Designing Better Environments for Cows to Feed

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Take Home Messages

- Creating comfortable environments for feeding is one important focus of current research within the UBC Animal Welfare Program.
- Lactating cows spend about one-quarter of their day at the feed bunk.
- Providing more space at the feed bunk increases feeding time and reduces competition among lactating dairy cows.
- Providing rubber flooring for the cows to stand on did not affect the amount of time they spent eating, but does increase slightly the time spent standing in this area

Introduction

Attention to cow comfort by producers and researchers alike has usually focused on improving conditions for lying down in the stall (see Tucker et al., 2004). This focus is appropriate, as cows spend about half the day lying down in the stall, and problems with stall design are known to contribute to health problems such as lameness.

Another important activity for cows is feeding. Promoting feed intake in lactating dairy cattle, particularly those in early lactation, is critical in terms of improving milk production, health, and body condition of the animal (Grant and Albright, 1995). Lactating dairy cows will spend 3-5 hours per day eating when given continuous access to a total mixed ration (TMR) (Grant and Albright, 2000). Despite the importance of this activity, very little research has been done on how to design a comfortable environment for feeding.

■ Feeding Patterns of Loose Housed Dairy Cows

A first step in improving the feeding environment is to understand the feeding patterns of loose housed cows and the impact that various management factors can have on these patterns. In one recent study we examined the normal feeding pattern of lactating cows (n = 24) housed in a free stall environment given unrestricted access to the feed bunk (DeVries et al., 2003). Cows were milked twice daily at approximately 05:30 and 15:30 h. An electronic bunk monitoring system automatically monitored the presence of individual cows at the feed bunk every 6 sec.

In this study we found that cows consumed an average of 7.3 meals per day and spent approximately 6 hours at the feed bunk over a 24 h period. Of particular interest was the 24 h diurnal pattern of bunk attendance (Figure 1). Clearly, the management practices of milking and delivery of fresh feed had the greatest impact in terms of mobilizing animals to come to the feed bunk. We were unable to determine whether the act of milking or the presence of fresh feed was stimulating cows to move to the feed bunk.

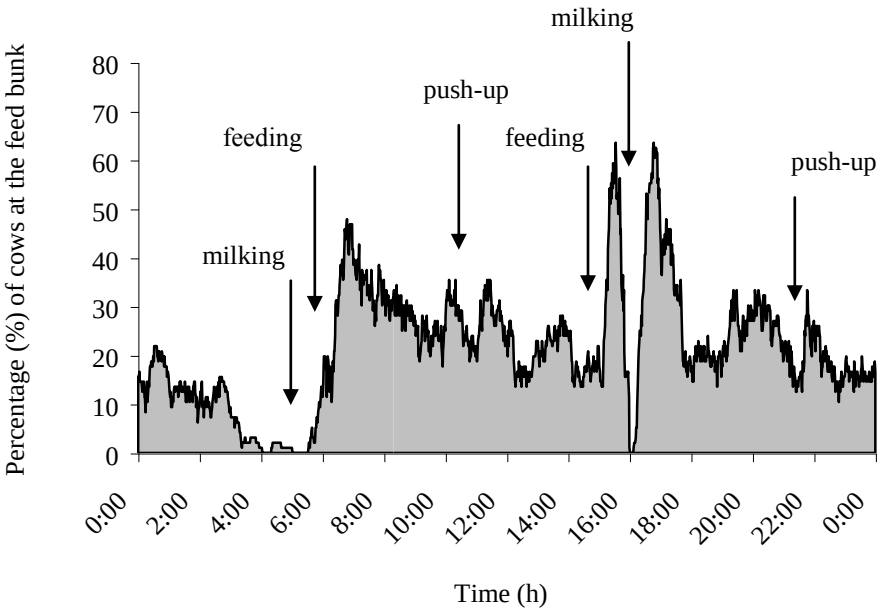

Figure 1. Feed bunk attendance during the normal feeding schedule (from DeVries et al., 2003).

