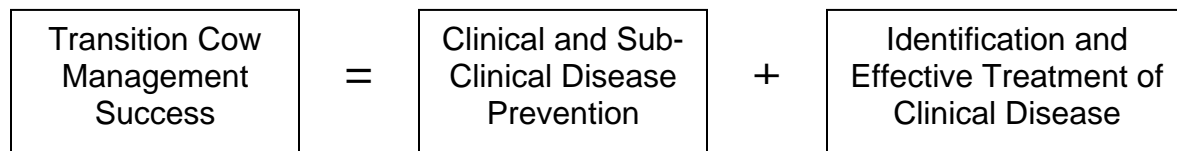


Makin' Me Dizzy – Pen Moves and Facility Designs to Maximize Transition Cow Health and Productivity

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Introduction

The success of a particular dairy herd's transition cow program is the sum of the strategies used by the herd to prevent sub-clinical and clinical disease and the ability of the health workers in the herd to identify and successfully treat the clinical disease that occurs, so that future production and health of the treated individual is minimally affected. Across the dairy herds that we visit, we will see success resulting from effective prevention, effective treatment, and a combination of the two.



This paper will examine current thoughts on the prevention of clinical and sub-clinical disease through grouping and housing.

The Importance of Change in DMI

Much attention has been focused upon the nutritional needs of transition cows over the last few decades, with the majority of dairy herds in North America following programs aimed at maximizing dry matter intake (DMI) at calving time. These programs revolve around feeding energy dense rations in the last 10-21 days of gestation, in the belief that this approach will enhance milk production and prevent metabolic disease in the early post-partum period. However, despite these apparent 'improvements' in dry cow nutrition, information from multiple sources suggests that peri-parturient health has not improved.

On average, 9.5% of cows in each herd were sold or had died by 60 days in milk (DIM) in 268 Wisconsin dairy herds over 200 cows in size, with a mean turnover rate of 37.9%. This is used as a crude monitor of fresh cow health. Field data from 95 herds visited by our group, averaging 680 cows herd size, with a 38.3% turnover rate, have 7.0% of cows in the herd found dead on farm and a 9.3% rate of displaced abomasum (DA). These numbers far exceed what we should be able to achieve as an industry and raise questions about the effectiveness of current management practices.

Interestingly, UW researchers have recently made the case that it may not be the absolute level of DMI at calving which is important for the prevention of metabolic disease, but the change in DMI during the last few days of gestation (Figure 1). This will be affected by a range of animal, dietary and management factors. The magnitude of the reduction in DMI is greater in mature cows, but the rate of change is faster in heifers – making them particularly susceptible to sudden changes in management at the point of calving. This paper will focus on recent findings from our field investigations that shed light on some of the management factors which may influence change in DMI.

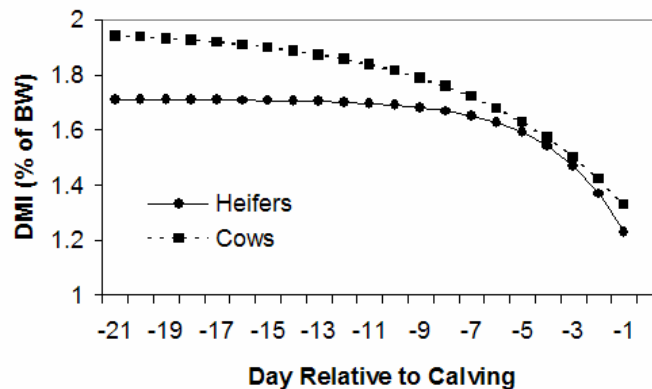


Figure 1. Predicted dry matter intake (DMI) of heifers and cows during the final three weeks of gestation (from Grummer et al., 2004).

