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The Effects Of Offering Concentrates During The Dry Period On Dairy Cow Performance

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Farmer Funded Research

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Reducing Greenhouse Gas Emissions from the Northern Ireland dairy sector through the development of (1) an on-line management tool, and through (2) an on-farm research programme targeted at improving dairy cow health, reproductive efficiency and longevity, via the adoption of improved management strategies during the 'transition period'

SUMMARY

- The period around calving (the transition period) can be highly stressful for the dairy cow. During this time the cow faces the stress of calving, an increased risk of infection and injury, social challenges as she enters the milking herd, a dramatic change in diet, and a rapid increase in milk yield which may lead to an 'energy deficit' and an increased risk of metabolic diseases.
- Nutrition and management during the dry period should prepare the dairy cow to achieve high milk yields and high fertility levels during the following lactation, whilst minimising the risk of metabolic and infectious diseases.
- Feeding concentrates during the dry period is often recommended as a means by which to improve the body condition score of cows prior to calving. In addition, it has been suggested that feeding concentrates during the dry period will 'prepare the rumen' to better cope with the high concentrate diets offered post calving. However, the actual benefits of feeding concentrates during the dry period are unclear.
- This study was conducted to examine the effects of offering concentrates during the dry period on dairy cow performance.
- The study was conducted on 10 Northern Ireland dairy farms over a two year period and involved 1217 dairy cows. These farms had annual milk yields in excess of 8000 litres per cow per year.
- Cows were managed on one of three treatments during the dry period, as follows:
  - Concentrates offered for the full 8 weeks of the dry period
  - Concentrates offered for the final 3 weeks of the dry period
  - No concentrates offered during the dry period
- Concentrate feed levels during the dry period ranged from 2 - 4 kg per cow per day, and averaged 2.7 kg per cow per day.
- Cows on all treatments were offered a 'dry cow' mineral/vitamin supplement for the duration of the dry period, with this considered essential for cow health.
- 88% of cows had a condition score of 2.5 or less at drying off (Low), while 12% of cows had a condition score of 2.75 or higher at drying off (Moderate/High)

- Cows with a Moderate or High condition score at drying off (2.75 or higher) lost more body condition during the dry period and during the first 12 weeks of lactation than those with a Low (2.5 or less) condition score. There is evidence that these 'fatter' cows had lower intakes.
- Neither fat + protein yield nor herd health was affected by condition score at drying off.
- Cows with a Low condition score (2.5 or less) at drying off tended to give birth to lighter calves. These cows also had slightly improved fertility compared to cows with a Moderate/High condition score at drying off.
- For cows managed on high input systems, these results support the recommendation of a target condition score at drying off of 2.75. Cows with a condition score greater than 3.0 at drying off are likely to have lower intakes and may have more health problems during the subsequent lactation. This target condition score (2.75) may not be appropriate for cows managed on low input grazing systems.
- Cows offered no concentrates during the dry period lost slightly more body condition during this period than those offered concentrates. However, this effect was extremely small and was of no practical importance. In addition, offering concentrates during the dry period had no effect on body condition score after calving.
- These results demonstrate that it is extremely difficult to get cows to gain body condition during the dry period, even if concentrates are offered throughout the entire dry period. This highlights an important management strategy, namely that cows should be dried off at the target condition score for calving.
- Offering concentrates during the dry period had no effect on milk production, milk quality or somatic cell count during the subsequent lactation.
- Calf birth weight was unaffected by offering concentrates during the dry period. In addition, during the subsequent lactation neither fertility performance nor cow health was affected by concentrate feeding during the dry period.
- Approximately 30% of cows that were culled during the experiment were culled during the first 60 days of lactation. This highlights the 'challenges' that cows face during early lactation
- Thin cows (condition score of 2.25 or less) offered a forage only diet during the dry

period had an increased risk of being culling during the first 60 days post calving. Some of these 'thin' cows may have been 'saved' with improved feeding and management.

- Cows offered poorer quality silages during the dry period lost more body condition than those offered higher quality silages, although the quality of silage offered had no effect on performance during the subsequent lactation. In general, silages offered to dry cows within this study were of high quality.
- A separate part of this project examined issues relating to 'climate change'. There is now convincing evidence that climate change can be attributed, in part, to increasing concentrations of greenhouse gases within the earth's atmosphere. In addition, the United Kingdom now has legislation in place requiring a very substantial reduction in greenhouse gas emissions during the next few decades.
- Greenhouse gases are produced from many sources. The main greenhouse gases produced from agriculture are carbon dioxide, methane and nitrous oxide. The production of these gases is wasteful, representing a loss of both energy and nitrogen from dairy systems.
- Reducing GHG emissions makes economic sense! More efficient production systems will have lower greenhouse gas emissions, and as such, lower production costs.
- A 'greenhouse gas calculator' was developed within this project to enable farmers to calculate greenhouse gas emissions from their farms. The calculator can be accessed through DARD online services.