To determine if changes in management can change these patterns, potentially to the benefit of the cow, we also tested cows with an alternative feeding

schedule, which incorporated an increased number of feed push-ups during the early morning hours (DeVries et al., 2003). Increasing the number of times feed was pushed up resulted in small numerical changes in the percentage of cows (n = 24) feeding at different times during the day (Figure 1 vs. Figure 2). However, as found before, the management practices of milking and delivery of fresh feed had a greater impact in terms of mobilizing animals to come to the feed bunk compared to the feed push ups. In new work we are testing the effects of providing fresh feed more frequently, and separating feeding times from milking times. By improving our management of feed delivery times we are seeking to increase time available for feeding, and minimizing time that cows spend idle waiting for feed or for access to the feed bunk.

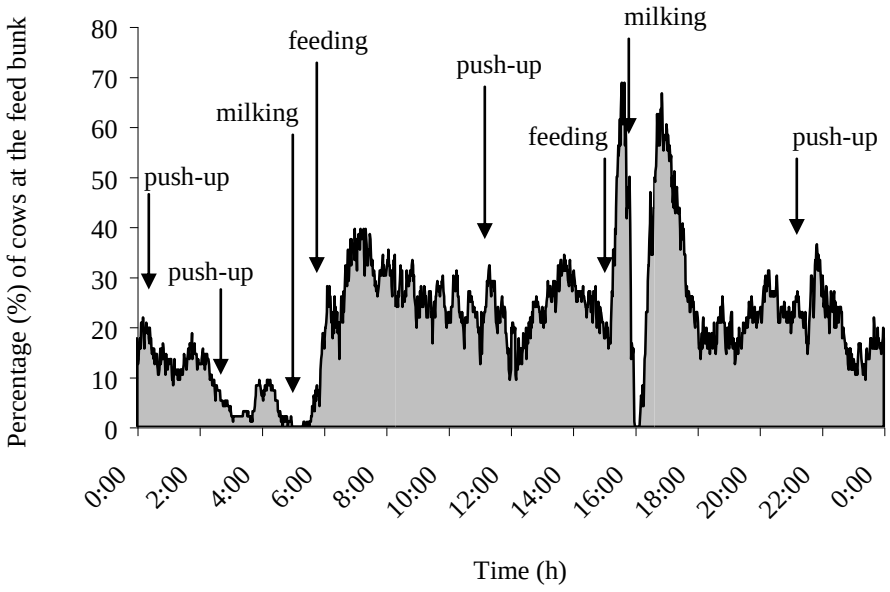

Figure 2. Feed bunk attendance during the increased push up feeding schedule (from DeVries et al., 2003).

■ The Effects of Competition and Social Hierarchies on Feeding Behaviour

Regardless of how well we design and build barns for cows, the ability of animals to benefit from the design is limited by the space made available to them. When grazing, cattle often synchronize their behaviour such that many animals in the group feed, ruminate, and rest at the same times (Miller and Wood-Gush, 1991; Rook and Huckle, 1995). Curtis and Houpt (1983) reported

that group-housed dairy cows housed indoors also synchronized 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. Unfortunately, studies have indicated that the synchronization of behaviours may be reduced when cattle are housed intensively indoors (O'Connell et al., 1989; Miller and Wood-Gush, 1991), perhaps as a result of increased competition for resources in a group-housing system.

Miller and Wood-Gush (1991) compared the proportion of time spent lying and eating by observing cows housed indoors and outdoors on pasture. They reported that cows kept outdoors were able to synchronize their lying and feeding times to a much higher degree than cows housed indoors. They attributed the lack of synchrony between animals housed indoors to increased competition for resources such as feeding. Thus the effects of social competition should be taken into consideration when putting forth feeding management recommendations.

