

Time for Technology



"Air" is the Fourth "Freedom" of the CowSignals Diamond

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In previous issues, we introduced the "CowSignals" concept and the philosophy that low stress management of the dairy herd provides cows with the "six freedoms of the pasture" illustrated in the "CowSignals diamond". These "freedoms" are unrestricted access to feed, water, light, air, rest and



The CowSignals Diamond can help identify weak spots in management

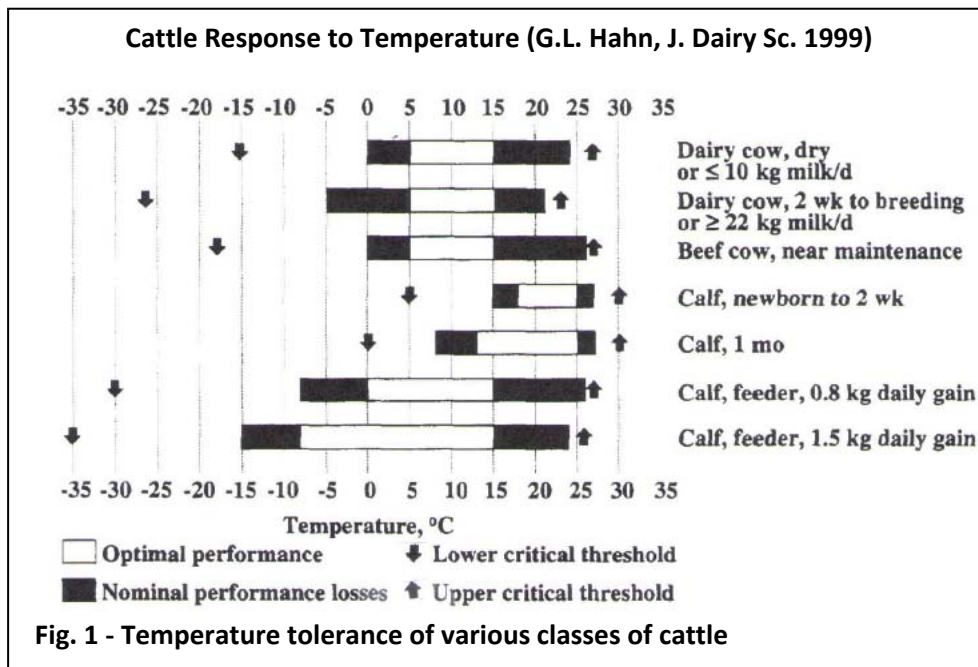
Every farmer trouble shooting their own dairy facilities and management and every advisor doing so for a client, brings their own set of biases to the situation. Applying the mantra of "feed, water, light, air, rest and space" to every assessment prevents tunnel vision and ensures every aspect of meeting the needs of the cow is given consideration.

When it comes to management decisions about "air" January is probably an ideal time to talk about "what the cow needs" in terms of air quality because it is quite different from what most farmers prefer to provide. With regard to air temperature, the chart below illustrates the optimal and acceptable range of temperatures for various classes of cattle. As shown, the temperature range for optimal performance in dairy cows is 5 to 15 degrees Celsius. This is a much lower comfort range at both ends than you and I experience, and that is because as a ruminant, the cow has a "built in furnace burning forages" which makes her much more cold tolerant in winter, and more susceptible to heat stress in summer.

Stale" barn air is loaded with moisture and carbon dioxide from the lungs of cows, as well as methane from their rumen, and ammonia and other gasses from their urine and manure. When cows are forced to breathe this stale air, they become uncomfortable, eat less feed and produce less milk. Fresh, dry air is also needed to dry the floors and beds. Humidity, resulting in damp bedding and wet floors promotes the growth of bacteria, resulting in mastitis, high cell counts, and lameness due to digital dermatitis and heel horn erosions. Opening things up in a naturally ventilated barn and running the fans in a fan ventilated setting will make more fresh air available and lead to better cow health and performance. If cows are "thermally neutral" at 5 degrees Celsius, and fresh air is better than stale air, the temperature in your dairy barn should be no higher than 5