Management Factors that Influence Transition Cow Health

We have focused on the interactions between three main transition management factors:

1. Duration of exposure to the close-up ration and to the herd-mates within a group
2. Movements between pens
3. Overstocking within these pens

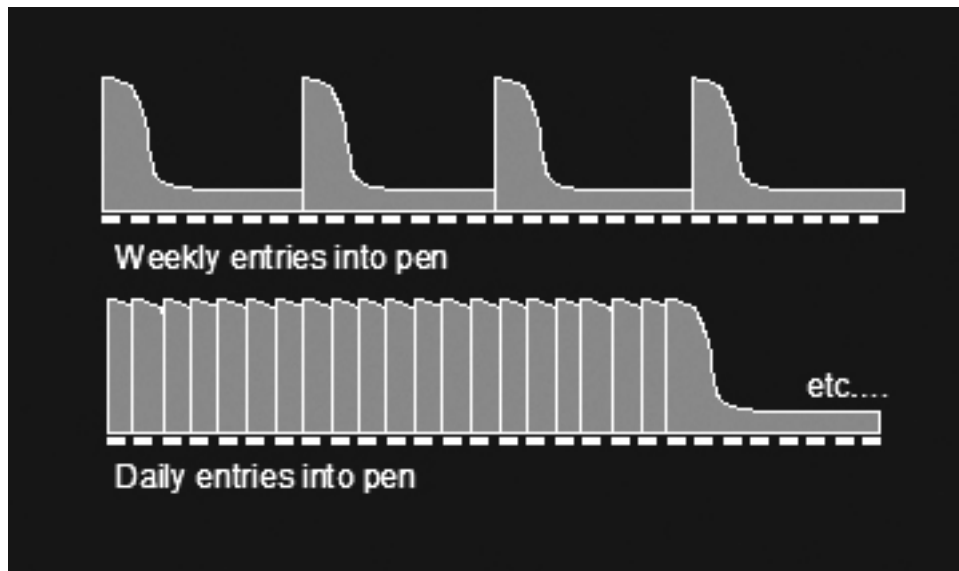
Large free stall housed dairy herds have developed a system of management that involves moving animals between groups to facilitate feeding, breeding and health management. Moving cattle between groups brings about a considerable change in behavior and a period of increased interaction for about 48 h before social stabilization and the development of a stable hierarchy. These changes may have a negative effect on milk yield and health in the moved individuals. Effects on milk production for mature cows moved after the transition period are small and short-term in nature. However, not all movements between groups should be considered equal, and the effect on individuals; first lactation animals and subordinate animals in particular, during a high risk period, such as the transition period, may be greater and last for longer. Although detected changes in milk yield may be small, there may be longer term effects on health that have yet to be identified that are of greater significance.

Transitioning the Rumen or the Cow?

Much credence has been given to the idea of transitioning the rumen for some undefined time period, to allow the papillae to develop and maximize nutrient capture when the cow is fed a lactating cow diet. We believe that this concept has perhaps been over-sold to the industry when cows are fed North American type diets, with the result that many nutritionists will protect time spent on the close-up ration 'transitioning the rumen' while allowing stocking density to exceed target.

These close-up groups are typically managed with weekly additions – characterized by 2 days of social turmoil and 5 days of stability (Figure 2). Stays of 4 days or less will be characterized by social disruption through most of the entire stay, whereas longer stays allow for acclimation to both rations and herd-mates – which may be of particular importance for heifers. In a one group short dry period strategy, benefits may accrue not only from increased consistent exposure to a close-up type ration, but from a reduction in group changes.

Figure 2. Graphic depicting the social turmoil profile of agonistic interactions in a pen characterized by weekly entries of new cows compared to a pen with daily entries.



Short Stay - High Throughput Groups

It is suggested that the ideal time to move the cow prior to calving is 12-24 h. However, a growing amount of field collected data and experience suggests that this timing is difficult to manage in practice. Predicting calving time is unreliable, and cows may remain in the maternity pen for 3-7 days rather than 2-3 days as expected. Although the cows in a spacious maternity pen, lying down on a well managed bedded pack, may appear to be in an ideal environment for freshening, we believe that the timing of the move to the maternity pen is critical.

Unlike the close-up pen, cows in the maternity pen are subjected to daily additions of new herd-mates (Figure 2), which ensures that the maternity pen is rendered in a continual state of social turmoil. In addition, feed and water management in these pens is often less than desirable.