BACKGROUND

The period around calving (the transition period) can be highly stressful for the dairy cow. During this time the cow faces the stress of calving, resulting in an increased risk of injury and uterine infection, together with the social changes associated with moving to the milking herd. In addition, the rapid increase in milk yield post calving normally means that the cow is unable to consume sufficient energy to support milk production, and this creates an 'energy gap' which is 'filled' by the cow mobilising her own fat reserves to maintain milk production. This is reflected in a loss of body condition. Excessive body condition loss can predispose the cow to metabolic disorders such as ketosis and fatty liver, and can lead to reduced immunity and an increased risk of infectious diseases such as mastitis. Finally, the change from what is typically a 'low starch' forage based dry cow diet to a 'high starch' lactation diet, can have a negative effect on rumen function.

For these reasons the dry period is normally considered to be a critical period for the dairy cow. In general terms, nutrition and management during the dry period should prepare the dairy cow to achieve high milk yields and high fertility levels during the following lactation, whilst minimising the risk of metabolic and infectious diseases. However, there is still considerable disagreement concerning the optimum diet type that should be offered during the dry period. Indeed, a number of contrasting viewpoints exist. For example, it has been suggested that restricting energy intake by offering a bulky diet containing large amounts of straw will improve rumen function and prepare the cow to deal with tissue mobilisation during early lactation. In contrast, others have suggested that offering concentrates during the dry period will improve body condition and prepare the rumen for the 'higher concentrate' diets offered post calving.

This study was conducted to examine this latter concept, namely the impact of offering concentrates during the dry period on subsequent performance.

AIM OF STUDY

The main aim of this study was to examine the effect of offering concentrates during the dry period on milk production, health and fertility of high-yielding dairy cows.

THE STUDY

Farms and cows:
This study was conducted on 10 Northern Ireland dairy farms. These farms had an average concentrate feed level of 2.5 tonnes per cow per year and an average annual milk yield in excess of 8000 litres per cow. The study was conducted over a two year period and involved a total of 1217 Holstein-Friesian dairy cows. These cows calved between November and May each year.

Treatments:
On each of the farms cows were condition scored at approximately eight weeks prior to calving using a 1 - 5 scale, where 1 = emaciated and 5 = overly fat. Cows were then categorised as having either a **'Low'** or **'Moderate/High'** condition score.

- Cows within the Low group had a condition score of 2.5 or less (88% of cows)
- Cows within the Moderate/High group had a condition score of 2.75 or higher (12% of cows).

Low condition score cows:
Cows within the Low body condition score group were managed on one of three treatments during the dry period, as follows:
- Concentrates offered for the full 8 weeks of the dry period
- Concentrates offered for the final 3 weeks of the dry period
- No concentrates offered during the dry period

Moderate/High condition score cows:
Cows within the Moderate/High condition score group were managed on one of two treatments during the dry period, as follows:
- Concentrates offered for the final 3 weeks of the dry period
- No concentrates offered during the dry period

The cows with a Moderate/High condition score were not managed on the treatment which involved offering concentrates for the full 8 weeks of the dry period. There is much evidence that 'over-fat' cows have an increased risk of health disorders post calving, and as such it would have been inappropriate to risk overfeeding the 'fatter' cows within this group.

The treatments examined within this experiment are summarised in Figure 1.

