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The effect of early lactation concentrate build-up strategies on dairy cow performance

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'Effect of early lactation nutritional strategies on the health, reproductive performance and milk production performance of lactating dairy cows'

SUMMARY

High yielding dairy cows are unable to consume enough food in early lactation to meet their energy requirements, and may enter a prolonged period of negative energy balance.

Negative energy balance is reflected in loss of body condition, and is also associated with metabolic disorders, lower immunity, and a decline in 'functional traits' such as health and fertility. The majority of production diseases occur in early lactation before cows reach their maximum milk yield.

To help meet their higher nutrient requirements, the quantity of concentrates offered to cows is normally increased rapidly in early lactation. However, high yielding cows may increase their milk yields in response to additional concentrates, and this may actually make the situation worse. In addition, feeding more concentrates will reduce the amount of forage that the cow consumes, and these two factors can lead to rumen health problems.

It has been suggested that these problems might be addressed by introducing concentrates into the diet of fresh calved cows at a slow rate, and by reducing the protein content of the concentrates offered. A slower or delayed build-up of a lower protein concentrate might slow the rate of increase in milk production in early lactation so that it better matches the cow's energy intake, thus reducing the extent of negative energy balance. In addition, this approach should increase the amount of forage in the diet, thus reducing the risk of rumen problems.

To examine this concept, three separate experiments were undertaken by scientists at the Agri-Food and Biosciences Institute (AFBI), Hillsborough.

Experiment 1
This study examined the effect of adopting either an Immediate or Delayed concentrate build-up strategy in early lactation on dairy cow performance.

Cows on both strategies were offered a common 'basal diet' from calving onwards (good quality grass silage plus 7.0 kg concentrate/cow/day). The protein content of this basal diet was approximately 15%.

An additional 7.0 kg concentrates were then offered using out-of-parlour feeders. With the Immediate build-up strategy, the additional concentrates were increased over a 10-

day period post calving. Cows on the Delayed build-up strategy received no additional concentrates until day-28 post-calving, with concentrates then increased over a 14-day period.

The total saving in concentrates over the first 42 days of lactation with the Delayed build-up strategy was 135 kg (3.2 kg/cow/day). As a consequence of lower concentrate intakes, cows on the Delayed build-up strategy had higher forage intakes in early lactation and maintained this higher forage intake until approximately week-15 post calving.

Cows on the Delayed build-up strategy had a lower milk yield during weeks 3, 4, 5 and 6 of lactation than those on the Immediate build-up strategy. There was no difference in milk yield between the two strategies from week-7 onwards, or on total milk output during the study.

Cows on the Delayed build-up strategy returned to positive energy balance earlier than those on the Immediate build-up strategy.

Concentrate build-up strategy had no effect on the number of cows with mastitis, or with a uterine infection at 3 weeks post calving. However, there was evidence of improved rumen health with cows on the Delayed build-up strategy.

Concentrate build-up strategy had no effect on cow fertility.

Experiment 2

This study examined the effect of adopting either a Rapid, Intermediate or Slow concentrate build-up strategy in early lactation on dairy cow performance.

From calving onwards all cows were offered a 'basal' diet comprising good quality grass silage plus 6.0 kg of concentrate/day. The concentrate was offered via in-parlour feeders. This basal diet had a protein content of 15%, and a starch content of 17%.

In addition, cows were offered a second concentrate (8.0 kg/cow/day) via out-of-parlour feeders. This second concentrate was introduced into the diet from calving onwards using either a Rapid (0.8 kg/cow/day), Intermediate (0.31 kg/cow/day) or Slow (0.19 kg/cow/day) build-up strategy. Cows on each of these build-up strategies were receiving their full concentrate allowance (8.0 kg/cow/day) by day-10, day-26 and day-42 post calving, respectively.

Forage intakes in early lactation were higher with cows on the Intermediate and Slow

build-up strategies. However, unlike in Experiment 1, these higher forage intakes were not maintained once cows reached their full concentrate feed level.

Although cows on the Slow build-up strategy had a lower milk yield during weeks 3 - 7 of lactation, than those on the Rapid build-up strategy, milk yield during the first 150 days of lactation was unaffected by build-up strategy.

Cows on the Slow build-up strategy had an improved energy balance during the first 150 days of lactation compared to those on the Rapid build-up strategy.

Cows on the Intermediate and Slow build-up strategies had fewer rumen health problems than those on the Rapid build-up strategy. Concentrate build-up strategy had no significant effect on the incidence of mastitis.

Cows on the Slow build-up strategy had a lower incidence of uterine infection at 3 weeks post calving than those on the Rapid or Intermediate build-up strategies. There was a trend for improved fertility with cows on the Intermediate build-up strategy.

Experiment 3

This experiment was conducted on five Northern Ireland dairy farms, and examined the effect of adopting either an Immediate or Delayed concentrate build-up strategy in early lactation. The study involved 385 Holstein-Friesian dairy cows.

From calving onwards, all cows on the study were offered a 'basal' diet containing forage and approximately 7.5 kg concentrate per cow per day. This 'basal' diet was designed to have a protein and starch content of 15%.

Additional concentrates were then offered using either an Immediate or Delayed build-up strategy. With the Immediate build-up strategy, concentrate feed levels were increased by 0.5 kg/cow/day over the first 14 days of lactation so that by day-14 of lactation cows had a total concentrate intake of approximately 14.5 kg/cow/day. With the Delayed build-up strategy cows remained on the basal diet until day-21 post-calving. Thereafter, concentrate feed levels were increased by 0.5 kg/cow/day over a 14-day period so that by day-35 of lactation cows had a total concentrate intake of approximately 14.5 kg/cow/day.

Cows on the Delayed build-up strategy had a lower milk yield than those on the Immediate build-up strategy during weeks 2, 3, 4 and 5 of lactation, however 305-day milk yields were not affected by build-up strategy.

Milk produced by cows on the Delayed build-up strategy had a higher average somatic cell count than milk produced by cows on the Immediate build-up strategy.

Only 4% of cows on the Delayed build-up strategy were treated for 'fertility problems' (mainly 'washouts') during the first 30 days post calving, compared to 9% of cows on the Immediate build-up strategy. While concentrate build-up strategy had no effect on days to first observed heat, conception rate to first service was 9% higher with the Delayed build-up strategy. However, overall fertility performance was unaffected by build-up strategy.

Cows on the Delayed build-up strategy had an increased incidence of mastitis, although the reasons for this are unclear. The percentage of cows treated for lameness or rumen health problems was not affected by build-up strategy.

Concentrate build-up strategy had no effect on the number of cows that were culled.

Overall conclusions (Experiments 1 – 3)
Adopting a Delayed or Slow build-up strategy resulted in a saving in concentrates of approximately 100 – 150 kg/cow.

