An introduction to the practicalities of cow comfort

The cow deserves a 'life worth living', the farmer deserves to make a living, and the consumer deserves to buy food that is both safe and aligns with their life choices. Here, vet and herd-performance consultant, Martin Kavanagh outlines the critical elements that are key to managing a successful farm system

A practical approach to managing a successful farm system requires an understanding of the critical elements that contribute to the above sustainability goals, prevent disease risk, and promote individual cow wellbeing and health. The elements include cows that are genetically fit for purpose for the chosen system, a farm environment that allows cows to express their genetic potential and remain healthy, a feed management system that exploits the farm feed resource and maintains cow health and longevity, and the ability and skills of the people on the farm to make the best use of these elements.

There is increasing pressure on cattle vets to engage with herd-performance management beyond the routine of treating the acute clinical case or herd event. Often, the reality is undervalued advice delivered at the time of crisis or, at best, as a crisis review. Veterinary herd-health advice leans toward infectious-disease prevention and management of defined production diseases such as mastitis, lameness, or fertility, in response to an increase in incidence. The Irish seasonal system, where 84% of dairy cows calve in the January to April window, lends itself to a cycle of 'short-term strategy to manage disease risk rather than allocating time and effort to a long-term strategy to manage fundamental causes' (Groves, 2020). The environment that cows live and work in has a fundamental bearing on rumen, udder and foot health, and the incidence of production diseases. Vets' understanding of cow comfort will inform long-term strategies in managing production disease and cow welfare. The communication of these strategies will determine the value.

COW COMFORT

The relationship between the wellbeing of the cow and a housing system can be described as 'cow comfort.' In a pasture-based context, it also describes the relationship of cow wellbeing to the pasture infrastructure such as the roadway surface, distances travelled, milking parlour and collecting yard environment, and herding practices.

The term 'six freedoms of pasture' can be applied to cow housing design, and describes the cow's requirement for rest, space, light, air, feed, and water, all of which should be readily available at pasture. Cows on pasture-based systems had lower levels of lameness, hoof pathologies, hock lesions, mastitis, uterine diseases, and mortality compared with cows on continuously housed systems (Arnott et al, 2017). The severity of hoof disorders was lower for pasture cows compared to housed cows from 85 days post calving onwards, and housed cows had shorter mean lying times compared to pasture cows in the same trial (Olmos et al, 2009).

However, there are potential areas of concern in pasture systems of more severe negative energy balance, as a pasture system is limited by the ability of the cow to graze enough, have enough time to graze, and weather stress. A main finding in ProWelCow, an Irish survey of risks to dairy-cow welfare, suggests that poor body condition score (BCS), overcrowding and lameness are all important causes of poor cow welfare in expanding, low-cost, pasture-based systems, and there is a need for investment in infrastructure and housing in the long-term (Boyle, 2017). Larger herds that are overcrowded in winter accommodation, walking longer distances, and herded aggressively have diminished rest, space, and access to feed and water.

Seasonal calving, pasture-fed cows have a requirement for housing for three to six months of the year depending on grass growth, cow type, ground conditions, and the ability of the herdsman to manage the grazing rotation. Whether indoors for prolonged or short periods, the same rules apply to any housed cow in terms of their need for the 'six freedoms.'

THE COW'S DAILY TIME BUDGET

The 'waiting cow' describes individual animals that are not actively being milked, feeding, or lying. About 70% of a cow's day should be spent resting and eating. Dairy cows are highly motivated to lie down for approximately 12 hours per day and have a strong behavioural need to rest (Grant, 2015). The goal is to allow a cow comfortable rest for up to 14 hours per day, eating time from six to nine hours per day, and the remaining time spent being milked, drinking, and interacting with the rest of the herd. Extended periods away from food and bed will reduce production and is a detrimental cost in rest time to the cow. Meeting time budgets for rest increases milk and reduces lameness (Espejo, 2007; Matzke, 2003). Increased resting time is positively correlated with increased milk yield (Grant, 2007).

