Understanding cow behaviour

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Dairy cows are completely reliant on our ability and knowledge to provide them with sufficient food and water to promote growth, productivity, health and welfare. Traditionally, animal nutrition has focused almost exclusively on the nutrient aspects of the diet, but has failed to consider how animal behaviour may affect the animals' access to food.

Despite many advances, we are still faced with the challenge of ensuring adequate dry matter intake (DMI) to maximise production and prevent disease. Since changes in DMI must ultimately be mediated by changes in feeding behaviour, it is important to understand the factors that influence this behaviour.

In North America, most lactating dairy cows are intensively housed in either free-stall or dry-lot dairies and are fed a total mixed ration (TMR) along a feed bunk.

In this article, we will first describe the factors that control the feeding behaviour patterns of group housed dairy cows. Even though group housing allows some freedom of movement for the cows and significant labour savings compared to the more traditional tie-stall facilities, this type of housing can result in high levels of competition at the feed bunk, which in turn may compromise health and production.

Secondly, we will review studies showing how feeding management and the design of the feeding environment can be altered in ways that reduce this competition and allow for increased access to feed for all animals.

Feeding behaviour patterns

An improved understanding of feeding behaviour, combined with the continued efforts of nutritionists, will allow dairy producers to manage and house their dairy cattle in ways that will allow their cows to fully utilise the nutritional potential of the ration provided, thereby maximising health, production and welfare.

Over the past few decades, the dairy industry has moved towards intensively housed dairy cattle. This has been followed by a rapid increase in dairy herd sizes.

Unfortunately, the majority of research on dairy cattle feeding behaviour has been completed with individually housed animals. In modern dairy operations, cows are group housed, and this social environment can have a major effect on feeding patterns.

When grazing, cattle often synchronise their behaviour such that many animals in the group feed, ruminate and rest at the same times.

Curtis and Houpt (1983) reported that group housed dairy cows housed indoors also synchronised their behaviour, particularly at feeding. They reported that when cows are fed in groups, the act of one cow moving to the feed bunk stimulates others to feed.

In addition to the influence of social synchronisation, stage of lactation and management factors can also affect feeding behaviour.

We have completed two studies investigating how feeding behaviour changes with stage of lactation.

In a study of feeding behaviour in 15 transition dairy cows that were monitored from 10 days before until 10 days after calving. The daily time spent feeding was variable over the pre-calving period, but averaged 86.8 ± 2.95 minutes per day.

During the post-calving period, the daily time spent feeding was lower (on average 61.7 ± 2.95 minutes per day) compared to the pre-calving period.

As is common practice, cows in this study were switched to a higher energy diet immediately after calving.

The decreased feeding times post-calving may be explained by an increased feeding rate due to the diet switch.

Despite the reduced time spent at the feed bunk post-calving cows increased their feeding time by approximately 3.3 minutes per day, most likely reflecting the rapid increase in DMI that occurs during this period to support the increasing demands of lactation.

In another study, time spent feeding increased as cows progressed in lactation, again likely reflecting the progressive increase in DMI that would occur over this time period.

To understand how the design and management of the feeding environment influenced the feeding behaviour requires cows that are relatively stable in terms of stage of lactation (for example, between peak and mid lactation) since changes in physiological status can affect feeding behaviour.

The normal feeding pattern of group

housed lactating cows fed a TMR ad libitum was established in a preliminary study.

Cows in the study consumed an average of 7.3 meals per day with an approximate daily meal time of six hours per day.

The 24 hour pattern of bunk attendance clearly demonstrated a diurnal feeding pattern, influenced by the time of feed delivery, feed push-up and milking.

Further, the most dramatic peaks in feeding activity occurred around the time of feed delivery and the return from the milking parlour.

On most commercial dairies, milking and feed delivery typically occur around the same time of day, making it difficult to determine which practice is the primary stimulus for movement to the feed bunk.

Therefore, a subsequent study evaluated which of these management practices has the greater ability to stimulate dairy cattle to go to the feed bunk.

We tested this objective by separating feed delivery and milking times and monitored the changes in behaviour patterns of group housed lactating dairy cows.

Lactating Holstein cows were subjected to each of two treatments:

- Milking and feed delivery times coinciding.
- Feed delivery six hours post milking.

When animals were fed six hours post milking, they increased their total daily feeding time by 12.5%.

This change was predominantly driven by a small decrease in feeding time during the first hour post milking and a very large increase in feeding time during the first hour immediately following the delivery of fresh feed.