A Delayed or Slow build-up strategy was effective in slowing the rate of increase in milk yield during the first few weeks of lactation. However, there was no overall reduction in milk yield during the first 150 days of lactation (Experiments 1 and 2) or over the first 305 days of lactation (Experiment 3).

Across the three studies a Delayed or Slow build-up strategy resulted in a number of benefits, including higher forage intakes, a reduction in rumen health problems and improved fertility. However, these benefits were not consistent across all three studies.

There is insufficient evidence to suggest that a delayed build-up approach should be widely adopted as a standard feeding practice. Nevertheless, this approach is likely to be beneficial on farms with significant rumen health issues in early lactation, provided high quality forage is available.

Based on the results presented in this booklet, a 'moderate' build-up strategy, based on a gradual increase in concentrates over the first 21 days of lactation, is recommended.

BACKGROUND

For a high yielding dairy cow the process of calving, and the changes which take places during the subsequent few weeks, can be extremely traumatic. In addition to the risk of injury and infection around calving, the cow experiences many physiological and hormonal changes as she adjusts from being pregnant to producing large volumes of milk.

While genetic selection for milk production has increased the milk production potential of today's Holstein dairy cow, these higher yielding cows are unable to consume enough food to meet their increased energy requirements for milk production, and as a consequence, cows frequently enter a prolonged period of negative energy balance in early lactation. Negative energy balance is reflected in a loss of body condition, and is also associated with metabolic disorders, lower immunity, and a decline in 'functional traits' such as health and fertility. Indeed, it is not surprising that the vast majority of production diseases occur in early lactation before cows reach peak milk yield. The risk of disease has been shown to increase with higher rates of increase in milk production post calving.

In an attempt to support the rapid increase in milk production post calving, and to minimise the loss of body condition, the quantity of concentrates offered to cows is normally increased rapidly in early lactation. However, cows with a high genetic potential for milk production may actually respond to concentrates at this stage of lactation by producing more milk, and this may make the situation worse. In addition, feeding more concentrates will reduce the amount of forage that the cow consumes, and these two factors can lead to sub-acute rumen acidosis (SARA), or in extreme cases, rumen acidosis. Acidosis can occur when rumen pH falls below 5.0 for a period of time, and results in impaired rumen function. In acute cases, normal rumen movement is reduced, decreasing fibre digestion and subsequently depressing appetite and milk production.

One option by which these problems might be addressed is by slowing the rate of increase in milk production in early lactation so that it better matches the cow's energy intake. It has been suggested that this might be achieved by introducing concentrates into the diet of fresh calved cows at a slower rate, and by reducing the protein content of the concentrates offered. Previous work at Hillsborough has demonstrated that a reduction in milk production can be achieved by decreasing the protein content of the diet; dietary protein supply is a key driver of milk production as the cow has a limited capacity to rely on body protein reserves to maintain a high level of milk production. In addition, provided total intakes are not reduced, this approach should increase the

amount of forage in the diet, thus reducing the risk of rumen problems.

In order to examine this strategy, a research programme was undertaken by the Agri-Food and Biosciences Institute (AFBI), Hillsborough, with three separate experiments undertaken, as follows:

Experiment 1
The effects of adopting an Immediate or Delayed concentrate build-up strategy in early lactation on dairy cow performance

Experiment 2
The effects of adopting either a Rapid, Intermediate or Slow concentrate build-up strategy in early lactation on dairy cow performance

Experiment 3
The effects of adopting an Immediate or Delayed concentrate build-up strategy in early lactation on five Northern Ireland dairy farms

EXPERIMENT 1

The effect of adopting an Immediate or Delayed concentrate build-up strategy in early lactation on dairy cow performance

OBJECTIVE OF THE STUDY

The objective of this study was to examine the effects on dairy cow performance of adopting either an Immediate or a Delayed concentrate build-up strategy in early lactation.

DETAILS OF THE STUDY

Cows
This study was conducted at AFBI-Hillsborough and involved 60 Holstein-Friesian dairy cows.

Treatments
Good quality grass silage and maize silage were offered in this experiment. The grass silage had a dry matter (DM) content of 27%, a protein of 15.4% (DM basis) and a ME content of 11.5 MJ/kg DM. The maize silage had a DM content of 28%, and a starch content of 21% (DM basis). It was recognised at the outset that high quality silages were essential when adopting a delayed concentrate build-up strategy.

All cows were offered a common 'basal diet' from calving onwards. This comprised a mixture of the grass silage and maize silage described above, plus approximately 7.0 kg concentrate/cow/day. The protein content of this basal diet was approximately 15% (DM basis).

In addition to this basal diet, cows were offered additional concentrates via an out-of-parlour feeder using one of two build-up strategies (Figure 1):

- An Immediate concentrate build-up strategy
- A Delayed concentrate build-up strategy

With the Immediate build-up strategy (red dashed line in Figure 1), concentrate feed levels via the out-of-parlour feeder were set at 2.0 kg/cow/day at calving, and were increased by 0.5 kg each day until day-10 post calving. From day-10 onwards cows were offered 7.0 kg concentrate/day via the out-of-parlour feeder.

Cows on the Delayed build-up strategy (blue dashed line in Figure 1) received no

concentrates via the out-of-parlour feeder until day-28 post calving. At this point concentrates were introduced into the diet, with levels increased by 0.5 kg/day over a 14-day period, so that by day-42 post calving these cows were also being offered an additional 7.0 kg concentrate/day via the out-of-parlour feeder.

Once cows on both strategies were being offered their full concentrate allowance (approximately 7.0 kg/day via the basal diet and 7.0 kg/day via the out-of-parlour feeder) the overall diet was designed to have a protein content of 18.0% (DM basis) and a metabolisable energy (ME) content of 12.4 MJ/kg DM.

Cows remained on these two dietary strategies for the first 150 days post calving.

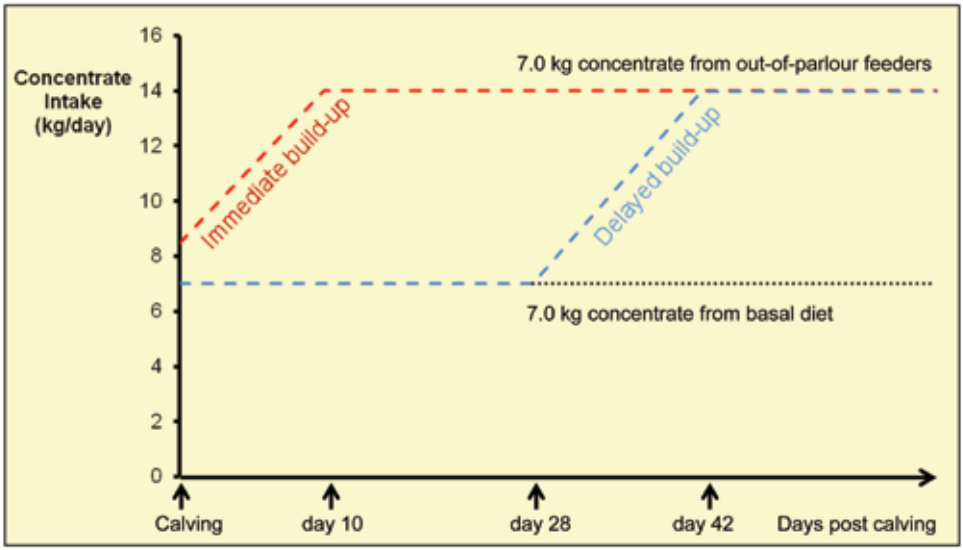

Figure 1 Concentrate build-up within the Immediate and Delayed build-up strategies

OUTCOMES

As expected, cows on the Delayed build-up strategy had a higher forage intake in early lactation, with this corresponding to the period before the additional concentrates were introduced into the diet (Figure 2).