Compared to cows moved within 2 days of calving, field investigation data show that NEFA concentrations are elevated in a greater proportion of cows moved into the maternity pen 3 days or more before calving, and there appears to be approximately a two fold greater risk for ketosis and DA. Risk of removal from the herd in early lactation appears to be elevated three fold. Effects on milk yield are greater for heifers than for mature cows.

Therefore, exposure to a short stay-high throughput group within 2 days of calving, and the social turmoil and potentially reduced DMI that this creates, along with the associated physiological changes that follow, such as elevated NEFA, appears to be a significant risk factor for fresh cow health problems.

Overstocking

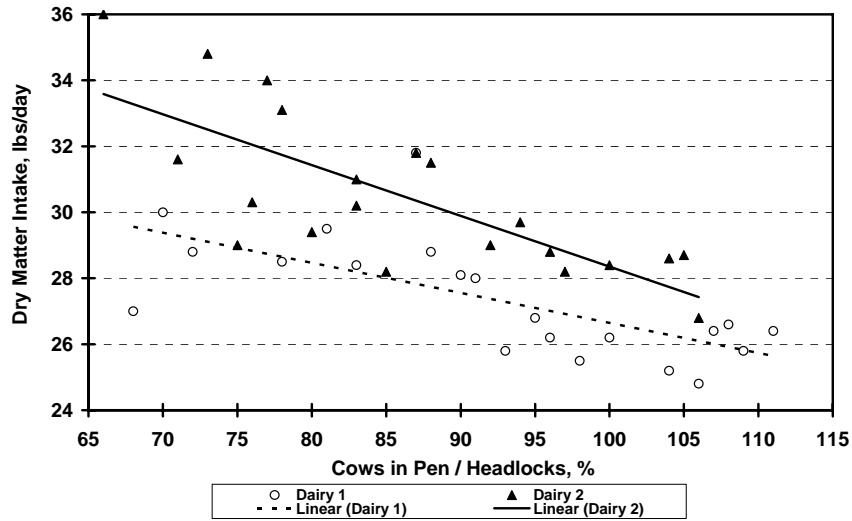
Whatever the pen move strategy, overstocking the pens carries a huge negative impact on transition cow performance. When we talk about overstocking we must be clear about what it is we are overstocking – the stalls or the bunk. For fresh cow performance, we are focused on the bunk. For lameness, we are focused on the stalls.

a. Overstocking the Feed Bunk

It is commonly thought that because dry cows are not lactating and DMI is lower, the close-up group can be overstocked relative to feed bunk space. We do not believe that this is the case. Unfortunately it is rare to see good research done monitoring the effect of overstocking on DMI, milk production and health. However, we are compiling many field experiences which confirm our suspicions. Some of these are given below:

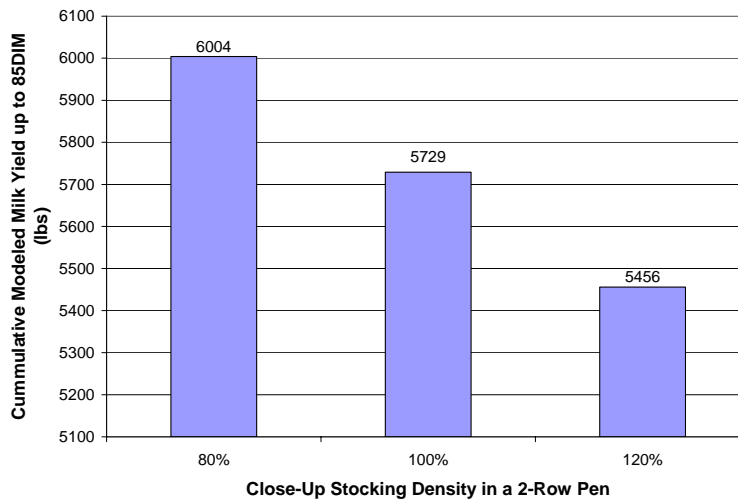
1. Reduced group DMI was documented in two dry cow lots fed identical close-up diets when cow numbers in the pre-fresh groups exceeded around 85% of headlocks. (Figure 3).