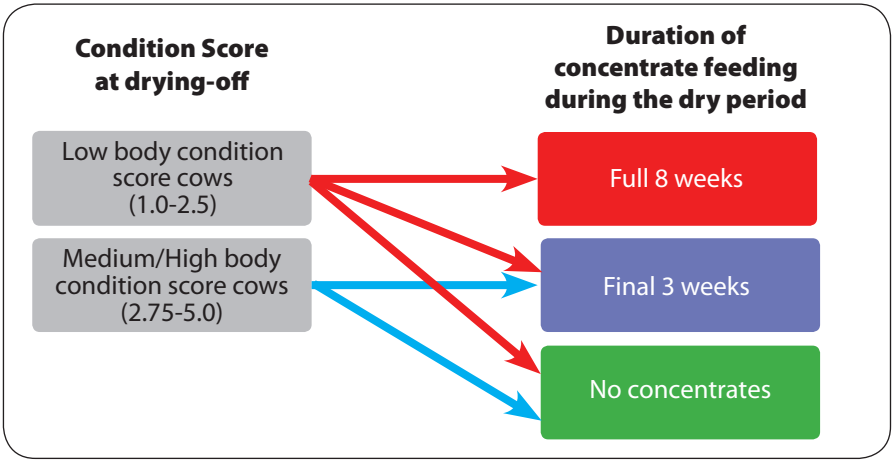


Figure 1: Overview of treatments examined within the study

Diets offered during the dry period

Concentrate intakes during the dry period ranged from 2 - 4 kg per cow per day, and averaged 2.7 kg per cow per day. On the majority of farms a commercial 'dry cow' concentrate was offered. Within each farm cows on all treatments were offered the same forage (or forages) during the dry period. In addition, all cows were offered a 'dry cow' mineral/vitamin supplement for the duration of the dry period, with this considered essential for cow health.

Management post-calving

Management regimes post calving varied from farm to farm, with all feeding decisions made by the participating farmers. In general, cows were offered diets in which the main forage component was grass silage. On most farms concentrate feed levels were increased during the first 2-4 weeks of lactation, with cows then 'fed-to-yield' thereafter. On four of the farms, high-yielding cows remained totally confined throughout the entire lactation period.

Data collection

Data were collected in a number of ways. The participating farmers collected data on calf live-weight, calving difficulty, fertility, health and culling. Information on cow condition score was collected by a member of Hillsborough staff during regular visits to each farm. Milk production and composition data were obtained through official milk recording schemes.

MAIN FINDINGS

The effect of body condition score at drying off on cow performance

Condition score changes: The results presented in Figure 2 demonstrate that cows with a Moderate/High condition score at the time of drying off lost more body condition during the dry period than cows with a Low condition score at drying off. In addition, these cows lost more body condition during the first 12 weeks following calving than cows with a Low condition score at drying off. These effects were particularly dramatic for cows with a condition score greater than 3.0 at drying off. There was a trend for cows in both groups to reach a similar condition score at approximately 12 weeks post calving.

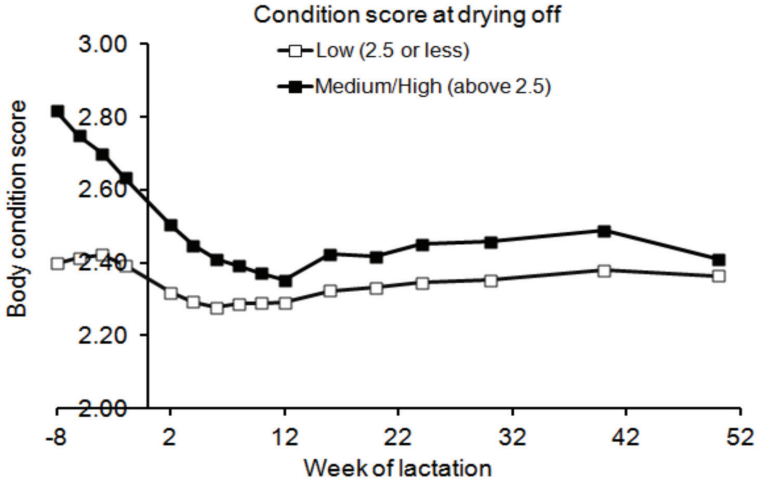


Figure 2: The effect of condition score at drying off on condition score change during the dry period and subsequent lactation

Milk production: Milk production was examined during the first 10 months post calving, with results presented in Table 1. Cows with a Moderate/High condition score at drying off tended to produce more milk than those with a Low condition score. However, cows with a Low condition score produced milk with a higher fat and protein content. The overall result was that fat + protein yield was unaffected by condition score at drying off.

Thus cows within the Moderate/High condition score group lost more body condition in early lactation (Figure 2) while producing a similar yield of milk solids. This suggests that these 'fatter' cows had lower intakes than the 'thinner' cows post calving, and used some of their own body fat reserves to support milk production. This is in agreement with the findings of other studies which have shown that 'fatter' cows have lower intakes and loose more body condition in early lactation.

Table 1 Average milk production during the first 10 months post calving

	Condition score at drying off	
	Low	Moderate/High
Milk yield (kg/day)	26.7	28.0
Milk fat (%)	4.14	4.01
Milk protein (%)	3.33	3.29
Milk fat + protein yield (kg/day)	1.97	2.02

Fertility performance: Cows with a Low condition score at drying off tended to give birth to lighter calves, and to have slightly improved fertility compared to cows with a Moderate/High condition score at drying off (Table 2). This trend towards poorer fertility with the Moderate/High condition score group is likely due to the greater condition score loss experienced by these cows during the dry period and early lactation. However, none of the health parameters examined within this study were affected by condition score at drying off. A greater percentage of cows with a low condition score at drying off were culled during the first 60 days post calving, and this will be discussed in more details later in this booklet.

