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Calves can get the fresh air they need

Delivering fresh, clean air for young calves to breathe is important for both health and welfare. It also can be a challenge, depending on housing situations.

Most calf-housing systems in the U. S. fall into one of two categories: individual pens and group housing. Both methods can be in outdoor hutches or various types of indoor, enclosed housing. With indoor structures, ventilation and providing fresh air to the calf become of utmost importance.

Ventilation can rely either on natural daily variation of wind currents, or various types of mechanically enhanced ventilation. Natural ventilation typically works best when the buildings are narrow and located in areas that don't restrict wind flow.

Mechanical ventilation options can include:

(1) Circulation fans that simply move the existing air within a structure
(2) Large fans that draw air from the outside and move it across the calves in either a tunnel or cross ventilation method (negative-pressure system)
(3) Positive-pressure tube ventilation (PPTV) that applies fresh air to the calves continuously without a draft.

Because option #1 -- recirculating poor-quality air -- is not sufficient for calf health, negative- pressure and positive-pressure ventilation systems are the two viable options for optimal calf health and comfort.

Dr. Ken Nordlund and his team at the University of Wisconsin have refined the method of PPTV in calf housing by providing insight into key factors that help prevent calves from experiencing respiratory disease challenges. The graph below helps explain the principles that they have determined are most important in calf housing. The three variables examined that have an effect on the incidence of respiratory disease include:

- The airborne bacteria level.
- The presence or absence of a solid barrier between each calf.
- The ability of the calf to "nest" into the bedding material within the pen.

Nordlund and his colleagues evaluated a wide range of calf-housing styles. The facilities examined that had the highest prevalence of respiratory disease had an absence of a solid barrier between calves and a nesting score of 1 (represented by an open circle). As the level of bacteria in the air decreased, the prevalence of respiratory disease decreased but not as much as the greater effect of adding a barrier (represented by a solid circle).

When the calves had a nesting score of 3 and the presence or absence of a solid barrier were examined, it

became clear that the prevalence of respiratory disease in the herd was highly dependent on having a barrier were examined, it became clear that the prevalence of respiratory disease in the herd was highly dependent on having a barrier between calves. The calves represented by the closed squares showed that the prevalence of respiratory disease was low even in the presence of high air bacteria as long as they had a solid barrier and a nesting score of 3. If the solid barrier is missing (represented by the open square), the air bacteria levels must be very low for the herd to have a low prevalence of respiratory disease within a group of calves.

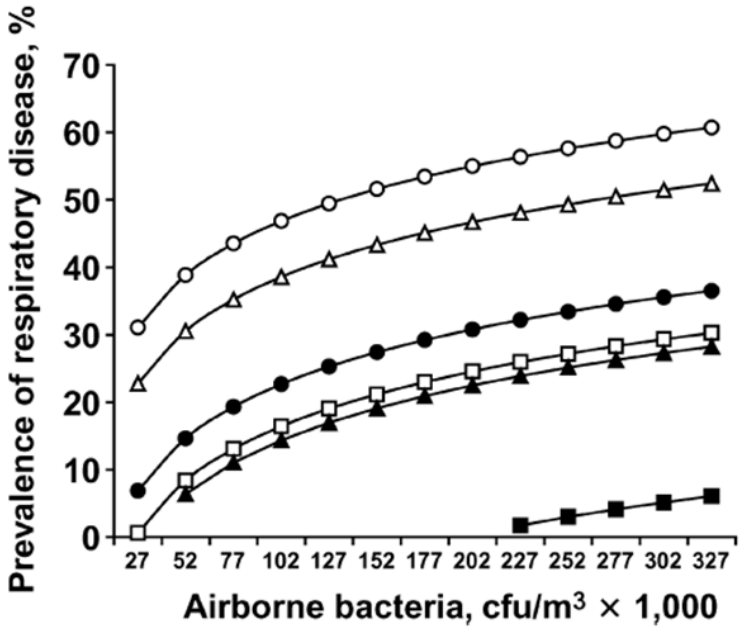

Figure 2. Model of the association between airborne bacterial concentration and prevalence of calf respiratory disease with different combinations of nesting scores and the presence or absence of a solid barrier between each pen. Nesting scores: 1 = legs visible above bedding when lying down; 2 = legs partially visible; 3 = legs not visible. Nesting score 3 and presence of a solid barrier (■); nesting score 3 and absence of a solid barrier (□); nesting score 2 and presence of a solid barrier (▲); nesting score 2 and absence of a solid barrier (△), nesting score 1 and presence of a solid barrier (●); and nesting score 1 and absence of a solid barrier (○).

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Tunnel or cross ventilation

With these principles in mind, consider the application of pulling air the length or the width of a building utilizing large exhaust fans mounted in one end or one side of a calf housing structure. Assume that the calves will have a nesting score of 3. The questions for consideration are:

- Will the calves have a solid barrier between them?
- Will the air bacteria level be low at the calf level?
- Can the air flow be restricted during cold weather so the calves do not have a draft (defined as air movement greater than 60 feet/minute at the calf level)?

Solid barrier present -- If the solid barrier is perpendicular to the air flow from the exhaust fans, then the air flow will not provide relief from high bacteria levels within each pen. The air will flow above the barriers and will not pull "bad" air or "dip" down inside the pens to refresh that air. Air flow is lazy -- it takes the path of least resistance and the shortest distance.

If the solid barriers are parallel to the air flow, the back and front of the pens need to be relatively open and not restrict the air flow within the pen. If there are multiple rows of calves, then the air flow for the calves near the air inlet will experience low air bacteria levels. Conversely, the air near the exhaust fans will have accumulated bacteria levels from over the length of the barn resulting in calves near the exhaust fans exposed to bacteria and other contaminants in the air from the entire herd.

Finally, applying a consistent airflow below draft speed is very difficult in a negative pressure system like a tunnel or cross ventilation system. However, during warm ambient temperatures, high speed air flow can help improve calf comfort if they actually are exposed to the moving air.

Solid barrier absent -- Generally, tunnel ventilation in calf barns without any barriers to air flow will result in good air quality with the exception of the accumulation of bacteria levels near the exhaust fans. But the overall benefit of barriers described above still will apply. Therefore, the prevalence of respiratory disease will be higher without the benefit of solid barriers between calves.

The benefit of cooling during warm temperatures and the challenge of drafting calves during cold temperatures apply as well.

Positive pressure tube ventilation (PPTV)

The first principle of PPTV design includes matching the fan size to the farm ventilation goals and the size of the building. Secondly, the tube that is attached to the fan should be designed specifically to meet the needs of the calves so that a known amount of air is provided to the calf housing consistently and continuously without a draft (systems designed for colder ambient temperatures). Tubes designed for summer weather provide air consistently and continuously at very high volumes and at a relatively high air speed. This ensures

the air quality during warm temperatures is improved consistently, the calves are cooled and the environment is dried.

Because PPTV systems can be custom-designed to fit nearly any type of calf housing, fresh air can be easily and consistently provided to calves that have solid barriers between them. The high bacteria levels within pens are constantly diluted with fresh air resulting in consistently low levels of bacteria.

With a PPTV system, the calves and the farm get the benefit of solid barriers and low air bacteria levels. All of this benefit occurs without a draft impacting the calf during cold weather. The air flow is strategically channeled through the PPTV system so it doesn't have a chance to be lazy. Calves benefit further when they have a deep layer of dry bedding in which to nest.

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