Figure 3. Group average dry matter intake of pre-fresh dry cows on two New Mexico dirt lot dairies and stocking density of headlocks on 24-inch centers. Unpublished data from Kenn Buelow.



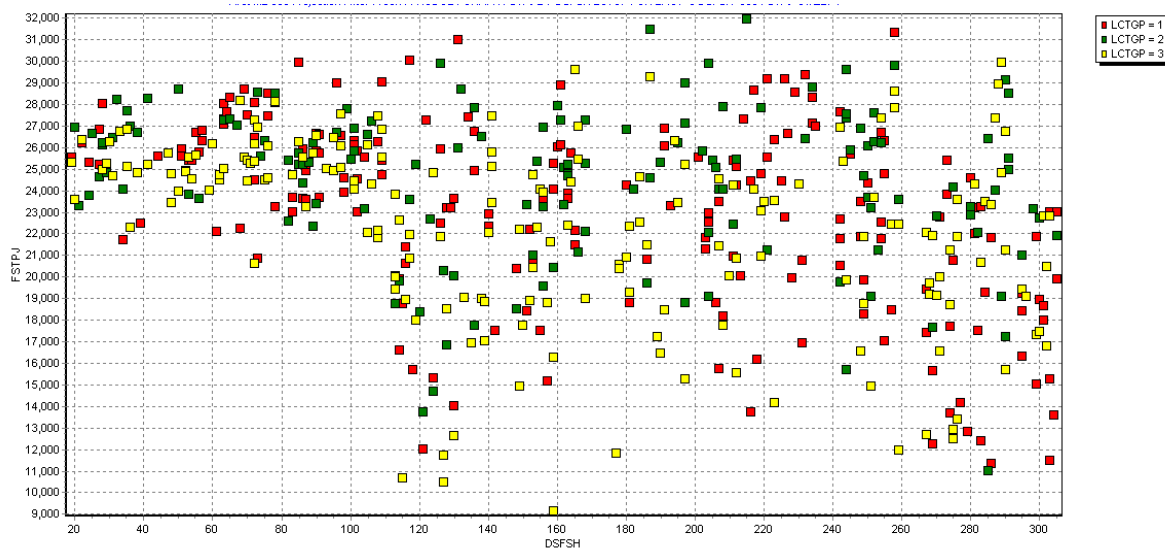
- The impact of over-stocking in a pre-fresh group housed in a 2-row pen on a 1600 cow facility was greater for first lactation animals penned with mature cows. There was a 6.5 lb per day increase in milk production over the first 80 days of lactation in first lactation animals stocked at 80% with respect to stalls, compared to overstocking at 120%. Over the first 85DIM, the milk production deficit amounted to 548lbs.

Figure 4. Modeled cumulative milk yield up to 85DIM for first lactation heifers in a 2-row pen at three levels of stocking density pre-fresh and no overstocking post-fresh. Unpublished data from Gary Oetzel.



- In an 800 cow dairy, pre-fresh stocking densities were improved from 120% to 85% of stalls in a 2-row pen, and post-fresh stocking density was reduced from 100% to 80% of stalls, and 120% to 100% of headlocks. Heifers and mature cows were mixed, and there was a two stage post-fresh group for 1-10DIM and 10DIM to 30DIM. Note the change in variation of first test 305 day milk projections. There is a reduction in the proportion of low producing cows. Note that the low rank cows are mixtures of mature cows and heifers – not just heifers alone.

