

article describes the effects of barn design and construction on the health and well-being of animals and your ability to keep them healthy.

VENTILATION

Three rules should be remembered concerning ventilation of barns: 1) Cows breathe out moisture (they also produce heat); 2) Air exchange removes moisture (it also removes heat); 3) Air moves through holes.

To maintain a healthful environment in any animal enclosure there must be a continuous supply of fresh air. A 1,400 pound cow will breathe out approximately 4.5 gallons of water per day regardless of outside temperature. Therefore it is necessary to exchange air even during cold weather. The same cow will continuously produce about 670 watts of heat. This heat will have to be removed from around the cow on all but the coldest days. The warmer the outside air the more fan capacity required.

When you examine a barn you should be able to identify how the fresh air gets into the barn (inlets), how the fresh air gets to all the cows (distribution), the force that causes the air to move (fans, wind, buoyancy), and finally how the foul air gets out of the barn (outlets). A poorly ventilated barn will have one of more of these items missing.

Signs of poor ventilation include: condensation on walls, ceilings and fog in the air; hot stuffy locations in the barn; and dust, gases and odors. In general, in the winter time if the barn "smells like a barn," it's under-ventilated.

Mechanical Ventilation

Mechanically ventilated barns utilize fans to cause air to move. Exhaust fan systems are most common. Ventilation rates required vary with outside temperature, therefore, more than one fan or fan speed is necessary. A small fan should run all the time to control moisture. Other fans will need to come on as temperatures rise.

The most common method of bringing air into a barn and providing for distribution in an exhaust fan system is a continuous slot inlet. Inlets should run along both long sides of the barn except near the fans. Barns wider than 38 feet may require center inlets. Thermostats for controlling fans should be mounted where they will sense the general barn temperature, away from the ceiling and other obstructions (normally over the center aisle). A thermometer should be located with the thermostats. For animals where a wide swing in temperature can cause problems, use a maximum/minimum thermometer.

The most common problems in mechanically ventilated barns are inadequate or inappropriate inlets (holes) and improper fans. If the fans shut off regularly during cold weather, a smaller continuously running fan is probably necessary. If the barn becomes stuffy on mild days, a larger fan or more inlets are usually necessary. Extra openings such as gutter cleaner chutes, broken windows or loose fitting doors can result in short circuiting of air and poor distribution. Various extension publications are available to aid in troubleshooting ventilation systems (Brugger, 1983).

Natural Ventilation

Naturally ventilated barns utilize openings, external winds, and thermal buoyancy to provide for air exchange. At least three types of openings are required (Graves, 1984). A continuous opening at the ridge or top of the barn allows warm moist air to exit year round. Continuous sidewall

openings (usually at the eaves) provide small amounts of air during cold weather. For summer conditions large sidewall openings are needed. Ideally, during hot weather all sidewalls would be gone and the barn would act like a sunshade. This exposes the animals to any outside breeze.

Many naturally ventilated barns still do not have open ridges. This results in trapping moisture during cold weather and heat during hot weather. Older free stall barns often have insufficient sidewall openings for summer cow comfort. For various reasons farmers are reluctant to make adequate openings in existing and often new barns.

HOT WEATHER COMFORT

High ambient temperature and humidity can have profound effects on milk yield, reproductive performance, growth and health.

The basic approach to hot weather cow management includes:

- keep cows out of the hot midday sun
- maximize air movement around the cows (2-5 mph at the cow is recommended)
- provide adequate air exchange to remove foul air from barns
- provide plenty of fresh cool drinking water (extra tubs may be needed during the summer).

Areas of particular concern during hot weather include holding areas where cows are crowded close together and feeding areas. Farmers are encouraged to take steps to provide fresh palatable feed and fresh water in a comfortable environment. If the barn or shade tree is more attractive than the feed bunk or water trough it is likely that feed consumption will decline. Management changes that may be considered include: feeding time and frequency, manure scraping times, use of outside paddocks at night or early morning, and bringing cows into well ventilated barns during the heat of the day.

Sprinkling Cows

Farmers using water sprinklers at feed bunks to improve cow comfort in hot weather and thus maintain feed intake report good results. This practice must be approached with care to be sure it does not result in wet sloppy udders. Sprinkling should be considered after all reasonable methods of opening barns and improving air exchange have been exhausted. Sprinkling cows in an enclosed barn or holding area, with inadequate air exchange, will result in a steam bath.

For additional comfort, large fans can be arranged to blow directly on cows to enhance drying. It is the evaporation of water directly from the cow's hide that provides the most heat removal or cow cooling. Recent reports from Florida (Means, S.L. et al, 1992) indicate that large quantities or long time periods of water are not necessary. An automated system that alternated 1.5 minutes of sprinkling and 13.5 minutes of fans was operated whenever temperatures were above 78° F. Flow rates were varied from 0.6 gpm per cow to 1.3 gpm per cow. There was no increase in cow comfort or productivity with higher flow rates.

An easy way to apply water is to drill and tap a 3/4 inch PVC or galvanized pipe every 4-8 feet to accept a spray nozzle or small lawn sprinkler. Place the pipe and nozzles to direct water onto the center of the cow's backs. The water