However, Figure 2 also demonstrates that these cows continued to maintain a higher

forage intake than those on the Immediate build-up strategy until approximately week-15 post calving. While the reasons for this are unclear, it is possible that the high forage intakes post calving prepared the rumen to have higher forage intakes during the subsequent period.

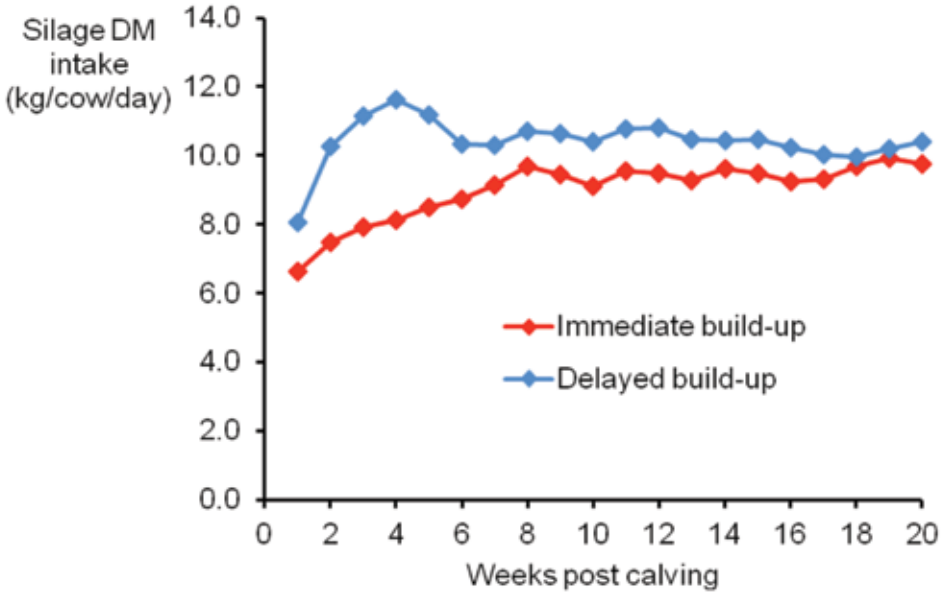

Figure 2 The effect of adopting either an Immediate or Delayed concentrate build-up strategy in early lactation on silage intake over the first 150 days post calving

The total saving in concentrates over the first 42 days of lactation with the Delayed build-up strategy was 135 kg.

Over the first 150 days of lactation cows on the Delayed build-up strategy had a lower concentrate intake (0.5 kg/cow/day) and a higher forage intake (1.4 kg/cow/day) than those on the Immediate build-up strategy (Table 1).

Table 1 The effect of concentrate build-up strategy on dry matter intake during the first 150 days of lactation.

	Concentrate build-up strategy	
	Immediate	Delayed
Silage DM intake (kg/day)	9.0	10.4
Concentrate DM intake (kg/day)	11.5	11.0
Total DM intake (kg/day)	20.5	21.4

Cows on the Delayed build-up strategy had a lower milk yield during weeks 3, 4, 5 and 6 of lactation than those on the Immediate build-up strategy (Figure 3). However, from week-7 onwards there were no significant differences in milk yield between the two build-up strategies.

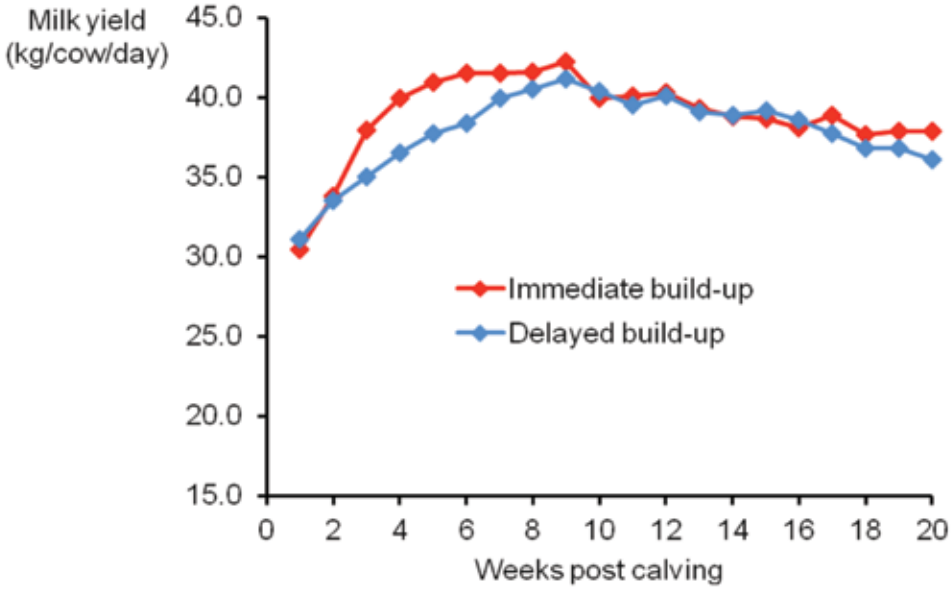

Figure 3 The effect of adopting either an Immediate or Delayed concentrate build-up strategy in early lactation on daily milk yields over the first 150 days post calving

Build-up strategy had no effect on average daily milk yield or milk composition over the first 150 days of lactation (Table 2).

Table 2 The effect of concentrate build-up strategy on daily milk yields and milk composition over the first 150 days of lactation

	Concentrate build-up strategy	
	Immediate	**Delayed**
Milk yield (kg/day)	38.9	37.9
Milk fat (%)	4.05	4.16
Milk protein (%)	3.42	3.33
Milk fat-plus-protein yield (kg/day)	2.88	2.81

Concentrate build-up strategy had no effect on cow live weight or body condition score during the experiment.