Cows are social animals and form social hierarchies. When visits to the feed bunk are grouped into meals, the number of meals correlates negatively with the social dominance of the cow; namely, dominant cows have fewer meals (Olofsson, 1999). When cows are kept in individual cubicles, free from the effects of social interaction, those with higher feed intakes take fewer meals during the day. Furthermore, meal size (quantity and length), but not meal number, is positively related to milk production (Dado and Allen, 1994). These data suggest that dividing feeding behaviour into a few, long meals may be a more efficient feeding pattern than dividing it into shorter meals. This may be because fewer meals results in more sustained time for ruminating and lying down (Metz, 1975). Social behaviour would seem to be one constraint in achieving this optimal feeding pattern. Reduced space availability has been shown to result in increased agnostic behaviours in cattle (Kondo et al., 1989), perhaps further limiting the ability of some cows to feed in an optimal pattern.

In situations where competition is expected (e.g. with limited bunk space and food), feeding behaviour is related to cow productivity (Friend and Polan, 1974; Friend et al., 1977). Clearly, current feeding management practices are such that competition at the feed bunk is highest when cows return from milking and when fresh feed is offered. At these times dominant cows will demand priority for feeding. Thus, those cows that are less dominant may be limited in their access to the feed bunk at these times, forcing them to eat less or at times where competition at the feed-bunk is reduced.

In another study, we tested if increasing space availability at the feed bunk improves access to feed and reduces social competition (DeVries et al., 2004). Twenty-four lactating Holstein cows, kept in groups of six, were each tested under two conditions: with 0.5 m or 1.0 m of feeding space per cow. Time-lapse video and an electronic feed alley monitoring system were used to monitor cow

behaviour. When animals had access to more space we observed 57% fewer aggressive interactions while feeding. This reduced aggressive behaviour allowed cows to increase feeding activity throughout the day (Figure 3). The increase in feeding activity was especially noticeable during the 90 minutes after fresh feed was provided. During this period, cows with access to more feeding space, increased time at the feeder by 24%, and this effect was strongest for subordinate cows.

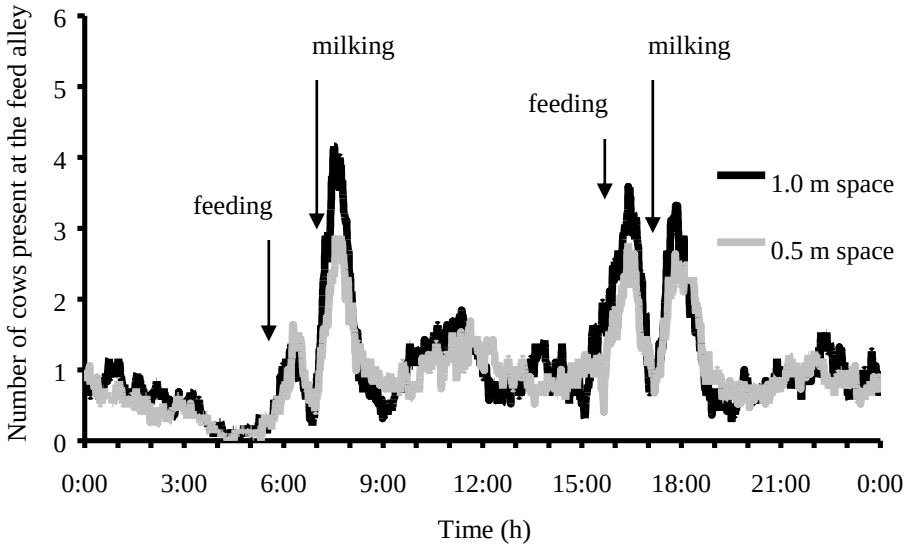

Figure 3. Feed bunk attendance with two levels of feeding space (from DeVries et al., 2004).

■ Improving the Physical Environment at the Feed Bunk

In addition to improving the management of feeding area to improve access to the feed, work is required to improve the physical environment. Two of the most obvious features are the surface that the cow is standing upon, and any physical barriers between the cow and the feed.

