Creating the Physical Environment for Transition Cow Success

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Abstract

Field studies of transition cow management using Transition Cow Index™ as the outcome variable have shown that housing constraints are the major risk factors for fresh cow health in freestall dairies today. Key factors to improve fresh cow health are provision of sufficient bunk space so that all transition cows can eat simultaneously; minimizing social stress or the need to establish social rank during the prepartum period; provision of soft, bedded surfaces for standing and resting; and sizing of stalls and packs to facilitate the motions of lying and rising for large, mature cows. Provision of these conditions allows caregivers to screen for fresh cows that need attention in the most effective way.

Résumé

Les études sur le terrain de la régie des vaches en transition qui se fondent sur les valeurs du *Transition Cow Index™* indiquent que les contraintes de stabulation sont des facteurs de risque majeurs pour la santé des vaches vêlées récemment dans les fermes laitières à stabulation libre d'aujourd'hui. Les facteurs clés afin d'améliorer la santé des vaches vêlées récemment sont les suivants : fournir assez d'espace afin de permettre à toutes les vaches en transition de se nourrir ensemble, minimiser le stress social ou le besoin d'établir un rang social durant la période post-partum, fournir des surfaces douces et matelassées pour se tenir debout et se reposer et ajuster la taille des stalles et des matelas pour faciliter les mouvements des grosses vaches adultes qui se couchent ou se lèvent. En remplissant ces conditions, il sera plus facile pour les responsables d'identifier adéquatement les vaches fraichement vêlées qui nécessitent des soins.

Introduction

The phrase widely attributed to the management writer Peter Drucker, "If you can't measure it, you can't manage it", seems to be especially pertinent to the development of our transition cow management advisory programs. Looking back, the development of the measurement tool Transition Cow Index™ (TCI)[13] has made possible our studies of transition cow management in the world of commercial dairies. It has allowed us to evaluate associations between housing systems and fresh cow health that are not financially possible for research institutions. Prior to our use of TCI, our clinical group would investigate complaints of "too many DA's, deads, or RP's" using primarily ration analysis techniques. Essentially, we were investigating poorly defined problems using very narrowly focused tools.

Our approach began to change following a field survey using TCI, which we conducted in 2005. We surveyed the transition management practices of 50 Wisconsin freestall herds with an average size of approximately 600 cows. The herds represented a stratified random selection of herd-average TCI values; meaning that equivalent numbers of herds were selected from each TCI category, i.e., <-1,500, -1,500 to -500, and -500 to +500. Another field study of transition cow management practices was conducted in 22 open-lot dairies in the southwestern US in the summer of 2009. From these surveys, a modest number of management practices have emerged as associated with improved herd TCI scores. Knowledge of these key transition management practices has informed our investigation services, our education programs for veterinarians and veterinary students, and an ever-increasing planning service for dairies as they construct new facilities.

Key factors associated with improved herd average TCI scores relate to provision of sufficient bunk space so that transition cows can eat simultaneously when fresh feed is delivered, minimizing social stress or the need to establish social rank during the prepartum period, increasing cow comfort with deeply bedded stalls or packs and provision of ample space to lie down, and an effective process to promptly detect fresh cows in need medical attention.

While ration formulations remain a part of our investigation services, variation in dry cow and close-up ration formulations in our survey work has not been associated with herd TCI averages. It would be a mistake to infer that ration formulations do not matter. Rather, it may be that the ration formulation services provided to larger herds are generally of good quality, and variation between well formulated transition rations is not a major determinant of overall transition success in our industry today.

Bunk Space

Sufficient space at the feeding fence for all transition cows to eat simultaneously appears to be the most important determinant of transition cow performance in our current industry. In very practical terms, we are recommending a minimum of 30 inches (76 cm) of bunk space per Holstein cow in pre-fresh and post-fresh pens for a 90-minute period after fresh feed is delivered and after every milking. A discussion of the studies that support this recommendation has been presented previously.[14]

To determine feeding space per cow, it is important to focus on length of bunk as opposed to counting self-locking stanchions or headlocks. Headlocks come in a number of widths, including 24, 27, and 30-inch intervals between each unit. Our video studies show that lactating Holstein cows fill a row of 24-inch (61 cm) headlocks to a maximum of 80% at peak feeding periods. This 80% maximal fill rate occurred in two and three-row pens, each with various stall stocking densities, suggesting that the finding was independent of the number of cows per headlock. Converting these numbers, it suggests that lactating Holstein cows will voluntarily fill a bunk at a spacing of one cow per 30 inches. It is likely that pregnant prepartum cows would take even more space than lactating cows.