Pasture-fed cows have similar limitations in that time spent away from the grass paddock can be equivalent to 'out-of-pen' time as described in housed systems. We always need to know how long cows spend 'outside the pen' – three and a half hours is an upper limit for healthy cows; half an hour for 'lame' cows (Gomez, 2010). Pasture cows have the added risk of distance travelled. In the trial carried out by Olmos, housed cows walked 10 times less than pasture cows, 210 metres versus 2,170 metres daily.

The goals in any system are to maximise the time cows spend off their feet to encourage rumination and reduce claw-horn, wear and tear, manage feed to optimise intake and reduce competitive stress, and reduce unproductive waiting time.

An important consideration as herd sizes grow is to recognise that cows do not operate as individuals but are slow-moving prey animals that depend for their survival on their interactions with their herd mates. Cows have clear hierarchical social systems and exhibit allelomimetic behaviour. The trade-off for this protective social cohesion is stressful competition for food and rest when there are limitations to access created by poor housing or system design.

Figure 1: Cow house with a two-row design – an optimum in feed and bed access.

THE PROBLEM THAT IS A CUBICLE

Cubicle housing is the most common system of housing for dairy cows in Ireland. Most cubicles are fitted to make the most of the space available and reduce the cost per bed, with a limited view on cow access to feed barriers, lying time, cow flow, cow cleanliness, and potential for injury in the system.

The common limitations to a cubicle are lack of lunge space, lack of a soft bed, incorrectly placed neck rail, and limited ventilation at the level of the cow's nose. Lunge space, which is the distance from the front of the mat/mattress/brisket board to the nearest forward obstruction, needs to be greater than 70cm to allow a cow to swing her head forward to counterbalance her back legs when getting up. Most cubicle systems are installed too close to walls or have bars at chin and head level that restrict movement. Cows must put their head to one side, hence the wide cubicle partition loops, resulting in a cow rising diagonally and depositing manure at the rear of the cubicle.

Not all beds are equally soft. As a rule, deep-bedded systems using sand, straw, or compost work best but are impractical in poorly ventilated houses or too expensive for slurry management in Ireland. Mattresses provide the next option for bedding, however mattress depth and the nature of the material they are made from will determine the comfort. Foam rubber mattresses were ranked above rubber crumb mats, which were ranked above water beds, in a trial carried out by Wagner-Storch et al (2003). Mats are a poor fifth option being little better than an insulator over concrete. Additional bedding material can compensate to some extent. Every extra kilogramme of bedding material such as sawdust or chopped straw will add extra minutes of lying time and keep the cow cleaner. The value of a more expensive mattress system is hard to appreciate as the effect is medium- to long-term, and the tendency is to accept a cheaper option rather than look at the long-term cow benefit.

Neck-rail position has been erroneously used as a method to maintain a cleaner bed surface by keeping cows closer to the kerb or heelstone in a cubicle. Incorrect neck-rail positioning leads to reduced use of the cubicle, cows perching, and reduced lying times. Neck rails should be positioned over a brisket board, 210-220cm from the kerb, measured diagonally. The cow should not touch the neck rail when standing with all four feet on the cubicle bed. The most important positioning tool is a brisket board. A rounded board or pipe at the front of the bed, not more than 10cm high and 170-180cm from the kerb, will guide the cow where to lie and stand. A brisket board will establish a safer lunge space for the cow in a short cubicle bed. Common signals of comfort in cubicle systems are:

- More than 70% of the cows lying in cubicles are ruminating;
- More than 80% of cows in a cubicle bed are lying down;
- Cows lie down within one minute of entering a cubicle;
- Less than 10% of the cows have hock lesions scoring grade 2 or 3; and
- Less than 10% of cows have udder hygiene scores of 2 or 3 (Hulsen, 2012).

Figures such as Cow Comfort Index and Standing Index can be used as an assessment of comfort and are usually predicated on being measured at certain times of the day after feeding or milking events and can be hard to quantify in an Irish context.

In all systems, all cows will lie down eventually if there are enough beds. Understanding the basic construction of cubicles and appreciating the softness of the beds give an indication if a system is a nine-hour or 12-hour lying system. This is an arbitrary way of looking at a building but is an easy descriptor when discussing limited comfort with a client.