Cows on the Delayed build-up strategy returned to positive energy balance earlier than those on the Immediate build-up strategy (week-7 vs week-18 post calving), and tended to have an improved energy balance during the first 150 days of lactation (Figure 4). This improved energy balance was primarily due to the higher intakes of cows on the Delayed build-up strategy.

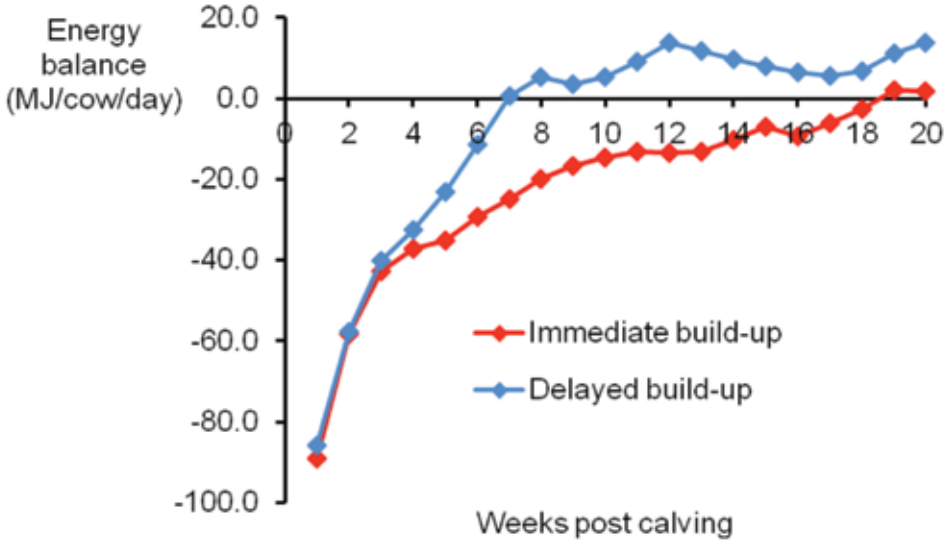

Figure 4 The effect of adopting either an Immediate or Delayed concentrate build-up strategy in early lactation on energy balance over the first 150 days post calving

Concentrate build-up strategy had no significant effect on the percentage of cows with at least one case of mastitis, or with a uterine infection at 3 weeks post calving (Table 3).

In early lactation, 45% of cows on the Immediate build-up strategy were treated for a 'dilated abomasum', compared to 18% of cows on the Delayed build-up strategy (Table 3). This suggests that cows on the Delayed build-up strategy had improved rumen function in early lactation, with this likely a consequence of the greater proportion of forage in the diet at this stage. (Note: In this experiment the term 'dilated abomasum' was used to describe animals which had excess gas in the abomasum, causing movement up the flank, but which did not display any other typical symptoms of a displaced abomasum).

Table 3 The effect of early lactation concentrate build-up strategy on cow health

	Concentrate build-up strategy	
	Immediate	Delayed
% of cows with at least one case of mastitis	55	43
% of cows with a uterine infection at 3 weeks post calving	31	32
% of cows with a right dilated abomasum	45	18

Cow numbers were insufficient to robustly measure fertility performance in this experiment. Nevertheless, there was a trend (although not significant) for cows on the Immediate build-up strategy to have an earlier resumption of oestrus post calving than those on the Delayed build-up strategy (Table 4). This may have been due to the higher starch levels in the diet with the Immediate build-up strategy, with high starch levels known to promote early resumption of oestrus.

However, concentrate build-up strategy had no effect on either conception rate or pregnancy rate within this experiment.

Table 4 The effect of concentrate build-up strategy on fertility performance

	Concentrate build-up strategy	
	Immediate	Delayed
Days to resumption of oestrus	33	45
Conception to first service (%)	41	36
Conception to first and second service (%)	59	59
Cows pregnant at 100 days post calving (%)	63	64

SUMMARY

- Adopting a Delayed concentrate build-up strategy in early lactation improved forage intake and had no detrimental effect on milk production over the first 150 days of lactation.

- Delaying concentrate build-up improved rumen function and tended to improve the energy status of the cow.

- Fertility performance was unaffected by build-up strategy.

EXPERIMENT 2

The effect of adopting either a Rapid, Intermediate or Slow concentrate build-up strategy in early lactation on dairy cow performance

BACKGROUND

Experiment 1 demonstrated that the adoption of a delayed concentrate build-up strategy slowed the rate of increase in milk yield post calving, promoted forage intakes and improved energy balance. However, delaying the initiation of concentrate build-up until 28 days post calving may be too 'extreme.' This second experiment was undertaken to examine if similar benefits might be achieved by adopting a more gradual concentrate build-up strategy.

OBJECTIVE OF THE STUDY

The objective of this study was to compare the effect of adopting either a **Rapid, Intermediate** or **Slow** concentrate build-up strategy in early lactation on dairy cow performance.

DETAILS OF THE STUDY

Cows
This experiment was conducted at AFBI-Hillsborough and involved 69 winter calving Holstein-Friesian dairy cows.

Treatments
The grass and maize silages offered within this experiment were of good quality. The grass silage had a dry matter (DM) content of 23%, a protein content of 14.8% (DM basis) and a ME content of 12.0 MJ/kg DM. The maize silage offered had a DM content of 33% and a starch content of 31% (DM basis).

From calving onwards all cows were offered a common basal diet containing silage (70% grass silage and 30% maize silage (DM basis)) and concentrates. These concentrates were offered at 6.0 kg/cow/day via in-parlour feeders. This basal diet was designed to have a protein content of 15% and a starch content of approximately 17% (DM basis).

In addition to this common basal diet, cows were offered a second concentrate via out-of-parlour feeders. The objective was to introduce another 8.0 kg concentrate into the diet of all cows using either a Rapid, Intermediate or Slow concentrate build-up strategy. The approaches adopted are presented in Figure 5.

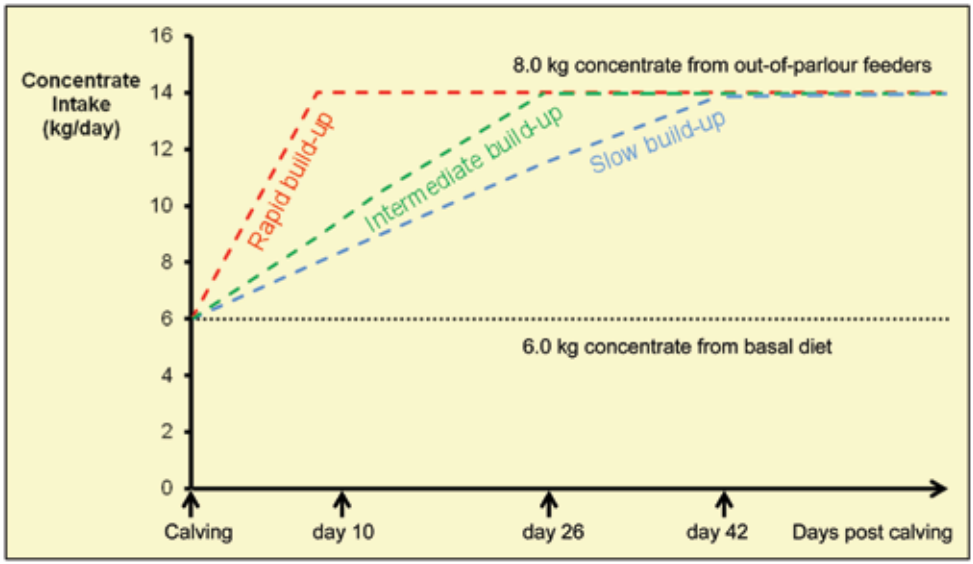

Figure 5 Concentrate build-up with the Rapid, Intermediate and Slow build-up strategies