Despite the change in feeding time, the delivery of feed six hours post milking did not change the daily lying time of the cows, indicating that the cows minimised the amount of time that they spent idle while waiting for feed or for access to the feed bunk.

These results indicated that delivery of fresh feed has a greater impact on stimulating cows to get up and feed than does the return from milking.

Feeding management

Basic observations of feeding behaviour patterns revealed that several feeding management factors have the potential to influence the DMI of dairy cattle. One of the most common feeding management practices believed to stimulate feeding activity is feed push-up.

When fed a TMR, dairy cows have a natural tendency to continually sort the feed and push feed away while eating, resulting in much of the feed being tossed forward where it is no longer within reach.

This becomes a particular problem when feed is delivered via a feed alley and, thus, producers commonly push the feed closer to the cows in between feedings as a means of ensuring continuous access to feed.

In an observational study, Menzi and Chase noted that the number of cows feeding increased after feed push-up, however, they concluded that feed push-ups had 'minor and brief effects' in comparison to milking on feed bunk attendance.

Stimulatory effects

In a more recent study, the stimulatory effect of feed push-up was tested by increasing the number of feed push-ups during the late evening and early morning hours. In that study, the addition of extra feed push-ups did little to increase feeding activity.

Even though feed push-up is an important management practice, it does not appear to have a dramatic effect in terms of increasing bunk attendance.

Contrary to the act of feed push-up, the delivery of fresh feed does stimulate feeding activity. It follows, therefore, that the frequency of feed delivery should influence feeding patterns of lactating dairy cows.

However, there is little research literature concerning these effects. How frequency of feed delivery affects behaviour of group housed dairy cows was tested in two experiments.

In each experiment, 48 lactating Holstein cows, split into groups of 12, were subjected to each of two treatments over 10 day periods in a cross over design.

The treatments for the first experiment were:

- Delivery of feed once per day (1x).
- Delivery of feed twice per day (2x).

The treatments for the second experiment were:

- Delivery of feed 2x.
- Delivery of feed four times per day (4x).

In both experiments, increased frequency of feed provision increased total daily feeding time by 10 and 14 minutes, respectively, as well as changing the daily feeding pattern.

The changes in daily feeding pattern resulted in cows having more access to feed throughout the day, particularly at the time of feed delivery.

Frequency of feed delivery had no effect on the daily lying time of cows or the daily incidence of aggressive interactions at the feed bunk.

Despite this, we did find that subordinate cows were not displaced as frequently when fed more often, indicating that these cows would have better access to feed, and particularly fresh feed, when the frequency of feed delivery is high.

In addition to behavioural measures, the effect of feeding frequency on feed composition throughout the day was evaluated.

In both experiments, NDF content of the TMR present in the feed bunk increased throughout the day, indicating that sorting of the feed had occurred.

Further, increasing frequency of feed delivery from 1x to 2x reduced the amount of TMR sorting, but no additional benefits were gained when feed was delivered 4x.

Changes in NDF indicated changes in the forage to concentrate ratio over the course of the day, particularly for the 1x treatment.

The results for feed composition and feeding behaviour suggest that higher feeding frequencies could reduce variation in diet quality of lactating cows.

A specific objective of cattle housing is to provide a comfortable environment and adequate food and water source for the animals to meet their behavioural and physiological needs.

There are several components of the feeding environment that have the potential to influence the ability of cows to access feed, including the amount of available feed bunk space and the physical design of the feeding area.

Reduced space availability has been shown to result in increased agonistic behaviour in cattle. When feed bunk space is limited, increases in aggressive behaviour are thought to limit the ability of some cows to access feed at times when they want to.

In a recent study, we tested if increasing space availability at the feed bunk improves access to feed and reduces social competition.

Feeding environment

Twenty four lactating Holstein cows were each tested under two conditions: with 0.5 or 1.0m of feed bunk space per cow.

When animals had access to more bunk space there was at least 60% more space between animals (regardless of the number of cows at the feed bunk) and 57% fewer aggressive interactions while feeding, than with access to 0.5m of feed bunk space.

These changes in spacing and aggressive behaviour, in turn, allowed cows to increase feeding activity throughout the day. The increase in feeding activity was especially noticeable during the 90 minutes after fresh feed was provided.

During this period, when cows had access to more feed bunk space, they increased their time at the feeder by 24%; this effect was greatest for subordinate cows.

In addition to the amount of available feed bunk space, physical design of the feeding area can influence feeding behaviour.

One of the most obvious features of the feeding area is the physical barrier that separates the cow and the feed.