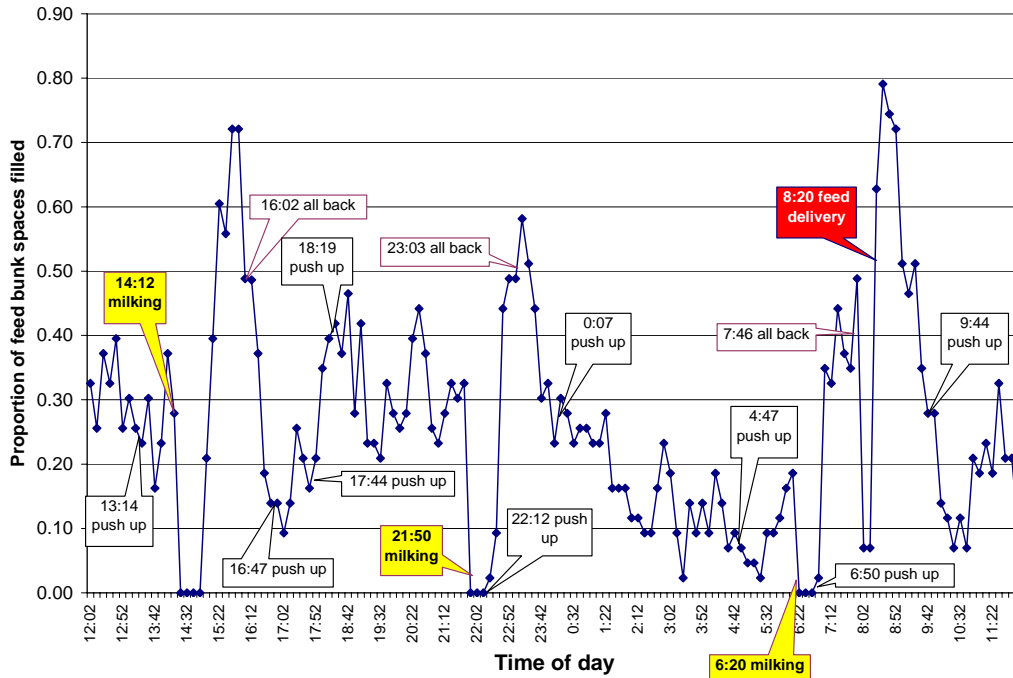
Figure 5. Change in first test 305 day milk projections following changes in pre and post-fresh stocking densities. Unpublished data from Paul Meagher.



We believe that stocking density relative to inches of bunk space per cow impacts DMI in subordinate cows in a group – these cows do not eat when they want to eat and their feeding behavior is affected adversely. Fresh cow health and performance is the most important consequence of this variable measured during transition.

When designing facilities we typically define one headlock as one feed space. However, when we look at feeding patterns of dairy cows in pens, and use this definition we find that it is rare to see all the headlocks/feed spaces occupied.

Figure 6. Graph of the proportion of headlocks filled through a period of 24 hours in the high production mature cow pen on a typical commercial dairy with 3-rows of stalls. The headlocks were spaced at 24 inches on center (from Mentink and Cook, 2006).



Peak bunk use is observed after fresh feed delivery and after each milking and this rarely exceeds 80% of headlocks filled. We believe that this is due to the design and dimensions of each feed space, and it is becoming very clear that mature lactating dairy cows, especially pre-fresh cows, are wider than 24 inches. Thus, if we are to allow feed access at peak times to the maximum number of animals we should stock 24 inch headlocks at 80% maximum, or use 30 inch headlocks, or provide 30 inches of bunk space per cow during the transition period, whatever the bunk design. Even this recommendation may not be enough in post and rail systems where dominant cows may position themselves parallel to the bunk and take up feed space for several cows at one time (Figure 7).

We therefore recommend that all transition cow pens have only two rows of stalls as we would have to severely under-stock a 3-row pen to achieve this feed space target. The economics of building a stall that a cow will not use are unsound! We also recommend against post and rails in favor of headlocks in transition pens, provided that heifers have experienced headlocks previously. If not, then a section of bunk without head locks needs to be provided for these animals to get access to feed.

Figure 7. Comparison of bunk use between headlocks and post and rail feeding barriers – note the angle of the cows relative to the bunk and the empty feed ‘spaces’.



When spikes in calving occur during the year it is interesting to investigate the response of the herd manager. Some will maintain stocking rates in the pre- and post-fresh pens and reduce time spent in the pen, while others overstock and protect time on the rations.