With the **Rapid** build-up strategy (red dashed line in Figure 5), additional concentrate was introduced into the diet from calving onwards at a rate of 0.80 kg per cow/day, so that an additional 8.0 kg concentrate/cow/day was being offered by day-10 post calving.

With the **Intermediate** build-up strategy (green dashed line in Figure 5), additional concentrate was introduced into the diet from calving onwards at a rate of 0.31 kg per cow/day, so that an additional 8.0 kg concentrate/cow/day was being offered by day-26 post calving.

With the **Slow** build-up strategy (blue dashed line in Figure 5), the additional concentrate was introduced into the diet from calving onwards at a rate of 0.19 kg per cow/day, so that an additional 8.0 kg concentrate/cow/day was being offered by day-42 post calving.

Once cows on all three strategies had reached their full concentrate allowance of 14 kg/cow/day (6.0 kg via in-parlour feeders and 8.0 kg via out-of-parlour feeders) the total diet was designed to have a ME content of 12.6 MJ/kg DM, and a protein and starch content of 17.8% and 20.5%, respectively (DM basis).

OUTCOMES

During the first 42 days post calving total concentrate intakes with the Rapid, Intermediate and Slow build-up strategies were 460, 435 and 365 kg/cow, respectively.

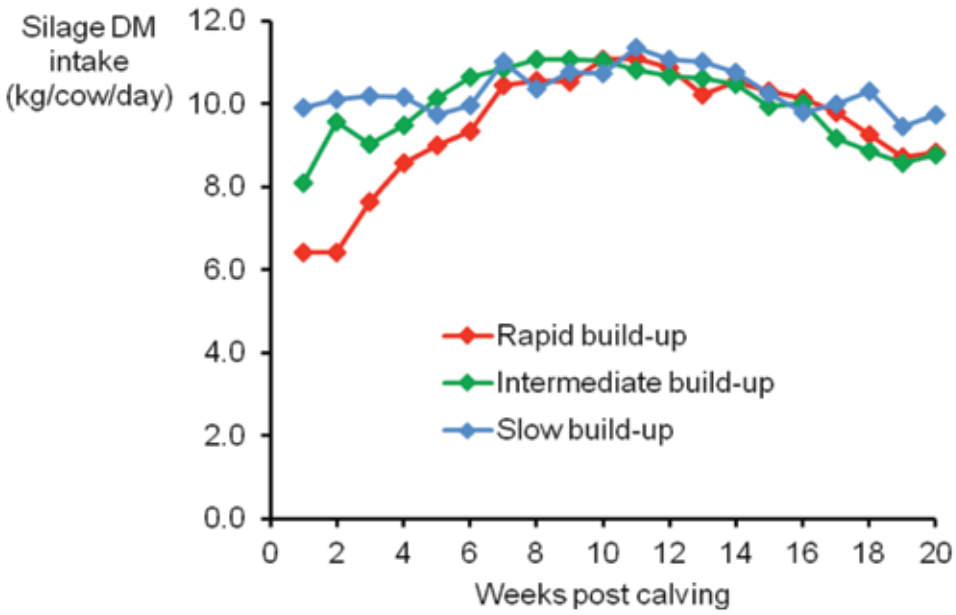

Figure 6 Effect of adopting either a Rapid, Intermediate or Slow concentrate build-up strategy in early lactation on daily silage dry matter intake

As a consequence of the lower concentrate intakes with the Slow and Intermediate build-up strategies during the first six weeks post calving, cows on these strategies had higher silage intakes in early lactation (Figure 6). However, cows on the Slow build-up strategy did not maintain this higher silage intake once all cows were on a common diet, in contrast to the findings of Experiment 1.

Concentrate build-up strategy had no effect on total dry matter intake over the first 150 days of lactation (Table 5).

Table 5 The effect of concentrate build-up strategy on dry matter intake during the first 150 days of lactation.

	Concentrate build-up strategy		
	Rapid	**Intermediate**	**Slow**
Silage DM intake (kg/day)	10.1	9.9	10.9
Concentrate DM intake (kg/day)	11.4	11.3	10.9
Total DM intake (kg/day)	21.5	21.2	21.8

Cows on the Slow build-up strategy had a lower milk yield during weeks 3 - 7 of lactation, compared to those on the Rapid build-up strategy (Figure 7). However, there was no significant difference in milk yield from week-8 of lactation onwards, the period when all cows were offered the full diet.

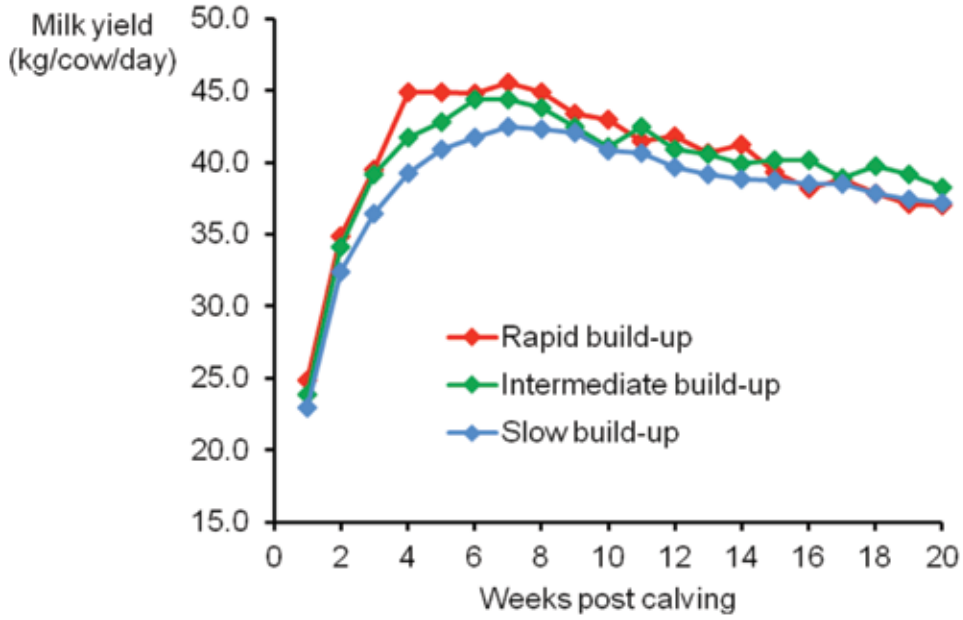

Figure 7 The effect of concentrate build-up strategy in early lactation on daily milk yield over the first 150 days post calving

Average daily milk yield over the course of the study was unaffected by concentrate build-up strategy. Similarly, concentrate build-up strategy had no effect on milk composition (Table 6).

