DESIGNING DAIRY GOAT HOUSING AND VENTILATION FOR OPTIMUM ANIMAL HEALTH

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Designing dairy goat housing and ventilation systems to optimize animal health may seem like a daunting task but following some simple management guidelines will help you minimize health challenges without breaking the bank. The key is to find the most economical way to provide for the needs of both animals and their caretakers.

Housing

Many different types of housing can be used successfully for dairy goats. Priority should be given to facilities that allow for a clean, dry environment for all management groups while providing plenty of fresh air and feed and water space. The facilities should also be labor efficient and economical while providing for safe conditions for workers and animals. When evaluating facilities needs, first determine how many management groups you will have and how large they will be. Then list out the needs for each group. Consider space and airflow requirements, feeding strategies, ease of animal movement, health care and treatment needs, and manure handling. Use Tables 1 and 2 as a guideline. Once you have decided on what the 'ideal' facility would look like from an animal perspective, list out the wants and needs of the owners and employees. Then you will likely need to make some compromises. Prioritize the list with needs first, wants second, and then determine how many of those items you can afford. You may have to drop some of the 'wants' from the list to stay within budget but try not to compromise on the needs.

If you are considering renovating an existing facility to house goats, think critically about what resources you have and the advantages and disadvantages of the building. Do you have enough land, labor, feed, and manure storage to accommodate the remodel or expansion project? Will the remodeled building fit within your management plan and provide the animal comfort and labor efficiency you are looking for at a reasonable cost? If not, go back to the drawing board and seriously reconsider your plans. Compromising on a building that is in a poor location or won't provide for good animal health is a recipe for failure and regret. Be aware of is-

Table 1. Resting area recommendations for dairy goats.

Housing type	Resting area			
	Doe	Buck	Young kid	Growing kid
Bedded pen with lot	12 – 18 ft^2	30 – 40 ft^2	3 – 5.5 ft^2	8 – 10 ft^2
Dirt lot	25 – 40 ft^2	100 ft^2	15 – 20 ft^2	20 – 30 ft^2
Paved lot	16 ft^2	50 ft^2	5 ft^2	10 ft^2
Bedded pen total confinement	20 – 25 ft^2	50 ft^2	8 – 10 ft^2	8 – 10 ft^2
Individual pen	6' x 6'	6' x 6'	4' x 4'	4' x 4'
Kidding pen (1 per 10 does)	5' x 5'	NA	NA	NA

Adapted from *Dairy Goat Production Handbook* (2016) American Institute for Goat Research and Langston University

Table 2. Feed and water space recommendations for dairy goats.

Feeding system type	Doe	Buck	Young kid
Limited feeding – grains or pellet feed (all animals require equal access)	16 – 20"/head	12"/head	9 – 12"/head
Feed always available – forages such as dry hay, silage, or mixed ration	6 – 8"/head	6"/head	2 – 4"/head
Automatic water bowl/nipple	40 – 50 head/bowl	10 head/bowl	50 – 75 head/bowl
Water tank perimeter	15 – 20 head/ft	No info	25 – 40 head/ft

Adapted from *Dairy Goat Production Handbook* (2016) American Institute for Goat Research and Langston University

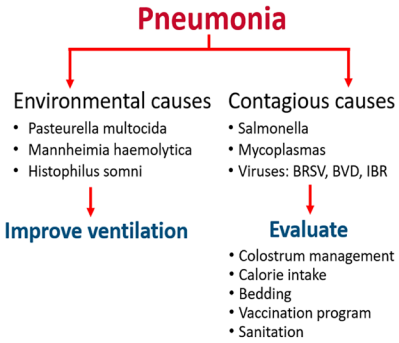

Figure 1. Flow chart for identifying management interventions.

sues due to questionable structural integrity, poor water access, corroded pipes, outdated wiring, low ceilings, or poor ventilation that might blow up your budget. A general rule of thumb for livestock buildings is that remodeling costs shouldn't exceed 70% of the cost of a new build. If they do, you may be better off spending the extra money for a new facility that better fits your goals and needs.

Ventilation

Proper ventilation can be difficult to achieve in goat facilities, especially if the building wasn't originally designed to house goats. To determine whether poor ventilation is causing respiratory problems, work with your veterinarian to determine what is causing the issue before investing in ventilation upgrades (Figure 1). Improving ventilation is not a cure-all for respiratory issues. It needs to be considered as part of an overall animal health and welfare strategy. If you can smell ammonia when you first walk into the barn or if you have excessive condensation or dripping from the ceiling or roof, this is a good indication that airflow is inadequate. Ammonia levels should be below 10 ppm measured at nose level.

Once you determine that ventilation needs to be improved, the next step is to determine what type of ventilation system will work best for your facility (Figure 2). Natural ventilation can work well for buildings with no ceiling and good access to prevailing winds. These buildings may just need to be opened a bit at the eaves and ridge to improve airflow. However, natural ventilation has some challenges. Wintertime temperature fluctuations can lead to conditions where the air inside the barn is colder than the air outside the barn. When this happens, warmer fresh air coming in through the eaves rises and exits the ridge opening, rather than dropping down to mix with the air inside the barn and forcing warmer stale air up and out the ridge vent.