These recommendations for 30 inches of space assume that the pens are equipped with lockups or other vertical dividers between feeding spaces. If the cows are fed at a post-and-rail feeder, additional space should be provided as dominant cows appear to clear subordinates sooner in these situations.[8]

While we focus the most attention on bunk space in the close-up and fresh pens, the actual number of cows in these pens usually changes every day. If cows are transferred into the close-up pen on a weekly basis, and if cows move to calving pens on a daily basis, there will be wide weekly swings in the number of cows in the pen. The opposite dynamics characterize the fresh pens. In addition, there will usually be seasonal changes in stocking pressure that track seasonal infertility and recovery by 9 to 10 months. Because of these pen dynamics, it is more useful to focus on the longer term capacity of the pens.

The traditional approach to sizing close-up and fresh pens is to calculate the average number of calvings per week by dividing the total number of calvings in the past year by 52 weeks per year. Then the average number of calvings per week is multiplied by the target number of weeks in the pen. For example, if a dairy has an average of 20 calvings per week and the planned duration of stay in the close-up pen is three weeks, most planning manuals suggest that the close-up pen should be designed to house 60 cows. By definition, pens designed in this manner are overstocked half the time.

We prefer to build special-needs pens to accommodate the surges in numbers of special-needs cows. Based upon a review of a number of midwestern herd records, we have recommended sizing close-up and fresh pens for 140% of the average number of calvings. In the example from the paragraph above, we would recommend provision of not 60, but 84 stalls in the pre-fresh pen with an available bunk that is 240 feet (73.2 m) in length. Sizing pens on this basis will mean that these pens are overstocked less than 10% of the time. There are also times when pens sized on this basis appear to be substantially understocked, or as some would say, "grossly overbuilt". Our estimations of the impact of this practice suggest that this makes economic sense. Each stall and headlock in a pre-fresh pen has an impact on the start of somewhere between 10 to 15 lactations each year. Because of the multiplier effect on the start of the lactation of so many cows, it is critical that these facilities are excellent and available to all cows.

Pen Moves and Social Stress Versus Stable Social Groups

Each pen move requires that a cow familiarize herself with the surroundings, as well as movement into a new social group also creates stress as the cow establishes rank within the group.[9] The first two days after entry into a new social group are characterized by a dramatic increase in the number of agonistic interactions, most of them physical.[11] If no additional new cows enter the pen, the group becomes relatively stable. More recent work with mid-lactation cows has shown reduced time spent eating, increased feed evictions, and reduced milk yield following a pen move.[19] Minimizing the number of regroupings through the transition period is consistent with successful transition programs. In most situations, steps to reduce any moves will result in improved transition performance.

A concept of a "social turmoil profile" of a pen has been described.[14] In pens where cows enter at intermittent intervals, like a week or more, extended stays in such pens are considered more desirable than in pens with entries and departures every day. Daily entry pens are considered to be in constant social turmoil, and every effort should be made to minimize the time that prepartum cows spend in these pens.

Cows are social animals. Isolation from the herd creates stress for a cow, and separating a single cow into a separate calving pen for more than a couple of days appears to be a practice with high risks for fresh cow health.

Dry and Close-up Pens

The traditional close-up pen is based upon cows entering the pen approximately three weeks prior to due

date. For reasons of convenience, cows are separated from the far-day pen and moved to the close-up pen once or twice each week. In some systems, the cows deliver their calves in the close-up pen, while in other systems they are removed to calving pens at various times relative to delivery.

Studies on the effect of the number of cows moved at one time have been conducted. Generally, movement of single animals should be avoided as it is believed that familiarity and social bonds among three to five moved animals may reduce the social stress of integrating within a larger group.[17] Sowerby and Polan did not find significant production differences between groups where between 2 and 14% of the cows were transferred at one time between lactating groups.[16] For reasons of both increased numbers of transferred cows and a decreased proportion of high-turmoil days, a weekly move policy would appear to be preferable to more frequent entries.