Table 6 The effect of concentrate build-up strategy on daily milk yields and milk composition over the first 150 days of lactation

	Concentrate build-up strategy		
	Rapid	**Intermediate**	**Slow**
Milk yield (kg/day)	42.0	41.2	40.1
Butterfat (%)	4.22	4.26	4.24
Protein (%)	3.35	3.29	3.33
Milk fat-plus-protein yield (kg)	3.16	3.08	3.00

Thus this study demonstrates that a short-term reduction in dietary protein content and concentrate levels can slow the rate of increase in milk yield in early lactation with no long term detrimental effect on performance.

Concentrate build-up strategy had no significant effect on mean live weight or body condition score during the first 150 days of lactation. However, cows on the Slow concentrate build-up strategy had an improved energy balance during the first 150 days of lactation compared to those on the Rapid concentrate build-up strategy (Figure 8).

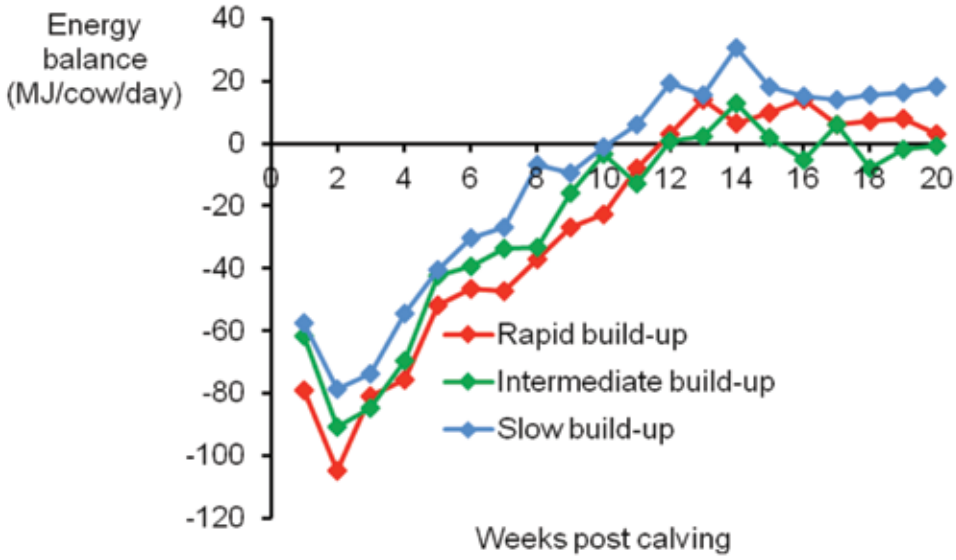

Figure 8 The effect of concentrate build-up strategy in early lactation on energy balance (MJ/cow/day) over the first 150 days post calving

Concentrate build-up strategy had no significant effect on the incidence of mastitis (Table 7).

In early lactation, 46% of cows on the Rapid build-up strategy were treated for a dilated abomasum, compared to 13% and 22% of cows on the Intermediate and Slow build-up strategies, respectively. This suggests that cows managed on both the Intermediate and Slow build-up strategies had improved rumen function.

Cows on the Slow build-up strategy had a lower incidence of uterine infection at 3 weeks post calving than those on the Rapid or Intermediate build-up strategies (Table 7).

Table 7 The effect of early lactation concentrate build-up strategy on cow health during the first 150 days of lactation

	Concentrate build-up strategy		
	Rapid	Intermediate	Slow
% of cows with at least one case of mastitis	32	17	30
% of cows with a right dilated abomasum	46	13	22
% of cows with a uterine infection at 3 weeks post calving	18	14	0

Despite the lower incidence of uterine infection with the Slow build-up strategy, fertility performance was not affected by build-up strategy (Table 8). An improvement in fertility may have been expected with cows managed on the Slow build-up strategy as they returned to positive energy balance before cows on the Rapid build-up strategy. However, there was no evidence of such an effect. Nevertheless, the relatively small numbers of cows involved in this study meant that it was not possible to robustly assess the effect of build-up strategy on fertility performance.

Table 8 The effect of concentrate build-up strategy in early lactation on fertility performance

	Concentrate build-up strategy		
	Rapid	Intermediate	Slow
Days to resumption of oestrus	32	30	33
Conception to first service (%)	50	47	33
Conception to first and second service (%)	72	79	56
Cows pregnant at 100 days post calving (%)	72	79	72

SUMMARY

The adoption of an Intermediate and Slow concentrate build-up strategy resulted in a saving in concentrates, without a significant loss in milk production.

While none of the effects were significant, there were trends for improved rumen health and fertility with the Intermediate build-up strategy.

EXPERIMENT 3

Effect of adopting an Immediate or Delayed concentrate build-up strategy in early lactation on five Northern Ireland dairy farms

BACKGROUND:

While the adoption of a delayed or slow concentrate build-up strategy in Experiments 1 and 2 resulted in a short-term reduction in milk production, average milk yield over the first 150 days of lactation was unaffected. In addition, there was evidence that cows managed on a delayed build-up strategy had an improved energy balance, higher forage intakes and fewer rumen health problems. However, no clear evidence of any fertility effects were identified, possibly due to the limitation of the numbers of cows involved. Consequently, these build-up strategies were examined on commercial farms to allow fertility and health to be examined more robustly with a larger number of cows.

OBJECTIVE:

To examine the effects on cow performance, health and fertility of adopting either an Immediate or Delayed concentrate build-up strategy in early lactation on five local dairy farms.

DETAILS OF THE STUDY

Farms and Cows

This study was conducted on five Northern Ireland dairy farms. The farms involved had an average annual milk yield in excess of 8,500 litres per cow. The study involved 385 Holstein-Friesian dairy cows, which calved between October 2012 and April 2013.

Diets and Treatments

Immediately after calving all cows on the study were offered a 'basal' diet containing forage and approximately 7.5 kg concentrate/cow/day (average across the 5 farms). This 'basal' diet was designed to have a protein and starch content of 15% (DM basis).

The forage component of this basal diet varied between farms and comprised grass silage only, or grass silage plus an alternative forage (maize silage or whole crop silage). On the majority of farms the 'basal diet' was prepared using a mixer wagon.

