



MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS

Ventilation Basics for Beef Cattle

Ventilation Principles

Good ventilation is important for the health and productivity of beef cattle. Cattle give off heat and moisture as they grow, especially feeder cattle on high energy rations. They also produce manure and urine which adds moisture to the environment, and gases like ammonia. It is important to remove stale air with excess moisture and gases and replace it with fresh air to avoid respiratory problems. When the weather is hot it is important to remove animal heat to keep the cattle comfortable. A good ventilation system will do these things.

Insulation helps improve ventilation. Insulation is used to reduce the flow of heat or cold in a barn. In cold weather a small amount of insulation under the roof steel can minimize condensation from occurring as moisture from warm moist air will condense on cold surfaces. Insulation is also important in warm weather to reduce the flow of heat into the barn and keep it cooler. Insulation under the roof steel of a single storey barn with an R-value of 5 to 10 is a good idea to reduce condensation and keep the barn cooler.

All ventilation systems require three basic components:

1. an inlet system to allow fresh air into a building.
2. an exhaust system to remove the stale air from the building
3. a control system to provide the correct amount of air entering and leaving the building.

The amount of fresh air required for beef cattle will depend on the size of the animal, and the time of year. The recommended ventilation rates for cattle are shown in Table 1.

Table 1. Recommended Ventilation Rates for Beef Cattle

Type of Animal	Ventilation Rate CFM */ Animal	
	Cold Weather	Warm Weather
Beef Calves < 3 months	10	120
Veal Calves	12	175
Beef Feeder	15	300
Beef Cow (1,000 lbs.)	20	400

* CFM = cubic feet per minute

Natural Ventilation

Natural ventilation relies on wind power to blow air through a building, combined with the buoyancy of warm air to exhaust air from a building. Natural ventilation works best when the barn is orientated 90° to the direction of the summer winds, so they can blow through the narrowest width of the barn. Generally, in Ontario most of our summer winds come from the west or southwest, so the barn should be orientated with the ridge running in a north-south direction. To be effective, the barn will require large openings on both sides to let the wind blow fresh air in and exhaust stale air out on the other side (Figure 1). In cold weather natural ventilation relies more on the fact that warm air rises, so air entering in the barn is warmed by the cattle's body heat and then allowed to exhaust through some form of chimney or ridge opening.

In the simplest form inlets can be windows that can be adjusted or removed for ventilation. However, most old barns with stone or concrete foundations do not have enough window space or are blocked by the mow access. Where possible, the inlets should be continuous openings of 4 ft. or more that are closed using adjustable curtain material.

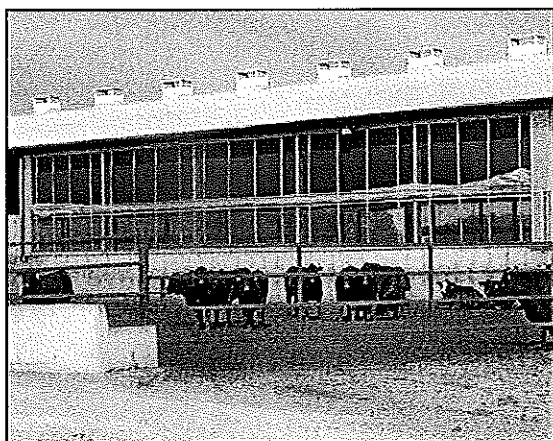


Figure 1. Natural Ventilation Requires Large Wall Openings

Air can be exhausted from a single storey barn through an open ridge. The size of the ridge opening is dependant on the width of the barn. It is usually 1-2 in. per 10 ft. of barn width (Figure 2). The ridge can be covered to reduce rain and snow from entering, as long as the cover does not reduce the flow of exhaust air. The ridge opening should stop 8 to 12 ft from the ends of the barn to help reduce down drafts.

