture during inclement weather results in poaching damage. Results from this study show that subsequent re-growth is reduced by 20% (250 kg DM/ha) compared to paddocks where animals grazed for a restricted period of time. During the experimental period there were no differences in most milk production variables (Table 2). However, supplementing cows with silage reduced milk protein content (1.6 g/kg) compared to cows offered full-time access to pasture (33.7 g/kg). The 2×3S treatment had a higher BW due to gut fill. However, there was no difference in BCS between treatments. Restricting pasture access time results in much greater grazing efficiency as animals from the 2×3 treatment grazed for 98% of their time at pasture compared to the animals given fulltime access to pasture (37%). Allocating silage reduced grazing time (56 mins) in comparison to the 2×3 treatment (353 mins).

Table 2. Effect of restricting access time to pasture for 30-days on milk yield, milk composition, bodyweight change, dry matter intake and grazing time

Treatments (pasture access time)	22	2×3S	2×3	2×4.5	SE	Sig
Milk yield (kg/cow)	28.1	29.0	28.5	28.0	0.55	NS
Milk fat content (g/kg)	42.1	43.3	42.6	42.9	0.99	NS
Milk protein content (g/kg)	33.7^{a}	32.1^{b}	32.7^{ab}	32.5^{b}	0.43	0.04
End body weight (kg)	488^{a}	508^{b}	481^{a}	479^{a}	4.4	0.001
Eating time (mins/day)	483^{a}	297^{d}	353^{c}	410^{b}	19.9	0.001

SE = Standard Error ; NS= Non significant, ^{abc} values in the same row not sharing a common superscript are significantly different

Contact Emer Kennedy Email: emer.kennedy@teagasc.ie.

Experiment 3

There was no significant difference in pre-grazing height (12.5 cm) or pre-grazing yield (1,708 kg/DM/ha) between grazing treatments and all grazed to a common post-grazing height of 6 cm. There were differences in the daily herbage allowance of the G1, G4 and G8 treatments (19, 14 and 12 kg DM/cow/day, respectively). Sward utilisation was similar for all treatments (0.77). The grass dry matter intake (GDMI) of the G1, G4 treatments was similar (14 kg DM/cow/day) yet higher than the G8 treatment cows (12.1 kg DM/cow/day). As all concentrate was utilised this resulted in a total DMI of 14.7, 18.2 and 20.1 kg DM/cow/day. When DMI was measured by weighing back refusals it was determined that the TMR cows were consuming 21 kg DM/cow/day. All treatments differed from each other in terms of milk yield (Table 3) – the TMR treatment had the highest milk yield (26.9 kg/cow/day) while the G1 cows had the lowest milk yield and milk solids yield (20.7 and 1.50 kg/cow/day, respectively). However milk solids yield was similar for the G8 and TMR treatments (1.80 kg/cow/day) due to the higher ($P<0.01$) protein content of the G8 milk. There was no difference in body condition score during the experimental period. There was no significant difference between the four treatments in the carryover period in terms of milk yield (23.9 kg/cow/day). However, milk solids yield was highest for the TMR treatment. The G1 treatment had higher milk solids yield (1.68 kg/cow/day) than the G4 and G8 treatments (1.64 kg/cow/day) during the carryover period. Even though the bodyweight of the G1 treatment was lower by the end of the experimental period this difference disappeared after the cows were offered a TMR diet during the carryover period. There was no difference in body condition score during the experimental or carryover period.

Table 3. Milk production performance of autumn calving cows assigned to one of four early lactation experimental treatments

	G1	G4	G8	TMR	SE	Sig
Milk Yield (kg/day)	20.7^{b}	23.4^{c}	25.0^{d}	26.9^{a}	0.48	0.001
Milk Fat Content (g/kg)	39.9^{b}	37.5^{a}	36.0^{a}	37.1^{a}	0.019	0.001
Milk Protein Content (g/kg)	32.1^{a}	32.3^{a}	33.2^{b}	32.4^{a}	0.025	0.01
Milk Solids Yield (kg/day)	1.50^{a}	1.63^{b}	1.72^{c}	1.87^{c}	0.037	0.001
End Bodyweight (kg)	498^{b}	505^{ab}	524^{a}	525^{a}	3.6	0.01
End Body Condition Score	2.52	2.66	2.56	2.68	0.049	0.529

^{abc} values in the same row not sharing a common superscript are significantly different

5. Opportunity/Benefit:

The information generated from this project has been disseminated by knowledge transfer personnel and is currently being integrated into grazing management practices during the spring and autumn to help extend the grazing season thereby reducing feed costs and helping to improve overall farm profitability.

6. Dissemination:

Main publications:

Kennedy, E., McEvoy, M., Murphy, J.P. and O'Donovan, M. (2009). Effect of restricted access time to pasture on dairy cow milk production grazing behaviour, and dry matter intake. *Journal of Dairy Science* 92:168-176

Kennedy E., Lewis E., Murphy J.P. and O'Donovan M. (2010) Comparison of grazed grass and a TMR diet on early lactation milk production performance. In EGF 2010 Grassland in a changing world, Kiel, Germany 29 Aug – 2 Sept. 2010. p. 75

Kennedy, E., Curran, J., Mayes, B., McEvoy, M., Murphy, J.P. and O'Donovan, M. (2011). Restricting dairy cow access time to pasture in early lactation: the effects on milk production, grazing behaviour and dry matter intake. Animal 5 (11) 1805-1813

Kennedy, E., Lewis, E., Murphy, J.P. and O'Donovan, M. (2011). Effects of Level of Grass Inclusion in the Diet of Early Lactation Autumn Calving Dairy Cows on Milk Production Performance. In: British Grassland Society, Belfast, Northern Ireland, 20-Sep-2011, p. 107

Popular publications:

Kennedy, E. and Dunwoody, T. (2011). Grazing management in autumn - extending the grazing season. Ballyhaise Agricultural College Open Day 6/10/11. Teagasc IE p. 25-27

Moorepark 09 and Moorepark 11
National Dairy Conference 2009

7. Compiled by: Dr. Emer Kennedy

Contact Emer Kennedy Email: emer.kennedy@teagasc.ie.