In general, the grass silages offered across the five farms were of good quality and had an average dry matter of 31%, an average protein content of 14% (DM basis) and an average

ME content of 11.6 MJ/kg DM.

The study examined two early lactation concentrate 'build-up' strategies:

- Immediate build-up
- Delayed build-up

With the Immediate build-up strategy, concentrate feed levels were increased by 0.5 kg/cow/day over the first 14 days of lactation so that by day-14 of lactation cows had a total concentrate intake of approximately 14.5 kg/cow/day (red dashed line in Figure 9). Thereafter, concentrates were offered on a 'feed-to-yield' basis on most of the farms.

With the Delayed build-up strategy cows remained on the basal diet until day-21 post calving. From day-21 onwards, concentrate feed levels were increased by 0.5 kg/cow/day over a 14-day period so that by day-35 of lactation cows had a total concentrate intake of approximately 14.5 kg/cow/day (blue dashed line in Figure 9). Thereafter, concentrates were offered on a 'feed-to-yield' basis on most of the farms (red and blue solid lines in Figure 9). These additional concentrates (those not included within the basal diet) were offered either via in-parlour feeders or out-of-parlour feeders.

Once cows were receiving their full concentrate allocation, the total diet was designed to have a protein content of approximately 17% and a starch content of approximately 19% (DM basis).

Data were collected in a number of ways. The participating farmers collected data on 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 milk composition data were obtained through official milk recording schemes.

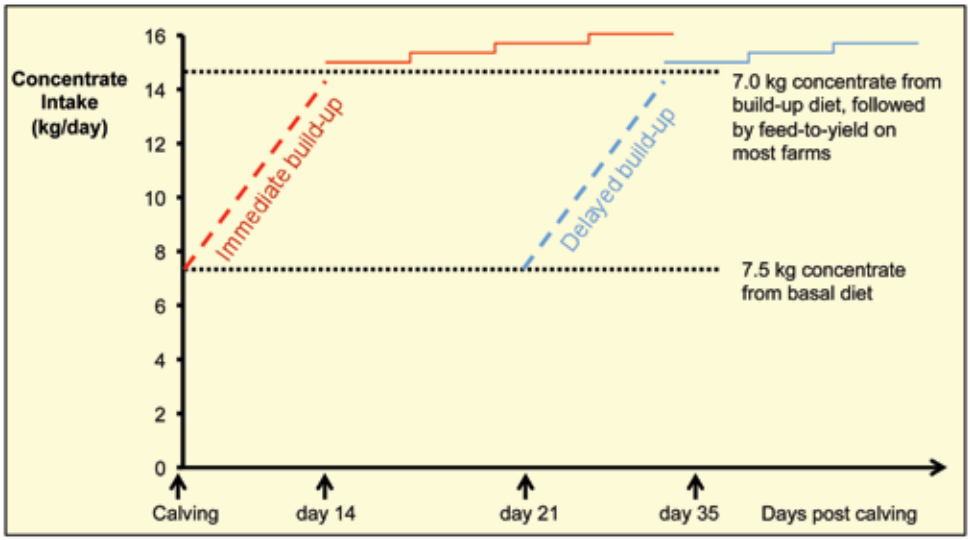

Figure 9 An overview of the two concentrate build-up strategies imposed on the five farms post calving.

OUTCOMES

Cow performance

Lactation curves for cows on the Immediate and Delayed build-up strategies are presented in Figure 10. Cows on the Delayed build-up strategy had a lower milk yield during weeks 2, 3, 4 and 5 of lactation, with yields being on average 2.0 kg/cow/day lower during this 4-week period. This resulted in a total reduction in milk yield of 65 kg/cow over the first 35 days of lactation.

It is not possible to quantify the exact saving in concentrates with the Delayed build-up strategy during weeks 1 - 6 post calving as the actual concentrate intake from the 'basal diet' cannot be determined accurately. However, the overall saving is likely to be similar to that recorded in Experiment 1, approximately 130 kg/cow.

From week-6 of lactation onwards, concentrate build-up strategy had no effect on average weekly milk yield.

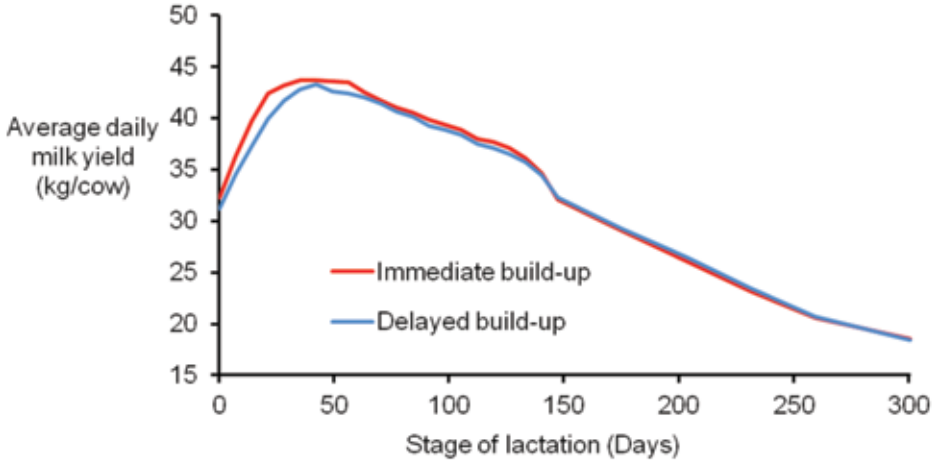

Figure 10 Effect of adopting either an Immediate or Delayed concentrate build-up strategy in early lactation on milk yields throughout the lactation

When considered over the first 305 days of lactation, concentrate build-up strategy had no significant effect on total milk output, milk fat content or milk protein content (Table 9). However, milk produced by cows on the Delayed build-up strategy had a higher average somatic cell count than milk produced by cows on the Immediate build-up strategy.

Table 9 Effect of either an Immediate or Delayed concentrate build-up strategy in early lactation on milk yield and milk quality over the first 305 days of lactation

	Concentrate build-up strategy	
	Immediate	**Delayed**
305-day milk yield (kg/cow)	10,069	9,914
Milk fat (%)	3.93	3.94
Milk protein (%)	3.20	3.21
Milk fat-plus-protein yield (kg/cow/day)	2.59	2.55
Somatic cell count ('000/ml)	282	315

Changes in body condition score of cows during the course of the study are presented in Figure 11. Concentrate build-up strategy had no effect on the body condition score of the cows either during early lactation, or during the course of the study.