We favor protecting inches of bunk space per cow above all other factors.

b. Overstocking the Stalls

Increasing the number of cows per stall potentially leads to a reduction in lying time and we recommend not exceeding one cow per stall. However, unlike the feed bunk, where maximal use is limited to short periods of time in the day around milking and fresh feed delivery, stall use can be spread out over a greater time period. This allows subordinate cows to compensate for overstocking to some degree by increasing lying time during periods of the day when high rank cows are otherwise engaged. This compensation may explain why some herds appear to tolerate stocking rates up to 115% in 2-row pens without apparent ill effect.

We also need to consider the ‘effective stall stocking density’. With small 45” wide stalls, it is common for the rumen and legs of one cow to overlap adjacent stalls, potentially reducing the use of these stalls (Figure 8). For that reason, stalls should be sized appropriately to the size of the cows occupying them. Stall width is a compromise depending on the size of the cows housed and whether heifers are to be mixed with cows pre-fresh. Width recommendations range from 48” on center for heifer groups to 54” for a dedicated mature cow pre-fresh group in Holstein dairy herds.

Figure 8. Compare the lying position of these large 1800lb Holstein cows in a 48” wide stall (left) and a remodeled 54” wide stall (right). Note that the wider stall allows the cow to stay within the confines of the resting area of the stall.



Simplified Management Groups

We believe that there is a great need to simplify cow grouping on farms. The degree of simplification will vary from farm to farm, and we are prepared to make compromises to suit individual management needs.

It is clear that most farms still wish to maintain two groups of dry cows, despite lowering days dry to around 45-50 days. The move between the far-off and close-up group is a critical step. The move should be made weekly, allowing at least 9 days of exposure to the close-up ration and there should not be a move between close-up groups within a week of calving. If possible, heifers and mature cows should be split into separate groups. However, provided that stocking density is not compromised, we believe that mixed groups can be tolerated.

Maternity pens should be operated like calving pens – with a move at the point of calving to an individual calving pen, where the cow stays for a matter of hours.

Ideally, we would milk fresh non-saleable and saleable milk cows together in the same pen and divert the contaminated milk from the bulk tank. However, on many farms this is too risky a procedure for milkers to be entrusted with and fresh cows continue to be milked in sick pens for 1-4 milkings. This is far from ideal from a disease management perspective, but enough well managed dairies perform this procedure without major impact on fresh cow health provided hygienic precautions are taken at milking time. It is likely that sick cows and cows very early in lactation are not much interested in establishing social rank.

How long do post-fresh cows stay in the same group? This will depend on herd size. In smaller herds we can keep cows longer, but in larger herds, post-fresh surveillance for sick cows is hampered by pens which are too large. In most large dairy herds, cows and heifers should be moved to a pen in which they will remain for most of their lactation from 10-14 DIM. In smaller herds, post-fresh cows can remain together up to 30DIM.

Sick pens contain predominantly mastitic cows under milk withdrawal. Some farms manage most of their mastitis cows in their pen of origin and merely divert the milk into a dump bucket during milking, other farms are too wary of a residue failure to do this and rely on segregation in a separate pen. Both systems appear to be successful when managed well; both are disastrous when managed poorly. For most dairy herds, a sick pen is probably essential, but we should strive to limit the number of cows entering it by using antibiotics with nil milk withdrawal and limit the duration of stay of cows in it by using appropriate effective therapies. On no account should sick pens be overstocked and they should be the most hygienic place on the farm from a bedding management and manure perspective.

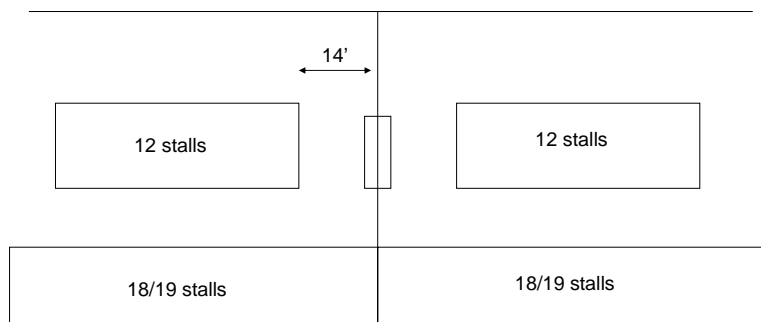
So What Does a Pre- and Post-Fresh Pen Look Like?