It will not make financial sense to rebuild an entire cubicle system. Improving mattress quality, adjusting the neck rail, or retrofitting a cranked neck rail, installing a comfortable brisket board, adding bedding, and removing restrictions to lunge space can improve a limited system.

Figure 2: Head room and lunge space.

FEED ACCESS

Lines of cubicles are arrayed parallel to a feed barrier with throughways between the cubicle rows to allow access. Throughways are convenient sites for water troughs and cow brushes. Parallel systems have two, three, or four rows of cubicles serviced by a single feed barrier. A two-row system has two rows of cubicles parallel to a single feed barrier, three-row system has three rows parallel to a single feed barrier, and so on.

A simple rule is seven cows can feed together in a single 4.7m standard bay. In a two-row system, there is one feed space per cow at 100% stocking rate. In a three-row system, there is one feed space to 1.5 cows. Cows feed in groups and in sheds with limited feed space, cows will compete aggressively when new feed is delivered. Cows in three-row pens experience more aggressive displacements than cows in two-row pens (Mentink, 2006).

Having feed present all-day does not compensate for lack of feed space, as all feed will be sorted over the day and subordinate cows will eat less feed with a lower energy content. For every 10cm increase in bunk space, there is an improvement in butterfat and somatic cell count (Sova, 2013). Less dominant cows will eat lower palatability feeds to avoid dominant cows (Rioja-Lang, 2012). From a practical perspective, this means that the construction of pens with three or more rows of cubicles per feed-bunk should be avoided, because these typically limit feed bunk space to 40-45cm per cow or less with 100% stall stocking (Devries, 2019).

Irish seasonal dry-cow systems that depend on ad-lib grass silage need control systems to manage body condition. Over-conditioned cows need to be limit fed, while under-conditioned cows need additional feed and unlimited access.

Overstocking cows on a feed barrier will lead to aggressive competition and higher risk of disproportionate numbers of individual cows losing or gaining weight. For risk cows, cows that are close to calving, cows with low body scores, lame cows and fresh cows, there should be a minimum feed space to allow simultaneous feeding (≥76cm per cow) to optimise health and production. For other lactating cows, providing good bunk availability is still critical to maximise dry matter intake (DMI) and promote good eating, lying, and rumination patterns. As such, the target requirement for those cows is a minimum of 61cm per cow (DeVries, 2019). More feed barrier length allows more feed to be put out, more access for less competitive cows at feed out, and more opportunity to group cows and manage intakes. Lack of feed space is a common constraint on Irish farms that increases the risk of transition disease events.

To achieve the maximum number of cubicles in a row, throughway space is often sacrificed. Cow-house builders do not think in cow sizes. A cow is 2.5-3m long from tailhead to nose-tip. Throughways and access passageways are generally too narrow. Once there is a water trough in a throughway, no cow can pass if others are drinking, unless the width of the passage is greater than 3.5m. This leads to more competitive stressful events and restricted cow-flow to beds and feed. Also, increasing the alley width at the feed barrier to 4.5-5m increases feed access as cows can walk freely behind feeding cows.

Some cubicle systems are arrayed perpendicular to the feed barrier and in most of these systems, the cubicle access passages end in a dead-end, allowing no escape routes or circulation. Feed space is restricted by fault of the design, ie. if the cubicle row length exceeds the barrier length, feed space can be reduced to less than one feed space per two cows in a multi-row perpendicular system.

FEED MANAGEMENT AT THE BARRIER

Cows feed in groups, feed in early morning and evening, and feed competitively. So, even if feed is present all day, cows will interact in ways that give some advantage over others (Grant, 2015). Fresh feed delivery and pushing up of feed will drive feeding behaviour. Every feed event stimulates cows to come to the barrier and allows subordinate cows opportunity to access fresher or less sorted feed.