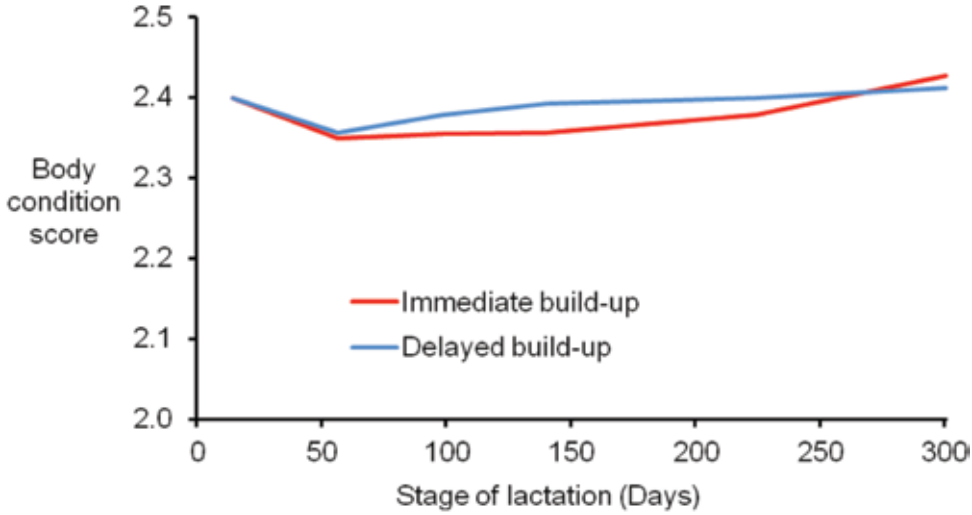

Figure 11 Effect of adopting either an Immediate or Delayed concentrate build-up strategy in early lactation on body condition score throughout the lactation

Cow fertility

Concentrate build-up strategy had no effect on either days to first observed heat, or days to first service. However, conception rate to first service was 9% higher with the Delayed build-up strategy (Table 10).

This may be due to cows on this build-up strategy having an improved energy balance in early lactation, and a lower incidence of 'fertility problems'. For example, only 4% of cows on the Delayed build-up strategy were treated for 'fertility problems' (mainly 'washouts') during the first 30 days post calving, compared to 9% of cows on the Immediate build-up strategy.

However, these initial benefits with the Delayed build-up strategy did not result in an overall improvement in fertility, with none of conception rate to first and second service, calving interval or the proportion of cows that were culled due to infertility affected by build-up strategy.

Table 10 Effect of adopting either an Immediate or Delayed concentrate build-up strategy in early lactation on fertility performance

	Concentrate build-up strategy	
	Immediate	Delayed
Days to first observed heat	62	60
Days to first service	76	76
Conception to first service (%)	23	32
Conception to first and second service (%)	47	50
Cows treated for fertility problems by day 30 post calving (%)	9	4
Cows treated for fertility problems during study (%)	39	35
Calving interval (days)	394	389
Cows culled due to infertility (%)	11	13

Cow health

The percentage of cows treated for mastitis during the first 60 days post calving, and throughout the study, was greater with the Delayed build-up strategy (Table 11). This increased incidence of mastitis is likely to have contributed to the higher somatic cell count with the Delayed build-up strategy. There are no obvious reasons why cows on the Delayed build-up strategy had an increased incidence of mastitis.

Concentrate build-up strategy had no effect on the percentage of cows treated for lameness or rumen health problems.

Table 11 Effect of adopting either an Immediate or Delayed concentrate build-up strategy in early lactation on cow health

	Concentrate build-up strategy	
	Immediate	**Delayed**
Mastitis		
Cows treated for mastitis by day 60 post calving (%)	4.0	9.5
Cows treated for mastitis during the study (%)	12.0	19.0
Cows culled due to mastitis (%)	2.5	3.5
Lameness		
Cows treated for lameness by day 60 post calving (%)	2.0	3.0
Cows treated for lameness during the study (%)	5.0	5.0
Cows culled due to lameness (%)	5.0	2.5
Rumen health		
Cows with rumen health issues by day 60 post calving (%)	1.5	1.5

Culling

The numbers of cows culled both during and on completion of their lactation provides a good overall reflection of health and fertility status. Within the current study concentrate build-up strategy had no effect on the number of cows that were culled, or the stage of lactation at which they were culled (Figure 12).

In addition, concentrate build-up strategy had no effect on the number of cows culled due to 'leg/feet' problems, mastitis or infertility. The percentage of cows culled during early lactation was very low within this study, with the majority of cows leaving the herd when they were more than 300 days calved (Figure 12).

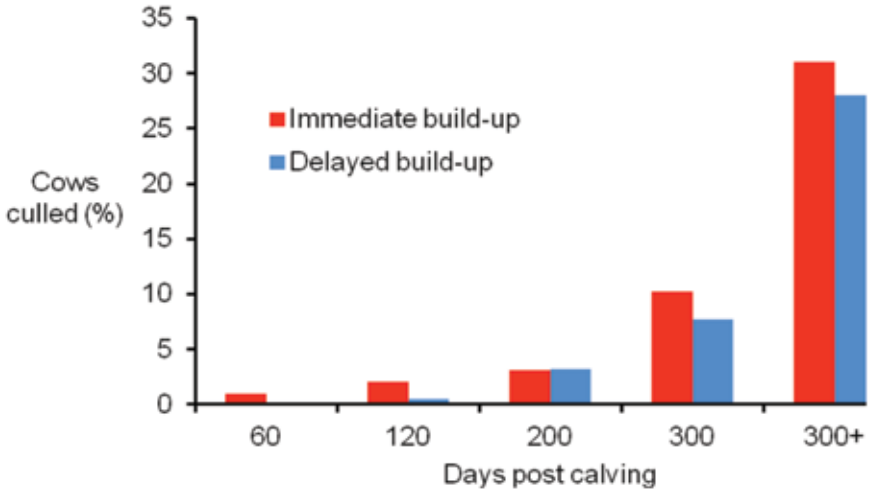

Figure 12 Effect of adopting either an Immediate or Delayed concentrate build-up strategy in early lactation on the percentage of cows culled at different time points during the study

CONCLUSIONS

While there was a short-term loss in milk yield in early lactation with the Delayed build-up strategy, neither milk yield nor milk composition over the first 305 days of lactation was affected by build-up strategy.

While conception to first service was improved with the Delayed build-up strategy (and fewer cows were treated for fertility related health issues within the first month of lactation), build-up strategy had no effect on overall fertility performance.

There was an unexplained increase in the incidence of mastitis with the Delayed build-up strategy.

Build-up strategy had no effect on the numbers of cows culled either during or on completion of the study.

AGRISEARCH BOOKLETS

1 SHEEP
The Effects of Genetics of Lowland Cross-Bred Ewes and Terminal Sires on Lamb Output and Carcass Quality

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

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

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Prevalence of BVD in Northern Ireland Dairy and Suckler Herds

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OTHER PUBLICATIONS:
- BovIS User Guide (Carcass Benchmarking Application)
- Diagnosis and Treatment of Lameness in Sheep

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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