°C unless it is warmer than that outside. You might prefer to have it warmer, but your cows will reward you if you make their needs your priority. Driving down the roads, we cannot "see" how fresh the air is in your barn, but when it's above 5 degrees outside and the curtains are not fully open, you are sacrificing air quality and making life more difficult for your cows. At lower outside temperatures, cows still suffer less from cold than from stale air, so at least down to the point where water and manure start to freeze it is better to err on the side of "fresh" than on the side of "warm". With curtain walls the downwind side of the barn should probably never be open less than a foot unless the inside temperature is at the point of freezing. Even at much lower temperatures cows do very well as long as they are out of the wind and have a dry place to lay down. If your manure and water systems cannot handle freezing temperatures, even well insulated barns suffer from poor air quality when the outside temperature is below minus 15. So where such weather is common, barns that can tolerate freezing usually perform better than those that are "closed up tight" to keep the frost out. Generally a good nose is all you need to judge barn air quality but when you work in stale air all the time you do get accustomed to barn odours. So perhaps the way you and your clothes smell to someone who hasn't been out to the barn may be a better test than your own nose.

As illustrated in the graph, in baby calves, that are not yet eating hay and other forages, the "furnace" is not on yet, and optimal performance is in the 18 to 25 degree range. It follows that good cow barns are never good places for baby calves. Keeping the new born warm with a heat lamp and a blanket is a good way to give them a head start. After that, experience shows that a cooler, drier environment is still better than a warm wet one. But milk fed calves housed at less than 15 degrees do need extra milk to produce body heat, and lots of bedding to nest in, to do well.



But when it comes to cow comfort, on the high end, cows get out of their "comfort zone" at just 15°C. So preventing summer heat stress is a critical issue. Cows cool down by breathing in dry air and blowing out wet

air. This is like sweating through the lungs. In summer up to 50 litres of water per day will leave the cow by this route. This is the most efficient system for the cow to lose body heat. A lot better than sweating by the skin. But this only works well if the air the cow breathes in is dry and fresh. Breathing faster is the main way that cows increase the rate of heat loss, so rapid breathing is one of the first symptoms of heat stress. Normally a high producing cow will breath between 10-30 times per minute. If you see one cow breathing fast (30- 60 times per minute) this might be because of pain, fever, inflammation of lungs or lungworm. It can also be normal behaviour after being chased or when in heat. If you see more cows breathing fast the ventilation and cooling are not good enough. Seeing more cows than normal standing in freestalls, instead of laying down is another signal. With heat stress they stay on their feet to have a bit better cooling because the breeze can go around them.

In terms of which ventilation systems work best, the air provided by natural ventilation is free so it is most logical to use this to advantage. With properly sized chimneys or ridge openings and good management of the inlets, meeting the ventilation needs for fresh air in winter is easy. Since the air outside is always colder and hot air rises, nature's principles do a great job of removing stale air. But in summer the demand for fresh air to keep cows cool is much greater and the chimneys don't help much because the outside air is often warmer than air inside the shaded barn. So the only force of nature that can help you is wind. If you are building new, building on a hill, away from other buildings, building with high fully open side walls, and orienting the barn so the side wall is perpendicular to hot weather winds all help to maximize natural air flow through the barn. In Ontario the best barns have 14 foot open side walls with gable ends oriented north west and south east to pick up the hot weather winds from the south west.

But on wind still days the only way to keep cows cool is with fans. One important place for a fan is the close up cows (dry cows 3 weeks before calving) This is a high risk group. A second place is the holding area before milking. Here the cows suffer the most stress because of being so packed together. Just compare it with a hot sweaty summer night when you don't like your partner to be too close to you in bed. In the milking cow area the first place for fans is over the freestalls. That is where cows are supposed to spend 14 hours per day, and that is a lot longer than the 6 hours at the feed manger. But that does not mean that a second row of fans at the manger doesn't pay off in very hot weather. Sprinklers, that wet the cow with big drops of water on the hide, combined with fans to evaporate that water are also helpful on very hot days, but only if you can make sure the humid air you have created gets replaced with drier air from outside. Humidity greatly increases heat stress problems.

Clearly summer and winter both have their specific challenges, but we often see the biggest problems in spring and fall when temperatures and winds can be quite unpredictable. These are the times that good managers pay special attention to the

weather and to their ventilation controls to make sure they are working properly and adjusted to the changing conditions.

When proper barn ventilation results in happy, healthy cows, the other outcome will be happy farmers, and that is the ultimate goal of the CowSignals concept.