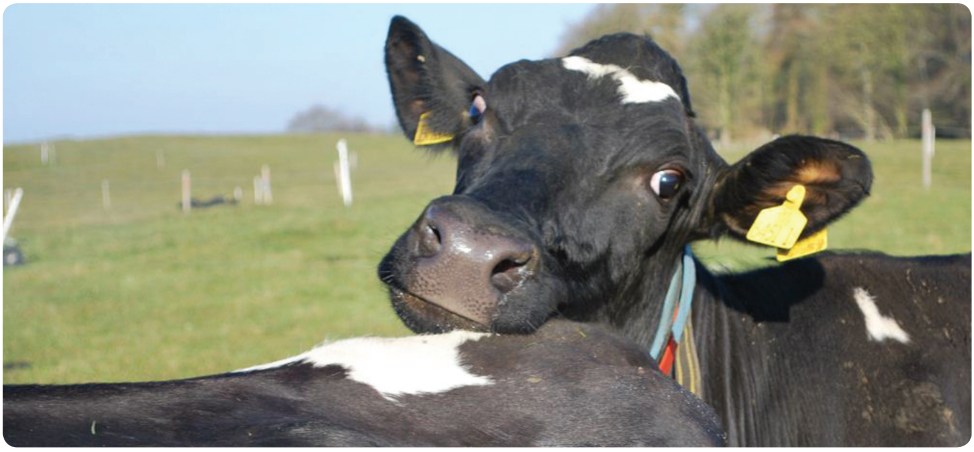
Table 2 Effect of condition score at drying-off on calf birth weight, on cow fertility and health, and on culling rates

	Condition score at drying off	
	Low	Moderate/High
Calf birth weight (kg)	43.4	44.3
Fertility performance		
Conception rate 1st service (%)	31.8	26.4
Conception rate 1st & 2nd service (%)	55.9	47.4
Overall conception rate (%)	79.2	71.9
Cows with health problems		
Metritis (%)	8.5	8.7
Anoestrus (%)	12.2	15.5
Culling rates		
During days 1 – 60 post calving (%)	6.9	2.7
Overall culling rate (%)	21.2	24.2

Effect of concentrate feeding during the dry period on cow performance

Body condition score: The effects of offering concentrates during the dry period on body condition changes are presented in Figure 3 for cows within the Low body condition group and in Figure 4 for cows within the Moderate/High condition score group. Within both condition score groups cows offered no concentrates during the dry period lost slightly more body condition than those offered concentrates. However, this effect was so small that it was of no practical importance. In addition, offering concentrates during the dry period had no long term effect on body condition score changes after calving.

These results clearly demonstrate that it is extremely difficult to get cows to gain body condition during the dry period, even if concentrates are offered throughout the entire dry period. One reason for this is that the intakes of dry cows fall during the weeks prior to calving, with dry cows frequently entering negative energy balance at this time. This emphasises an important management strategy, namely that cows should be dried off at the condition score at which they should calve. In the case of cows which are managed on high concentrate input systems post calving, the target condition score at drying off is 2.75. Feeding concentrates to cows at the levels adopted within this study (2 – 4 kg/cow/day) is unlikely to result in any substantial gain in condition score during the dry period.



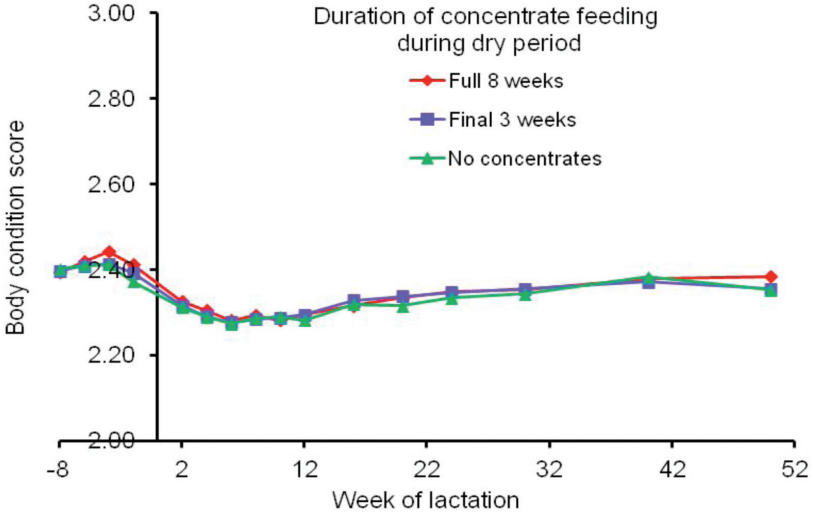


Figure 3: The effect of concentrate feeding during the dry period on condition score change during the dry period and subsequent lactation, for cows within the Low condition score group (2.5 or lower) at drying off