If the building has a ceiling that can't be removed and/or is tightly constructed, then a mechanical ventilation system may be a better option. Negative pressure systems that pull air from the barn can work well if there are air inlets that allow evenly distributed fresh air to be pulled into the building without creating drafts on the animals. If there are large, uncontrolled openings such as doorways that can't be closed, then a positive pressure system that forces fresh air into the barn may be a better choice. Either way, mechani-

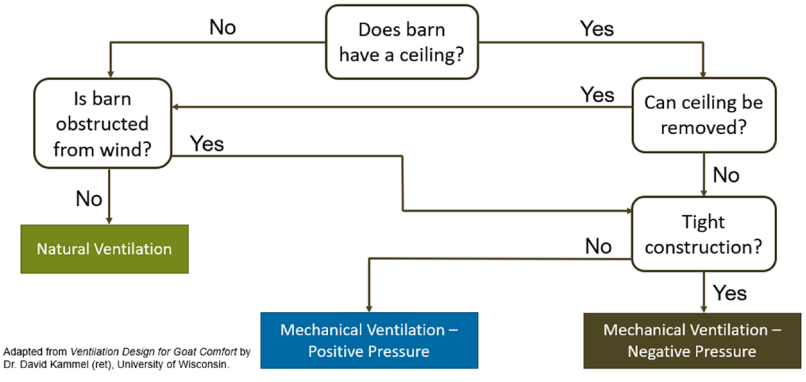

Figure 2. Flow chart for determining optimal ventilation system for different building types.

cally ventilated systems need to be properly designed and controlled to provide adequate fresh air exchange without creating dead spots or drafts. See Table 3 for recommended ventilation rates. Wintertime airspeeds at animal level should be less than 100 ft. per minute for adult goats and less than 50 ft. per minute for young goats to prevent cold drafts.

Positive pressure ventilation tubes are another option that can improve airflow in both natural and mechanically ventilated barns. These tubes work by placing a fan in the exterior wall that forces fresh air into the barn through a tube with rows of small holes along the length of the tube (Figure 3). These are a great option for providing minimum wintertime ventilation rates without creating drafts. They help remove stale air from the barn during temperature inversions or when windspeed is too low for good natural ventilation. The systems can typically be made to work with odd-shaped pens, low ceilings, and other challenging layouts. However, they need to be properly designed to function correctly. The size and positioning of holes and the output of the fan need to be customized for each facility. Off-the-shelf tubes with pre-punched holes are a poor choice for goat housing. Work with a consultant who has training in positive pressure tube ventilation design. The University of Wisconsin Dairyland Initiative maintains a list of consultants who have received training.

	Adult goats (cubic ft/min)	Young goats (cubic ft/min)	Air changes per hour
Cold weather	20	3	4
Mild weather	60	10	15
Hot weather	150 – 200	30	60

Table 3. Mechanical ventilation rates for dairy goat facilities

By following these relatively simple guidelines, you can design a facility that will help you optimize animal production and health and while achieving your management goals and staying within budget. ■

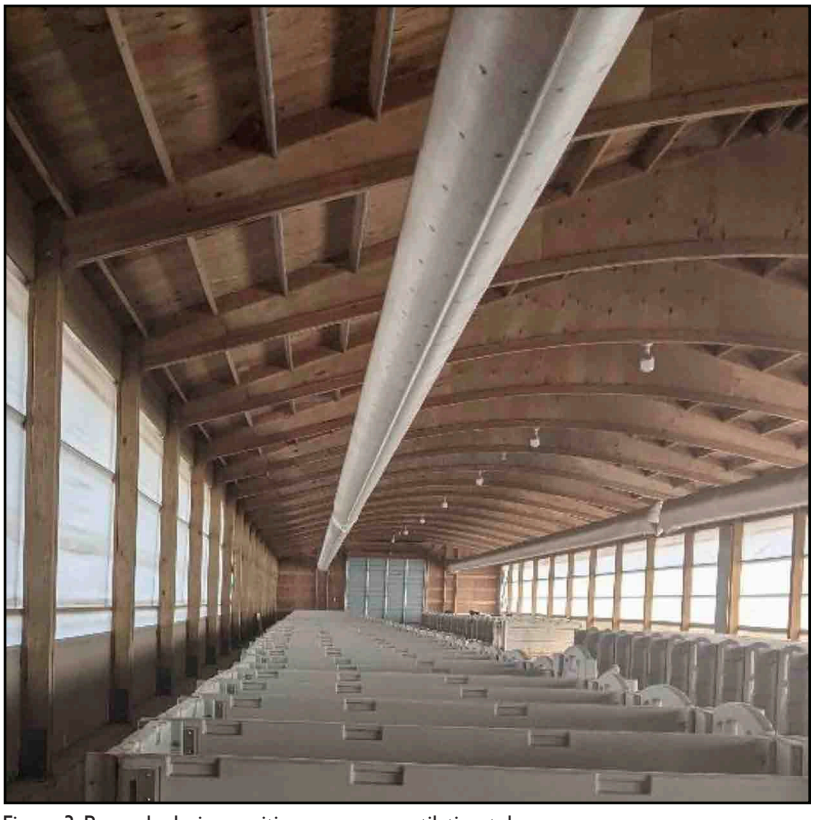

Figure 3. Properly design positive pressure ventilation tube.