Cows will exert significant pressure on a badly designed feed barrier and can injure themselves with repeated contact, as signalled by lumps and wounds on the neck and on the point of the shoulders. Feed barriers should allow sufficient reach for cows. Ideally, the bottom of the feed rail should be 130cm above the floor where the cow stands. The feed retaining wall should be no more than 55cm in height above the floor where the cow stands. The cost of locking barriers is questionable, especially in a seasonal herd when the need to restrain cows during the housed period is short term unless the farm has no access to a drafting and handling system.

Once a feed bunk is empty for greater than three hours, a cow's motivation to feed increases significantly (Schultz et al, 2006). If the shed is overstocked, competition for feed gets worse and cows are at risk of 'slug' feeding, eating larger meals faster, and consequently, developing acidosis.

Feed troughs can help with keeping feed in reach and available for cows. However, the tendency is to use the cows to clean out the trough as against feeding the herd to a refusal and cleaning out the waste feed. Pushing up food more regularly, particularly in the two to three hours after fresh feed delivery, encourages intakes and reduces competitive feeding.

Figure 3: Five-metre feed alley.

WATER ACCESS

Cows should be afforded multiple drinking points in a group to avoid competition. One drinking point per 20 cows, water pressure of 20L per minute, and regular cleaning of water troughs are optimal. But there should be at least two water points per group of 20-60 cows. Water troughs should be checked daily for filling pressure and contamination.

STOCKING DENSITY

Overstocking sheds improves the facility economics but impacts on individual cow outcomes. Overstocking results in reduced resting times, increased waiting, more aggressive competition, and decreased rumination. Current recommendations are, for three-row systems (six rows of cubicles, two parallel feed barriers), never exceed 100% (one cow per bed). Two-row systems (four rows of cubicles, two parallel feed barriers) stocked at 100% offer the cow the optimum in feed space and bed access. 'Risk' cows in any system should be stocked at not more than 80%.

In an Irish context, the highest-risk group in a seasonal system is the transition cow at peak calving. Feed barrier space and bed access can be limited at peak stocking density prior to full-time grazing and increases the risk for ketosis, abomasal displacement, and BCS loss. Outbreaks of these conditions reflect the constraints in the system for the highest risk animals. Overstocking to reduce infrastructure costs is both a false economy and a cow welfare issue.

COW OUTCOMES

The 'wellness' of the individual cow is the indicator of a successful system. A poorly designed system that is professionally managed can result in a better outcome than the converse. So, while there are useful structural rules that can be applied to a housing system, the success of the overall system will depend on the contribution of the four elements outlined above. A structural change may not yield the expected result if there are other constraints in the system that are more important to solve. Systems should be judged on the Cow Signals® of health and performance as well as conformance to standards of design for optimum cow comfort. However, implementing rules of one bed and one feed space per cow, and ensuring cows have continuous access to feed, water, and rest, would solve most constraints in cow housing.

CONCLUSION

The impact of the cow's environment on her ability to express her genetic potential is underestimated. Feed management and feeding environment will influence the nutrition outcome and is often as significant as formulation. Sub-optimal cow housing environments contribute significantly to the incidence of production diseases.

There is an acceptance that because the Irish system is dominated by pasture access for more than eight months, that the system is forgiving on cow comfort. Farms that have not invested in roadways and extra housing as the herd expands belie that assumption. To achieve sustainability goals of reduction in the use of antibiotics on-farm, increase in cow survivability, and reduction in replacement stock inventory, there must be a better understanding of the interaction of cows with farm environments. Investment in cow housing and comfort measures is a dilemma. The cost of remodelling or building new sheds is known; the potential cow response on any given farm is not. For vets involved with production disease control, understanding the requirements of the cow will help guide long-term solutions to common problems of lack of feed space, overcrowding, excess waiting times, and poor cubicle comfort. Cheap changes to cubicle systems by adjusting neck rails, installing brisket boards, increasing feed space, increasing bedding, and removing dead ends yield benefits that are visible to the farmer.

Vets should not be excluded from the conversation on building for the cow. It is important to come to this discussion with practical and meaningful solutions that offer both the cow and the farmer a return on investment. Cow comfort and the appreciation of cow welfare outcomes in both housed and pasture systems is becoming more significant in planning sustainable farms. The cow, the farmer, and the consumer will demand it.

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