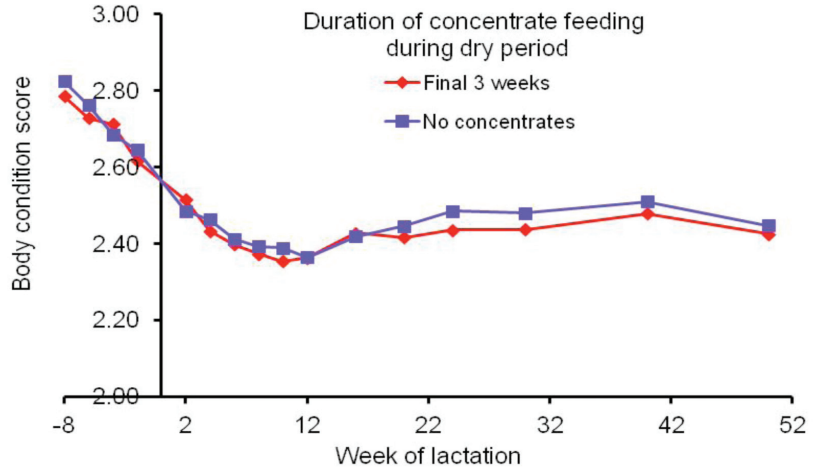


Figure 4: The effect of concentrate feeding during the dry period on condition score change during the dry period and subsequent lactation, for cows within the Moderate/High condition score group (2.75 or greater) at drying off

Milk production: The effects of offering concentrates during the dry period on milk production during the subsequent lactation are presented in Table 3. The results of this study clearly demonstrate that irrespective of condition score at drying off, offering concentrates during the dry period had no effect on milk production or milk quality during the subsequent lactation.

Table 3: Effect of concentrate feeding during the dry period on average milk production during the first 10 months post calving, for cows within the Low and Moderate/High condition score groups

	Duration of concentrate feeding during the dry period		
	Full 8 weeks	**Final 3 weeks**	**No concentrates**
Low condition score group			
Milk yield (kg/day)	26.9	26.8	26.7
Milk fat (%)	4.13	4.08	4.09
Milk protein (%)	3.30	3.32	3.31
Milk fat + protein yield (kg/day)	2.00	2.03	1.97
Moderate/High condition score group			
Milk yield (kg/day)		26.9	27.3
Milk fat (%)		4.04	3.99
Milk protein (%)		3.29	3.25
Milk fat + protein yield (kg/day)		2.02	2.04

Fertility and health: Table 4 highlights that calf birth weight was unaffected by offering concentrates during the dry period. In addition, irrespective of which condition score group cows were in at drying off, offering concentrates during the dry period had no effect on either fertility performance or cow health during the subsequent lactation.

Culling: The effects of concentrate feeding during the dry period on culling rates are presented in Table 5. Across all treatments, approximately 30% of cows that were culled during the experiment were culled during the first 60 days of lactation. This value can be attributed to the early lactation challenges described previously, which increase the risk of culling.

Within the Low condition score group at drying off, concentrate feeding had no effect on either culling rates during the first 60 days post calving, or on overall culling rates (Table 5). However, when very thin cows were examined (condition score of 2.25 or less) a greater number of these very thin cows managed on the 'No concentrate' treatment were culled during the first 60 days post calving, compared to the other treatments (Figure 5). While the reason for this is unclear, it is possible that thin cows offered no concentrate supplement had reduced immune function during early lactation. Some of these 'thin' cows may have been 'saved' with improved feeding and management.