Regardless of the frequency of new cow additions in our traditional close-up pen, each cow remains in a dynamic social system for a period of several weeks before calving. New arrivals tend to be involved in more agonistic interactions than the current residents of the pen. Brakel and Leis showed that during the first day after regrouping, the average moved-cow was involved in approximately double the rate of agonistic interactions of the resident cows in the pen.[2] Moved-cows tend to maintain their rank relative to the other cows that were moved,[15] but occupy a low rank with respect to the resident cows, even first-lactation, that already occupy the pen. However, the situation is sometimes more complex. Hook observed a complete reversal of the social rank of a group of six heifers with the removal of the high-rank individual and the simultaneous introduction of a new heifer.[10]

As we began applying these concepts to transition cow management, we proposed that the optimal transition cow pens would be based upon an "all-in" pen, where a cohort of cows due to calve within a short period of time, such as a seven to 14-day window, are assembled with no further additions through the calving process.[4,14] The stable social group could be assembled at the time of the traditional close-up period of three weeks prior to calving date, or the groups could be assembled at dry-off. In either system, social rank would be established in the first days after the group is assembled, but would be followed by relatively less turmoil in the weeks that precede calving. Depending on the planned duration of the dry period, there could be four or more separate cohorts of dry cows in the series of stable group pens. The usual policy would be to periodically move entire pens of cohorts intact into the next pen in order to keep the cows near due date in a location proximal to the calf delivery facilities.

Establishment of stable groups at the time of dry-off appears to bring with it several benefits. First, the group is established long before calving date, and even cows that deliver their calf a week or two prematurely are well established in a stable situation. Second, it eliminates the additional lockup of dry cows and removal of close-up cows from that group. Third, monitoring dry matter intakes of close-up pens becomes more meaningful when the cows within each pen are stable in numbers and stage of pregnancy.

In practical terms, even though there is an attempt to develop stable groups at dry-off, it is typical to need to make some modest number of transfers between pens. Individual cows may be dried off early or late and may need to be transferred into a pen with cohorts more likely to calve at a similar time. Likewise, as the cows deliver and are transferred out to the fresh cow pen, there will ultimately be a situation where there is a single cow remaining. It is generally viewed as preferable to merge them with the next cohort of cows when two remain in the pen.

Calving Pens

Calving pens can refer to either a pen to which a cow is moved hours before delivering her calf or it could be a close-up pen where cows enter several weeks before their anticipated calving date and deliver the calf within the pen. If the calving pen has a stable social structure (no additions), extended stays are fine. If new cows are continually being added, we recommend that the duration of stay be limited to 48 hours, maximum. Clinical data from field investigations by the Food Animal Production Medicine group at the University of Wisconsin show dramatic increases in ketosis and displaced abomasums, and early lactation culling of cows that stay three to 10 days in daily-entry group calving pens.[14] When cows are moved to calving pens on a daily basis, they should be selected carefully so that minimal numbers spend more than 48 hours in these high turmoil pens.

It has become common to move cows to calving pens when the feet or head of the calves are showing. Moving cows to calving pens once calving has begun, commonly called "just in time" calving, effectively minimizes the time in high turmoil pens, but presents a new set of challenges. First, it requires round-the-clock labor to check and move cows. Freestall pens can be designed to facilitate this practice with the construction of two-row head-to-tail arrangements of the stall rows. With the tails of all cows visible from the central feed alley, the observer can monitor each cow without walking through and disrupting the pen. Second, workers must be monitored carefully in that they should not move cows into calving pens too early. In a report on moving cows when parturition was imminent,[3] cows that were moved when in labor but with only mucus showing had 2.5 times the

rate of stillbirths as cows that were moved when the calf's feet or head were showing. When the close-up cows are in freestalls, there is a tendency of laborers to move cows into calving pens too early. By moving cows into the pens early, fewer calves are born into the alleys and workers can avoid soiling their clothing when picking up slurry-covered calves. This tension between worker convenience and calf health needs to be monitored and managed in these "just in time" calving systems.

Isolation pens, i.e., box stalls, would appear to minimize social turmoil, but cows are social animals and separation from the herd is usually a stressful experience. If cows are moved to individual box stalls for calving, the duration of stay should be limited to a matter of a few hours.

Surface Cushion in Stalls, Packs, and Under Shades

A loose, deeply bedded surface has emerged in our field studies as a major factor for improving fresh cow TCI scores. In freestall herds, sand-based stalls were associated with more than a 1,000 lb (454 kg) TCI advantage over herds with mattress freestalls. Similarly, depth of loose bedding under shades emerged as a risk factor affecting herd-average TCI scores in open lot dairies.

There is increasing evidence that locomotion scores increase for a substantial proportion of transition cows[20] and physiological mechanisms have been proposed where the same physiological changes that are associated with the loosening of the pelvis to accommodate parturition also relax the suspensory apparatus of the digit in the hoof.[18] The study of sand and mattress freestalls by Cook *et al*[5] showed that cows with elevated locomotion scores changed their behavior on mattress stalls, but not on sand, and may explain the substantial improvement in fresh cow performance on sand surfaces.

Any deep, loose surface will be an improvement over a hard surface. Mattresses covered with modest quantities of shavings or other materials are viewed as average, and any stall surface such as concrete or other firm-packed materials covered with modest bedding should be considered a high risk to successful transitions.

