Is Automated Calf Feeding Right For Your Farm?

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Take Home Messages

- The percent of dairy operations housing preweaned calves in groups has increased in recent years in the U.S.
- Computerized, automated calf feeders make it easier to feed young calves in groups.
- Larger amounts of milk and more frequent meals can be delivered with an automated feeder without additional labor required.
- Housing young calves in groups can increase incidence of disease.
- Information on feeding behaviour provided by the feeder software can help identify sick calves. Human observation is also critical.
- Management practices such as cleanliness of equipment and housing, high quality milk, small group size, good ventilation and adequate feeding regime are important for successful use of automated feeders.
- It takes excellent management for the system to work. Installing a feeder and not spending the time and effort to make it work will result in system failure. Are you committed to making it work?

Housing Calves in Groups

The majority of pre-weaned calves in the U.S. (about 75%, USDA 2007) are housed in individual pens or hutches until after weaning; however, interest in automated calf feeders used to feed calves in groups has been growing in the U.S. Automated calf feeding systems make it more convenient to house calves in groups where the calves can interact with each other and drink milk many times a day without necessarily increasing human labor. There is very limited research in the U.S. on best housing, ventilation and management practices to be used with these automated feeders.

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Individual calf housing has advantages for animal welfare, such as the reduced transmission of infectious diseases as a result of limited physical contact between calves. In addition, individually housed calves are easier to observe, which can result in more effective disease treatment. There also is less competition for food between calves with individual housing. However, there are also potential welfare disadvantages with individual housing. The most obvious ones are the lack of social contact among calves and the limitation of movement by the reduced physical space provided. In addition, individually housed calves are usually fed only twice a day.

Automated feeders can provide pre-weaned calves either cow´s milk or milk replacer and water individually in a controlled manner. Calves are housed in a group and identified using radio frequency identification (RFID) tags. A processor integrated into the feeder ensures that the milk quantity is allocated according to prescribed parameters, such as age, and dispensed over several feedings per day. The milk replacer concentration, feed quantity per visit, and total feed allocation per day can automatically adjust to the calves' physiological development or age. Cow´s milk alone or combinations of cow's milk and milk replacer can also be fed, dispensed and adjusted according to a predefined plan. Weaning can be done automatically and gradually according to age or intake of solid food.

Feeding group-housed calves on an automated milk feeding system was shown to require less labor time than when calves were housed individually, helping offset the initial investment cost of the machines (Kung, 1997). This might not be the case on every farm, as in order to use the system successfully, a similar amount of labor time might still be required. Based on our survey, the expectation of reduced labor is one of the main reasons why producers invested in automated feeders.

Dairy producers might be interested in purchasing automated calf feeders partly because of labor savings, but the ability to feed calves many times a day, a more natural behavior, is also an advantage. Our research team has collected data from many operations using automated feeders to document labor costs. It appears that labor time is not necessarily reduced, but the type of labor changes. Calves still need to be observed, pens cleaned, equipment cleaned and sanitized, etc. However, it would be very labor intensive to feed calves 4 to 6 times a day without automation.

An advantage of using the automated system compared to manually feeding calves twice a day is that the feeders allow for distribution of the total daily milk intake into small meals throughout the day, with no extra labor input, allowing a greater amount of milk to be fed without requiring the calf to drink a very large amount at each meal. These automated systems also can monitor the feeding behavior of each calf, such as number and timing of visits, the amount of milk consumed by each calf, and the number of unrewarded visits

(when no milk is fed), which has been shown in controlled research studies to help identify sick calves (Borderas et al., 2009).

Efficiency of automated feeders can be improved if the amount of time that each calf spends at the feeder in visits when it is not entitled to be fed is reduced. Feeding larger amounts of milk reduces the number of these unrewarded visits. In addition, automated feeding systems need to be managed properly to avoid competition. Potential strategies would be to keep group sizes relatively small, to properly introduce new calves to the group with adequate training, and to feed higher quantities of milk and in larger meals (4 times a day instead of 8 times a day). Many of these points were well addressed at this conference last year on a review by Steele et al. (2015).

Are any of the above mentioned strategies being successfully used on farms with automated calf feeders in the upper Midwest of the U.S.? There has been consistent growth in the upper Midwest U.S. on the number of farms installing computerized automated calf feeders. No research had been done in our region; therefore, we collected on farm data to learn what strategies are most common in typical Midwest herds. Automated calf feeders represent a new technology that needs study in order to understand housing and management characteristics that enhance calf welfare and dairy operation profitability.