Table 4: Effect of concentrate feeding during the dry period on calf birth weight and cow fertility and health, for cows within the Low and Moderate/High condition score groups

	Duration of concentrate feeding during the dry period		
	Full 8 weeks	**Final 3 weeks**	**No concentrates**
Low condition score group			
Calf birth weight (kg)	43.7	43.6	43.4
Fertility performance			
Conception to 1st service (%)	34.4	29.6	32.3
Conception to 1st & 2nd service (%)	57.4	52.9	56.6
Overall conception rate (%)	77.8	78.0	81.0
Cows with health problems			
Metritis (%)	8.5	7.6	8.3
Anoestrus (%)	13.4	13.2	13.7
Moderate/High condition score group			
Calf birth weight (kg)		44.1	43.8
Fertility performance			
Conception to 1st service (%)		26.0	24.5
Conception to 1st & 2nd service (%)		46.9	54.7
Overall conception rate (%)		69.6	79.5
Cows with health problems			
Metritis (%)		11.1	11.3
Anoestrus (%)		14.4	10.4

Table 5: Effect of concentrate feeding during the dry period on culling rates within the Low and Moderate/High condition score groups

	Duration of concentrate feeding during the dry period		
	Full 8 weeks	**Final 3 weeks**	**No concentrates**
Low condition score group			
Culling rate during first 60 days post calving (%)	6.2	6.6	7.5
Overall culling rate (%)	21.8	20.6	21.2
Moderate/High condition score group			
Culling rate during first 60 days post calving (%)		0	6.5
Overall culling rate (%)		18.4	29.5

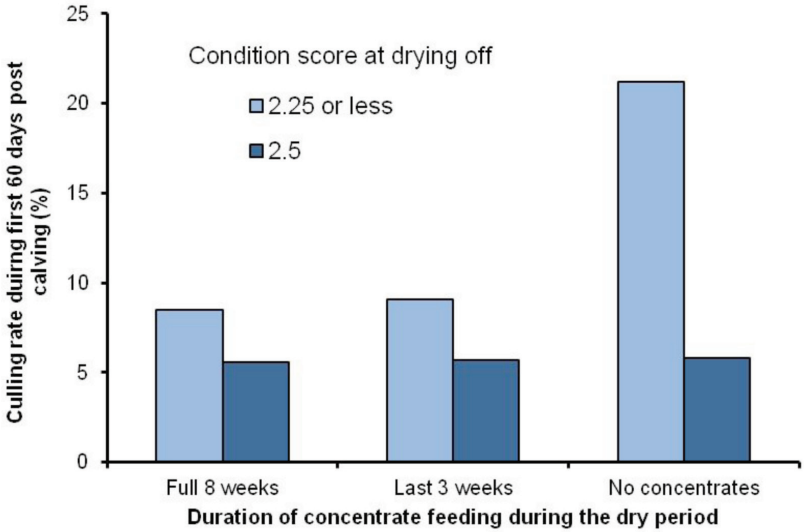


Figure 5: Effect of offering concentrates during the dry period on culling rates during the first 60 days post calving for cows with a condition score of 2.25 or less, and for cows with a condition score of 2.5

Effect of silage quality on condition score change:

Cows offered poorer quality silage during the dry period lost slightly more body condition than those offered higher quality silages. However, the quality of silage offered during the dry period had no effect on milk production during the subsequent lactation. Nevertheless, the silages offered within the current study (average dry matter = 27%, crude protein = 14% DM, metabolisable energy = 11.2 MJ/kg DM) were of higher quality than those commonly offered to dry cows within Northern Ireland. Based on the trends observed, offering a poorer quality silage would almost certainly have resulted in a greater body condition score loss, although the likely impact on performance is unknown.

Key conclusions and recommendations

Cows with higher condition score (greater than 3.0) as drying off lost more body condition during the dry period and post calving that those with lower conditions scores. As fat + protein yield was unaffected by condition score at drying off, these 'fatter' cows are likely to have had lower intakes post calving, while also tending to have poorer fertility.

For cows managed on high concentrate input systems post calving, these results support the recommendation of a target condition score at drying off of 2.75. A target condition score of 2.75 is unlikely to be appropriate for cows managed on low input grazing systems

Offering concentrates during the dry period at the levels used in this study (2 – 4 kg/cow/day) did not result in any practical improvement in body condition. These results demonstrate that it is extremely difficult to get cows to gain body condition during the dry period. This highlights an important management strategy, namely that cows should be dried off at the target condition score for calving.

When cows have a condition score of 2.5 or above at drying off, and are offered good quality silage together with a quality dry cow mineral supplement during the dry period, there are unlikely to be milk yield, health or fertility benefits arising from offering concentrates during the dry period.

However, when cows are very thin (condition score of 2.25 or less) at drying off the quality of the dry cow ration would appear to be more important. Thin cows which received no concentrates during the dry period had an increased risk of being culled during the first 60 days of lactation.