Concrete is a popular flooring surface in dairy barns due to its durability, availability, cost and ease of cleaning. Unfortunately, use of concrete flooring is known to contribute to the risk of cows developing hoof injuries and lameness. Concrete floors may also affect the comfort of cows, reducing important behaviours such as time spent eating and displays of estrus. Alternative flooring surfaces such as rubber are becoming popular with some producers,

but no previous research has tested if these surfaces provide real improvements in comfort for cows. In one study, our group tested the effects of providing cows with an alternative surface to stand upon when eating (Fregonesi et al., 2004). The objective of this experiment was to test if rubber flooring in the area where the cow stands at the feed bunk increased feeding time and time spent standing at the feed bunk. Four groups of 12 cows each were tested with both 1" solid rubber flooring and grooved concrete in this area. Each group was observed for a 3-week period on each surface, and individual cow behavioural responses were recorded with time-lapse video equipment. We found that providing rubber flooring for the cows to stand on did not affect the amount of time they spent eating. However, cows showed a slight increase in time standing without eating when they were provided the rubber surface (Figure 4). Clearly, much more work needs to be directed towards developing more appropriate walking and standing surfaces for dairy cows. Some of this work is reviewed in the companion paper in this volume (see Rushen et al., 2004).

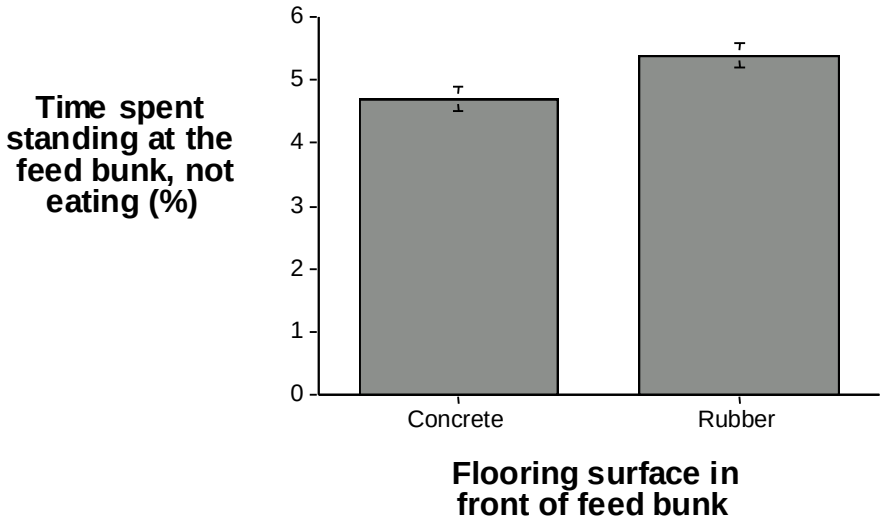

Figure 4. Percentage of time spent standing at the feed bunk without eating on two different flooring surfaces (from Fregonesi et al., 2004).

Fence line feeding, designed to allow all cows to feed at the same time, is the most common method used in free stall dairies. However, the physical barrier separating the cows from where the feed is delivered may also affect feeding behaviour. Many producers believe that a feed line barrier that provides some sort of separation between cows (e.g. head locks) will reduce competition and increase intake. Unfortunately, there is little work comparing different feed line barriers in free-stall barns. Two recent conference proceedings (e.g. Batchelder, 2000; Brouk et al., 2003) describe comparisons of post and rail

feed barriers versus head lock 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 collaboration with Dr. Marcia Endres from the University of Minnesota, we recently completed an experiment in which four groups of 12 cows were exposed to both post and rail feed line barriers and headlock feed line barriers. We will say more about these results during the talk.

■ Conclusions

New research at the University of British Columbia has focused on improving the management and physical structure of the feeding environment for dairy cows. Our work has shown that under current feeding management practices, cows in free stall barns exhibit a diurnal feeding pattern. More frequent pushing up of feed has only a modest effect on bunk attendance. Providing more bunk space per cow has a greater effect, reducing aggressive and increasing feeding activity throughout the day, especially for subordinate cows. Access to rubber flooring at the feeder has little affect on cow behaviour. However, softer surfaces may provide longer-term benefits in terms of hoof health and lameness. New work is examining the effects of other physical and management changes on cow behaviour, productivity, health and comfort at the feed bunk.

■ Acknowledgements

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