The needs of the transition cow have been described above. We need to design pens that:

1. Offer flexibility in sizing
2. Have appropriately sized stalls for heavily pregnant animals
3. Offer ease of cow flow and management
4. Provide at least 1 stall and 30 inches of bunk space per cow
5. Have headlocks to reduce disturbances between cows while feeding

To meet these needs, we suggest building a series of 30 cow pens, end to end. The tail to tail or head to tail 2-row pen layout offers some advantages in terms of cow movement, and with 14 foot cross-alleys every 12 stalls, bunk space is never limited and water access meets the requirements of hot climates. By using these small groups, heifers may be split from mature cows and housed in stalls of different dimensions.

Figure 9. Layout of a 2-row tail to tail or head to tail pen, with a water trough location allowing splitting of the pen

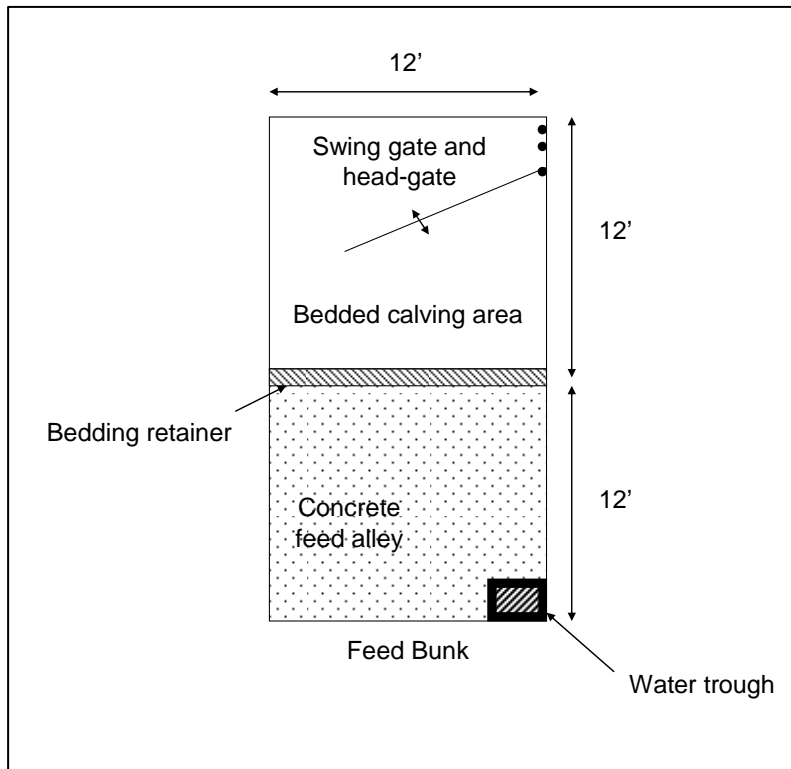


31 stalls per pen @ 48" wide = 29.4" bunk per cow
 31 stalls per pen @ 50" wide = 30.6" bunk per cow
 30 stalls per pen @ 54" wide = 32.4" bunk per cow

Calving Pen Accommodation

If we are to manage cows through individual calving pens, they must be located immediately adjacent to the pre-fresh pen, for ease of cow movement and be appropriately sized. They should also not be in a heavy traffic area, where the cows might be easily disturbed. There should be a bedded area and a feed area. The lock up for the cow should be on the bedded area, with sufficient room available behind the cow to deliver the calf. Water troughs should NEVER be located on the bedded area.

Figure 10. An ideal layout for an individual cow calving pen.



Conclusion

Successful transition cow management results from adequate prevention of clinical and sub-clinical disease, and the recognition and effective treatment of clinical disease. We continue to focus on management risk factors which exacerbate the change in DMI during the last few days of gestation, and our main focus is on protecting inches of bunk space in the transition pens.