This article summarizes some of the findings of a longitudinal field study we are conducting at the University of Minnesota involving 38 farms with calf feeders. These types of studies can provide descriptive information on housing and management practices, and by collecting many animal and facility measurements, we can identify factors that are associated with successful use of these systems. This methodology does not provide a direct ‘cause and effect’ connection, but we can identify guidelines and factors that can be important and then adopted by producers or investigated in more detail.

▪ Housing and Management Practices in the Midwest U.S. Automated Calf Feeder Facilities

Our study showed that 61% of the farms retrofitted an older facility (tiestall, pig barn, chicken barn, etc.) into a calf facility whereas the remaining 39% built a new barn specifically for the preweaned calves. We did not find a difference in calf health between new and retrofitted barns. Of these facilities, 50% were naturally ventilated barns, 39% were mechanically ventilated, 8% were additions to tunnel ventilated barns, and 3% were naturally ventilated “igloos.” A great majority of facilities (87%) supplemented ventilation systems with positive pressure tubes. It is important that dairy producers work with an experienced engineer when designing a new barn or retrofitting an old one to

make sure all important aspects of ventilation and layout are properly considered.

The average number of calves per pen was 18.2 (Figure 1) which is less than the maximum suggested by the manufacturers (up to 30); the space per calf within the pen was 4.6 sq. meters. There was a wide distribution among farms.

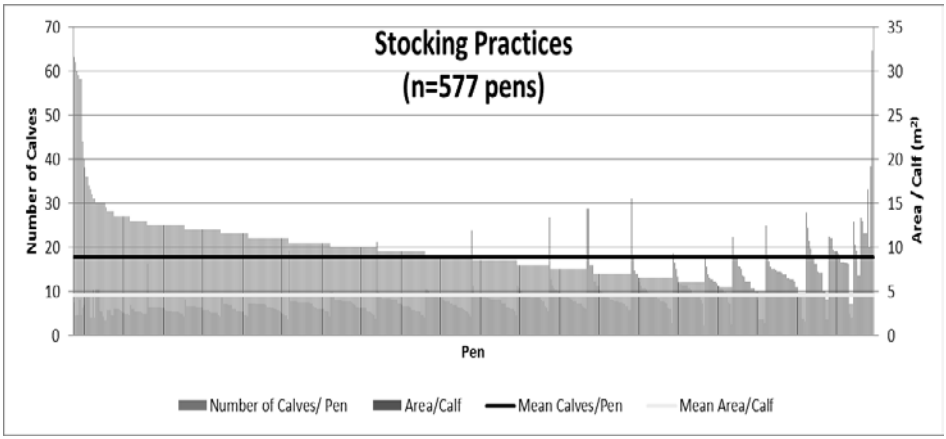

Figure 1. Stocking density as number of calves per pen and area per calf.

Average peak milk allowance was 8.3 liters per day and start milk allowance was 5.4 liters per day (Figure 2). A total of 68% of farms fed calves reconstituted milk replacer, 24% fed whole milk plus replacer or protein balancer, and 8% fed unsupplemented whole milk. Mean time from feeder introduction to peak milk allowance was 18 days.

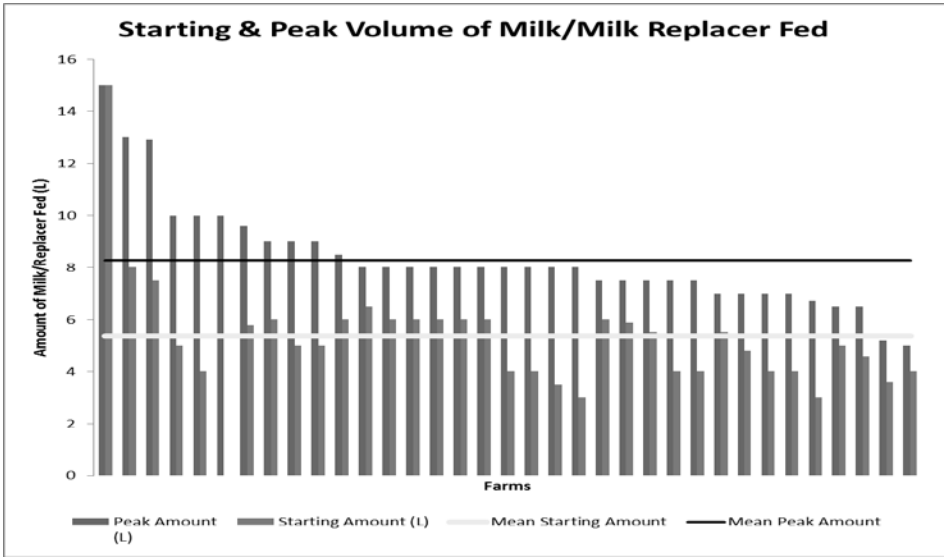

Figure 2. Starting and peak amounts of milk/milk replacer fed.