Calculating the carbon footprint of Northern Ireland dairy systems

Climate change and greenhouse gas emissions

The temperature of the earth's atmosphere has increased during the last century, and this is now having an effect on global climate patterns. In addition, there is convincing evidence that 'climate change' can be attributed in part to increasing concentrations of greenhouse gases within the earth's atmosphere. Greenhouse gases are produced from many sources, some natural, others directly related to 'human activities'. Human activities which lead to the production of greenhouse gases include transport, electricity generation, domestic heating, and agriculture. Within Northern Ireland approximately 26% of total greenhouse gas emissions are from agriculture, compared to only 9% within the UK as a whole. This difference simply reflects the importance of Agriculture within the local economy.

Why is this important for Northern Ireland dairy farmers?

1) Many governments are setting targets by which greenhouse gas emissions should be reduced, and there is increasing pressure to meet these targets.

2) Supermarkets are increasingly interested in being able to demonstrate that the produce they sell has a low 'carbon footprint', and in the future may seek to source milk from farmers who are able to demonstrate that their production

systems are associated with low greenhouse gas emissions.

3) Greenhouse gases represent a loss of both feed energy (in the form of methane) and nitrogen (in the form of nitrous oxide) from your farm. This costs you money!

4) There is considerable uncertainty about the long term impact of global climate change on our local climate. Nevertheless, climate change could make farming within Northern Ireland more difficult.

Which are the main greenhouse gases?

The main greenhouse gases produced from agriculture are carbon dioxide, methane and nitrous oxide.

- Carbon dioxide: is produced from burning fossil fuels (i.e. diesel in tractors, coal during electricity production, and gas during the manufacture of fertilisers).
- Methane: is produced by natural processes which takes place when bacteria within the rumen of cattle digest food, and is lost through the cow's mouth when she belches. Although it is a natural process, it represents a loss of energy, with approximately 7% of the energy which a cow consumes lost as methane! This is energy which could have been used for milk production. The amount of methane produced is influenced by the amount of food consumed and by the type of diet offered. Methane is also produced at a much slower rate when bacteria 'digest' slurry in slurry tanks. Methane has a 'global warming potential' that is 25 times greater than carbon dioxide.
- Nitrous oxide: is produced when bacteria break down nitrogen. This takes place within the soil when nitrogen from fertilizers, manures and the soil's own nitrogen reserves are broken down. Nitrous oxide is also released when bacteria breakdown nitrogen within slurry in slurry stores. Nitrous oxide has a

'global warming potential' approximately 300 times greater than carbon dioxide.

Calculating the 'carbon footprint' of dairy systems

Total greenhouse gas emissions from a farm can be calculated using a greenhouse gas calculator. In the case of a dairy farm, emissions are normally presented as 'emissions per kilogram of milk produced', and this is normally referred to as the 'carbon footprint' of the milk produced. In order to be able to account for the different global warming potentials of carbon dioxide, methane and nitrous oxide, total emissions from all sources are expressed as 'carbon dioxide equivalents' (CO_2-e).

A greenhouse gas calculator (The AFBI Dairy Systems Greenhouse Gas calculator) was developed within the current project. Where possible, this calculator has been developed using the results of research undertaken within Northern Ireland, thus improving the accuracy of the calculator for local dairy systems. As part of this project, the greenhouse gas calculator was used to calculate the mean carbon footprint of seven of the farms that participated within the dry cow study described earlier.

Average carbon footprint of the farms participating in the experiment

Across these seven farms, total whole farm emissions associated with milk production averaged 1822 tonnes CO_2e (per farm), with 75% of these emissions arising 'on-farm' and 25% of emissions arising 'off-farm'. The 'off-farm' emissions were largely associated with the production and transport of fertilisers, concentrates and electricity generation, and must be included within the carbon-footprint of milk produced on the farm.

Figure 6 summarises the average greenhouse gas emissions per kilogram of milk produced across the seven farms. The top green bar indicates that total emissions per kilogram of milk were 970 grammes. Of this, the largest source of emissions was methane from rumen fermentation (40% of emissions), followed by emissions from manure (18%), concentrate production and transport (16%) and fertiliser production and application (13%). Emissions associate with land use and land use change, fuel and electricity, and veterinary products/wrapping etc each represent no more than 5% of total emissions.

A single bar appears to the left hand side of the graph, and this represents carbon sequestration. This is the process by which the soil 'locks up' carbon dioxide from the atmosphere, and thus reduces greenhouse gas emissions. While there is still much uncertainty about the importance of this process, carbon sequestration is known to be high under grasslands.