Amply Sized Freestalls, Packs, and Shades

A deeply bedded pack is probably the preferred housing for close-up cows in confinement housing. The guideline of 100 square feet (9.3 sq m) of space per cow[1] includes the bedded area only and assumes that cows have access to an external feeding alley or outside lot. If the feeding area is continuous with the bedded pack, the space should provide a minimum of 120 square feet (11.1 sq m) per cow with good bedding covering most of the area. The pack should be sized to accommodate surges in cow numbers as discussed in the section on bunk space above.

Prepartum freestalls, in particular, need to accommodate the ample dimensions of pregnant cows and allow for some clumsiness in their rising and lying motions. Stalls for prepartum Holsteins and Jerseys should be at least 50 and 45 inches (127 and 114 cm) wide, respectively.[6] Length is the distance between the outer corner of the rear curb to the point where the stall surface touches the brisket locator. If there is no brisket locator, the total stall length is the stall resting length. This distance should be greater than 70 and 63 inches (179 and 160 cm) for Holstein and Jersey cows, respectively. Appropriate dimensions have been developed for cows of other breeds and various sizes.[6,12]

Evaluating the potential for "lunge, bob, and rise" should reflect assessments of three separate items in a freestall: a brisket locator that does not restrict rising motions, including the forward swing of the front foot; freedom from impediments to the forward lunge of the head and shoulder, absence of "bob" zone obstructions; and the neck rail being sufficiently high and forward.[6,12] For a stall to be considered low-risk for Holstein cows, the total stall length should be at least nine feet (2.7 m) long with no obstructions to forward lunge and bob. If the stall is less than nine feet, but the lower side rail is 11 inches (28 cm) above the stall bed or less, it should allow side lunging and is considered an average risk for transition cows. If the stall is less than eight feet (2.4 m) and has obstructions to side lunging, such as lower divider rails greater than 13 inches (33 cm) above the stall bed, the stalls present major risks to successful transition performance. Finally, the neck rail should be approximately 48 to 50 inches (122 to 127 cm) above the stall surface.

In open-lot dairies, transition cow facilities should provide at least 45 square feet (4.2 sq m) of shade per cow, with loose bedding at least three inches (7.6 cm) deep below the shade.

Effective Screening Program for Cows Needing Attention

While difficult to assess, the primary determinant of the fresh cow screening and treatment program is the quality of the people and how much they care for the cows. Facilities that allow easy restraint without exciting the cows is also critical to these programs.

The optimal screening programs appear to use some form of appetite assessment. The practices of the herdspersons of the elite transition programs in our survey study were remarkably similar: delivery of fresh total mixed ration (TMR) while fresh cows were

being milked, palpation of udders for fullness while being milked, observation of cow demeanor as the cows returned to the pen, i.e., does she go to feedbunk or does she lie down, and an assessment of appetite and attitude. Beyond process, the herdspersons in the elite herds knew and cared about the fresh cows under their watch. Effective screening requires both special people and facilities.

Back to the bunk space issue, it requires sufficient feeding space for all cows to eat simultaneously. Cows that do not lock-up, or cows that lock-up with suppressed appetite or signs of depression, were examined. Other examination procedures including rectal temperature, observations for vaginal discharge, ketosis, displaced abomasum, and lung sounds were conducted when primary assessments indicated further evaluation.

While formal screening programs in lockups for fresh cows are a desirable practice, the procedure needs to be efficient and not interfere significantly with the daily time-budget of the fresh cows. Screening procedures that lock cows up for a period of one hour or less per day are considered optimal. While cows are quite capable of compensating for a one to two hour change in routine, if lock-up is prolonged and in association with other stressors, such as overstocking, then the ability of the cow to compensate and catch-up on lying time may be exceeded. Cooper *et al* showed that when cows were deprived of lying for two to four hours per day, they only managed to recover approximately 40% of the lost lying time by 40 hours after the deprivation.[7] Extended lockup time adds substantially to the stresses of transition.

The location of the screening procedures has a substantial impact on the time constraints. If the cows have access to feed while being examined, feeding and the screening can proceed almost simultaneously. Screening time at a palpation rail, for example, must be weighted as riskier than equivalent time in lockups over feed.

This antagonism between holding time and the thoroughness of the screening procedure puts some severe constraints on the fresh pen.

Disclaimer

Obviously, this paper does not provide a comprehensive listing of risk factors for transition cows. However, the risk factors presented here are considered to be common problems in today's intensively managed dairies and virtually all dairies will realize improved fresh cow health if they correct deficits in the areas discussed in this paper.

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