Calves were placed on the feeder group at 5.4 days of age (range of 0 to 14 days; Figure 3); 10 farms placed calves in the group at zero or one day of age. Placing calves on the feeder at a younger age requires more training and observation to make sure that calves are able to drink their required amounts of milk.

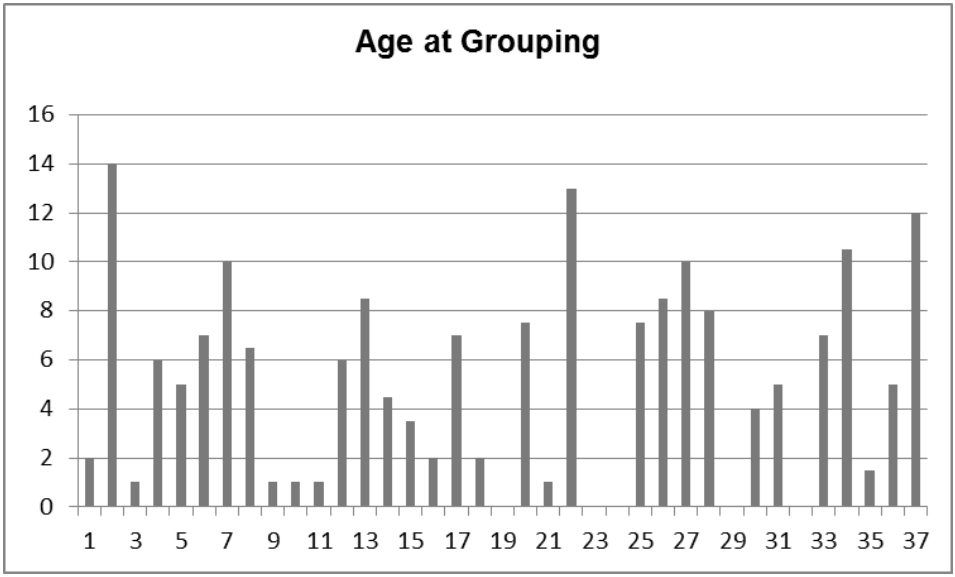

Figure 3. Age of introduction to group pen with automated calf feeder.

▪ Calf Health Observations

During each visit, calves (n=10,179) were scored for health by a single observer using four categories: attitude (0–4), ears (0–4), nose (0–3), eyes (0–3), and cleanliness (an indicator of diarrhea, 0–2), with 0 representing a normal, healthy calf. Body temperature was measured if a calf had an abnormal health score. In addition, blood was drawn from any calves one to five days old (n=985) and serum protein concentration used to assess passive immunity transfer. Milk samples were collected from the mixing container inside the feeder and at the end of the hose (tube) nearest to the nipple for measurement of standard plate count (SPC) and coliform count.

Figure 4 summarizes the calf health scores for the top 10th and the bottom 10th percentile farms. There was considerable variation among farms, indicating that housing and management factors can definitely influence the success of using these feeding systems. Table 1 summarizes the SPC and coliform counts for the top and bottom farms for the samples collected from the mixer and the hose (or tube). Again, there was a lot of variation and some very extreme numbers were detected. The milk the calf is drinking should have less than 100,000 CFU/ml for total plate count.