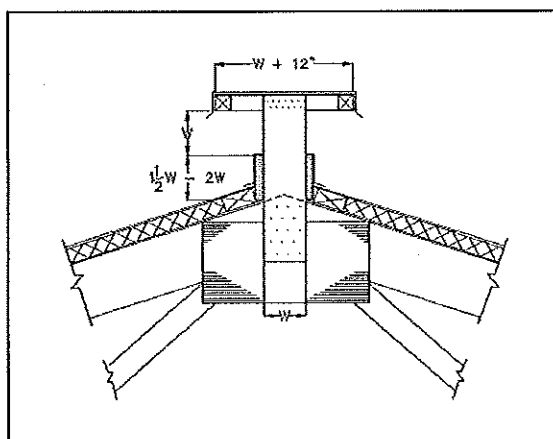


Figure 2. Open Ridge

The other option for exhausting stale air is with chimneys. Individual chimneys reduce the amount of rain and snow that can enter, and they can also be used in a two storey barn. The following thumb rules will help with the selection of chimney sizes:

- Provide $\frac{1}{2}$ ft² of chimney opening for ever 100 ft² of floor space in a single storey barn
- Provide 1 ft² of chimney opening for ever 100 ft² of floor space in a two storey barn
- Always provide at least 2 chimneys
- Chimney size should never be larger than 4' x 4' to prevent down drafts
- Dampers can be used to control the exhaust of air in chimneys in two storey barns, and should be located near the top of the chimney to keep in warm, and to help it draw better.
- Should have one chimney for every 2,000 ft²
- Chimneys should be no further than 20 to 24' apart in wide barns

The third aspect of a natural ventilation system are the controls. The wall openings need to be adjusted depending on wind direction, outside weather and size of animals. Most curtain openings are adjusted with manual winches. Automatic controls are available but only justified with sensitive livestock.

Fan Ventilation

Most structures for beef cattle are ventilated naturally, but sometimes exhaust fans are necessary, especially in old two storey barns with few windows. Fan ventilation relies on electrical power to move air instead of natural wind forces. Inlets are still required to allow for the entry of fresh air, but a fan is used to remove air from one side of the wall to the other. The fan builds up a negative air pressure in the barn, and sucks the air out. The fans are turned on and off using a thermostat.

Fans are not often used in cattle barns as natural ventilation is preferred because of its simplicity and minimal operating costs, but fans can be useful in older two storey barns to exhaust stale air where natural ventilation isn't possible. The minimum winter ventilation rate can be calculated from Table 1. This minimum ventilation rate

may need to be increased to 4 air changes per hour to provide good air quality in cold weather. It is better to have two small fans spread out than one large fan to provide the minimum rate. Fans will draw air from the easiest place possible, so if there are too many cracks in an old barn or if fans are located near a leaky window they will not do an effective job of removing stale air, so its best to spread them out.

Operation of the Ventilation System

The goal of the ventilation system is to provide fresh air to remove excess moisture and heat, and gases without causing drafts. It is healthier to keep cattle cold and dry as opposed to closing up a barn to keep the heat in and not let it freeze. This also keeps all the moisture and gases in which can result in respiratory problems.

It is important to provide fresh air without drafts. Cattle notice air movement to be drafty, when it is moving too fast relative to the room temperature, or it is much colder than the room temperature. It is important during cold weather to bring in fresh air as high as possible on a wall, so it has a chance to mix with room air before it reaches the animals. You should try to avoid bringing in fresh air along the floor. This means that it is important to seal along the bottom of doors in the winter, or sometimes it may be necessary to cover gates with plywood to block air movement along the floor. Sometimes shade cloth (used in the greenhouse industry) can be used to allow fresh air in while slowing down the wind speed. Shade cloth is a woven material that comes in different porosities (i.e. 80% material:20% open).

Ventilation Manual

OMAFRA recently published a manual on Ventilation for Livestock and Poultry Facilities - Publication 833 (see figure 3).

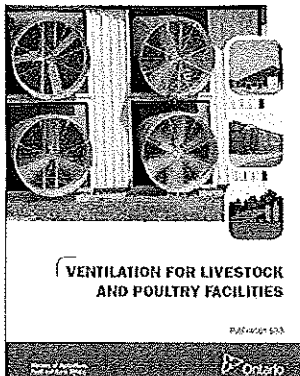


Figure 3. OMAFRA Ventilation Manual

This manual was prepared to assist producers and ventilation designers in the design, installation and maintenance of ventilation systems. It explains the basic design principles, operational requirements and maintenance of ventilation equipment in livestock and poultry barns in Ontario. Examples are provided throughout the book to demonstrate how the various principles and components are interconnected in actual barn situations.

The Ventilation Manual can be ordered through ServiceOntario. The cost is \$50.00.

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