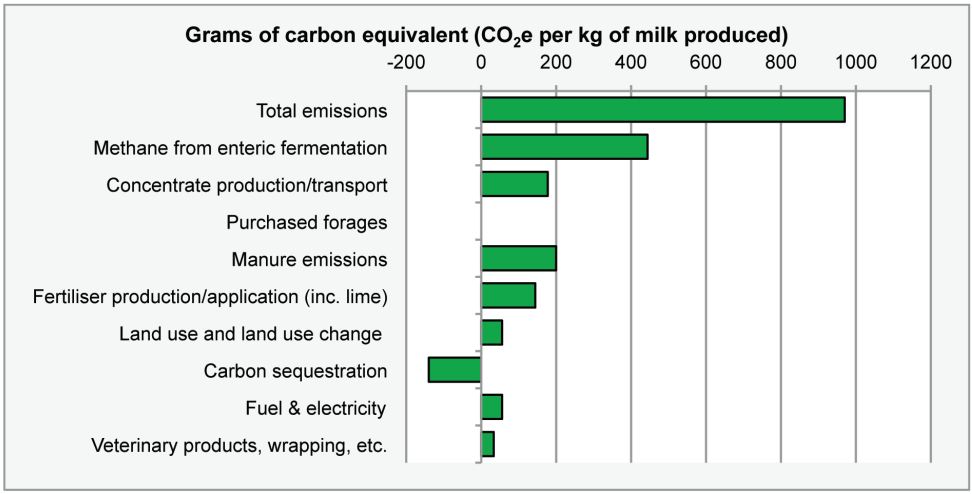


Figure 6: Average greenhouse gas emissions per kg of milk (CO2e) for farms participating in the dry cow study

Reducing GHG emissions makes economic sense!

The good news is that more efficient dairy farming systems will have lower greenhouse gas emissions per litre of milk produced, and this should be reflected in lower production costs. In seeking to improve the efficiency of your production system, for example by improving cow fertility and health, by making more efficient use of fertiliser nitrogen and manures, and by improving milk yield per litre of concentrate fed, you will reduce the carbon footprint of your system, while improving farm profit at the same time.

Calculate the carbon footprint of your own farm

The calculator developed within this project is now available for use by Northern Ireland dairy farmers. By inputting your own farm information, you will be able to determine the carbon-footprint of your farm. The calculator can be accessed through DARD online services.

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2 DAIRY
A Comparison of Four Grassland-Based Systems of Milk Production for Winter Calving High Genetic Merit Dairy Cows

3 DAIRY
Dairy Herd Fertility - Examination of Effects of Increasing Genetic Merit and other Herd Factors on Reproductive Performance

4 SHEEP
Developing Low Cost 'Natural-Care' Systems of Sheep Production

5 BEEF
An Examination of Factors affecting the Cleanliness of Housed Beef Cattle

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Effective Footbathing of Dairy Cows

14 DAIRY
Effects of Feeding Forage Maize and Whole Crop Silages on the Performance of Dairy Cows Offered Two Qualities of Grass silage

15 BEEF
Maximising Beef Output from the Suckler Herd Through the Production of Heavy Bulls

16 DAIRY
The Effect of Reducing the Protein Content of the Diet on the Performance of Dairy Cows

17 DAIRY
Comparisons of Dairy Cow Management Strategies which Differ in Labour Inputs

18 DAIRY
Reducing Phosphorous Levels in Dairy Cow Diets

19 DAIRY
The Effect of Applying Slurry During the Grazing Season on Dairy Cow Performance

20 BEEF
Contribution of Meat (Beef and Lamb) from Grass-Fed Ruminants to the Total Human Dietary Intake of Long Chain N-3 Polyunsaturated Fatty Acids.

21 BEEF
Maximising Returns from Beef Sourced from the Dairy Herd

22 DAIRY
A Comparison of the Performance of Holstein-Friesian and Norwegian Red cows on Northern Ireland Dairy Farms

23 DAIRY
The Effect of a Number of Novel Supplementation Strategies on Milk Production and Fertility of High Yielding Dairy Cows

24 DAIRY
A Comparison of the Performance of Holstein-Friesian and Jersey Crossbred Cows across a Range of Northern Ireland Production Systems

25 DAIRY
The Effect of Applying Cattle Slurry as the Sole Source of Nutrients over a Four Year Period on the Yield and Persistency of Seven Perennial Forage Crops

26 DAIRY
Grassland performance and its relationship with profitability on 10 Northern Ireland dairy farms

27 DAIRY
The Effect of offering concentrates during the dry period on dairy cow performance

For further information or to request a copy of the the full scientific report detailing the experimental tests and statistical analysis contact

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