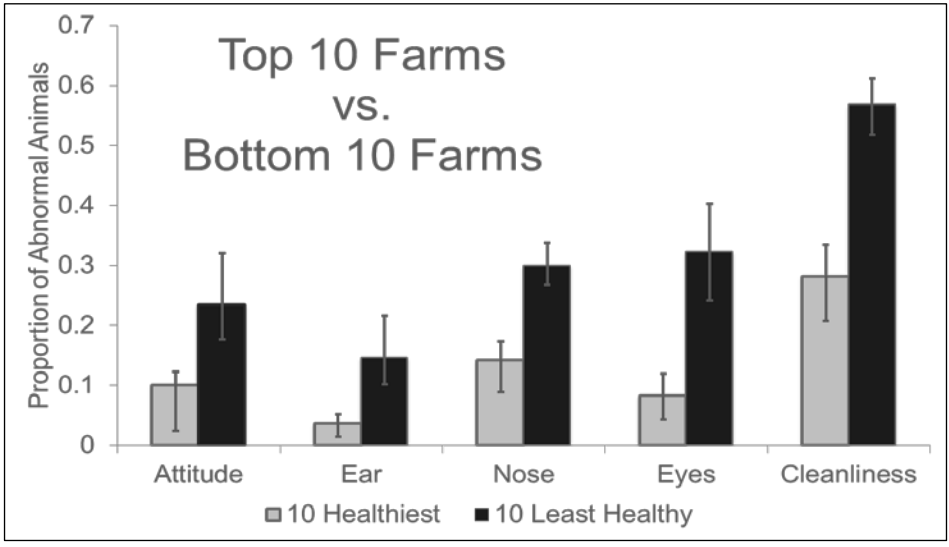

Figure 4. Average proportion of abnormal health scores.

Table 1. Farm average bacterial counts (cfu/ml) across visits for top and bottom 10 farms.

Item	Tube Coliform	Mixer Coliform	Tube SPC	Mixer SPC
Median of Top 10 (Q1-Q3)	887 (206-1,211)	12 (3-15)	87,590 (32,603-134,940)	9,006 (2,308-9,392)
Median of Bottom 10 (Q1-Q3)	5,659,567 (1,198,059-14,344,063)	522,263 (64,564-20,001,213)	21,140,625 (18,644,538-71,642,610)	10,209,920 (3,204,500-43,673,293)

▪ Risk Factors for Abnormal Health Scores

We conducted a mixed model statistical analysis to investigate the association of various housing and management factors with calf health. The factors listed below were associated with abnormal health scores; therefore, farms that have these characteristics are more likely to have more sick calves and be less successful using an automated calf feeder system.

- Number of calves per group: farms with greater numbers of calves per group had a higher number of sick calves.
- Space per calf: less space per calf was associated with higher number of abnormal scores. This was independent of group size. What this means is that a small group size with not much space available to move around the pen could still be a problem. This would be an important consideration when determining the pen size.
- Time to reach peak milk allowance: farms that waited longer to reach the maximum amount of milk had worse health scores. Most farms increased the amount of milk incrementally rather than offering a large amount of milk from day one. That is a good management practice, but the analysis indicated that it is better to achieve the peak amount in a shorter number of days, for example 8 days instead of 18 days. Plane of nutrition is important.
- Air speed in resting area and at the feeder: faster air movement at the resting area was associated with worse nasal scores, an indicator of respiratory disease; air speed at the feeder was associated with abnormal ear scores. This result can be an indication that ventilation is important, but drafts are undesirable.
- Standard bacterial plate count (SPC) on hose (tube) milk samples greater than 100,000 cells per ml: higher counts were associated with higher number of calves with abnormal health scores. We need to provide high quality, clean milk to calves.

▪ Why Use an Automated Feeder?

Dairy producers were asked the top reasons for purchasing the automated calf feeder. In order of priority, their top responses included:

1. less time spent on menial tasks
2. improved calf growth rate
3. improved information on calf feeding
4. natural diet changes/ more natural feeding
5. improved labor condition
6. reduced labor cost
7. social interaction between calves
8. ability for calves to express natural behaviors

▪ Conclusions

Automated calf feeders are growing in popularity and this trend will probably continue as producers want more flexible labor management and consumers want animals to have a more natural life. Feeding calves in groups allows calves to express some natural behaviors that cannot be expressed when housed individually, but offers some challenges in relation to maintaining good health, another important aspect of good animal welfare.

It was interesting to learn that producers might not be aware of the need for cleaning the equipment on a routine basis, which resulted in a wide distribution in the cleanliness of the milk that the calves were drinking across farms. It is extremely important to run all the circuit cleaning as recommended by the manufacturer (or more), replace hoses and nipples regularly, use a good disinfectant (such as chlorhexidine) to remove biofilms from the surfaces, keep the area around the feeder clean, provide clean and dry bedding to the calves, have good quality milk, calibrate the equipment to deliver appropriate concentration of nutrients and temperature for the milk, etc.

Good health is certainly achievable when using automated calf feeders to raise preweaned calves as long as appropriate management and maintenance are emphasized and implemented.

Acknowledgments

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