The various barriers are all designed with the intention of allowing cows access to feed, however, some designs can have unintended consequences, such as limiting the cows' ability to freely access feed and increasing the frequency of aggressive interactions at the feeder.

Many producers believe that a feed line barrier that provides some sort of separation between cows (for example, headlocks) will reduce competition and increase intake.

Unfortunately, there is little work comparing different feed line barriers in free-stall

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barns. Two recent conference proceedings describe comparisons of post and rail feed barriers versus headlock barriers on group feed intake and milk production.

Unfortunately, it is difficult to make strong conclusions from these studies due to limited treatment replication.

In a recently completed experiment, 48 cows were exposed to both a post and rail feed line barrier and a headlock feed line barrier.

The objective was to evaluate the effects of the two feed barrier systems on the feeding and social behaviour of dairy cows.

Cows were housed in four groups of 12 at a stocking density of 0.61m per cow. The groups were assigned to one of two starting conditions: access to the feed alley via a post and rail or via a headlock barrier.

Average daily feeding time did not differ when cows had access to feed via headlocks (271.7 ± 3.8 minutes) compared to the post and rail barrier (277.8 ± 3.8 minutes).

However, there were certain changes in feeding time during periods of peak feeding activity: cows that had lower feeding times relative to group mates when using the post and rail barrier showed more similar feeding times to group mates when using the headlock barrier.

There were also 21% fewer displacements at the feed bunk when cows accessed feed by the headlock barrier compared to the post and rail barrier.

These results suggest that using a headlock barrier reduces aggression at the feed bunk and improves access to feed for socially subordinate cows during peak feeding periods.

To gain a further understanding of how the amount of available feed bunk space and the physical design of the feeding area interact with one another, a subsequent trial examined how stocking density at the feed bunk affected the feeding and social behaviour of dairy cows.

Type of feed barrier

A secondary objective was to determine if this effect is further influenced by the type of feed barrier used.

Thirty six lactating Holstein cows, divided into four groups, were subjected to each of four stocking density treatments and two feed barrier treatments. Initially, two groups were assigned to a headlock barrier, and two groups to a post and rail barrier.

Each group was then exposed to four stocking density treatments (0.81, 0.61, 0.41 and 0.21m per cow, corresponding to 1.33, 1.00, 0.67 and 0.33 headlocks per cow), in four successive 10 day treatment periods. After these periods, the feed barriers were switched between the groups and the four stocking density treatments were administered again with the alternate barrier.

Daily feeding times were higher and the duration of inactive standing in the feeding area was lower when using a post and rail compared to a headlock feed barrier. As well, regardless of barrier, feeding time decreased and inactive standing increased as stocking density at the feed bunk increased.

Cows were displaced more often from the feeding area when the stocking density was increased, and this effect was greater for cows using the post and rail feed barrier.

Further, subordinate cows were displaced more often with the post and rail barrier design, particularly at high stocking densities. These results suggest that overstocking the feed bunk will decrease feeding activity and increase competition, resulting in poor feed access.

Use of a barrier that provides some physical separation between adjacent cows, such as a headlock feed barrier, can reduce competition at the feed bunk.

A less aggressive environment at the feed bunk may also have long term health benefits, as it has been suggested that cows engaged in a high number of aggressive interactions at the feed bunk may be at risk for hoof health problems.

Conclusions

Recent research in the Animal Welfare Program at The University of British Columbia has focused on understanding what motivates feeding behaviour in group housed lactating dairy cows.

Specifically, how the management and physical structure of the feeding environment influences this motivation. Under current feeding management practices, group housed dairy cows exhibit a diurnal feeding pattern, which is predominantly influenced by the timing of feed delivery.

Further, increasing feeding frequency increases access to feed, particularly fresh feed, and has the potential to reduce the variation in diet quality consumed by the cows.

Findings have also suggested that the amount of available feed bunk space and the design of the feeding area can influence the ability of cows to access feed when they want to.

Increasing the stocking density at the feed bunk decreased feeding activity and increased competition, resulting in poor feed access. Use of a barrier that provides some physical separation between adjacent cows, such as a headlock feed barrier, can be used to further reduce competition at the feed bunk, and provide better access to feed, particularly for subordinate cows.

This work has primarily focused on the behavioural responses of mid-lactation cows to changes in their feeding management and environment.

Future directions for our research group will now be to undertake the challenge of determining how feeding behaviour influences individual DMI, milk production, and the long term health of lactating cows at the various stages of their lactation cycle. ■

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