1988

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COOPERATIVE EXTENSION SERVICE

Agricultural Engineering Update

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AEU-35

REDUCING SUMMER HEAT STRESS IN DAIRY COWS

By

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Potential declines in milk production of as much as 20% or more are the reason we need to be concerned about heat stress in dairy cows. Heat stress can reduce feed intake, milk production and reproductive efficiency. There are several options available to Kentucky dairymen to combat heat stress in cows.

Heat Stress - Definition and Effects on Production

Researchers define heat stress as any combination of environmental conditions that causes the effective temperature of the environment to be higher than the animal's thermoneutral (or comfort) zone (see Figure 1). Four environmental factors influence effective temperature: 1) air temperature, 2) relative humidity, 3) air movement, and 4) radiation from the sun or other source.

There are a number of heat stress responses shown by dairy cows. The reaction to heat begins with sweating and continues with increases in water consumption, body temperature, and respiration rate. Longer exposure to excess heat reduces feed consumption, milk production and breeding efficiency. Milk yield and milk solids not fat have been shown to be significantly decreased by thermal stress. A test with lactating Holsteins showed that the rate of body temperature rise was related to the heat sensitivity of the animal. The rate of temperature rise was highest in the best milk producers and decreased with time since freshening.

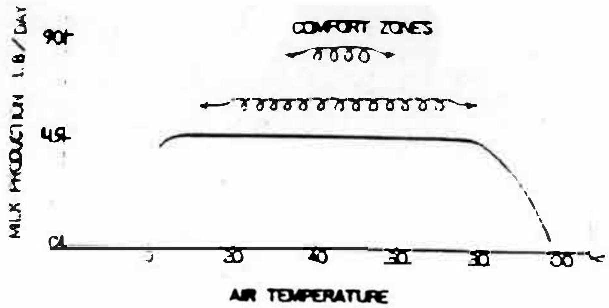

FIGURE 1: Dairy cow comfort zones.

The expected production losses from dairy cows during the summer heat stress period range from 200 to 400 lbs. per cow for cows producing an average of 66 pounds of milk per day. Therefore, in Kentucky, production losses of a cow producing at this level could range from about 2.5-5% of summer production during a typical year and could be much higher in severe summers.

Once the air temperature rises above 80°F, particularly if humidity is high, dairy cows are usually in a potential heat stress situation. Response of individual cows depends on several factors: 1) breed, 2) size of animal, 3) level of production, 4) stage of lactation, 5) present and previous weather, 6) length of stress period, 7) prior conditioning, 8) compensatory growth and, 9) relative levels of environmental factors. These different factors will determine where the limits of the cow's "comfort zone" lie. The range for most cows is 40° - 75°F, increases in temperature and/or humidity begin to cause stress.

Methods for Reducing Heat Stress

There are several means for reducing heat stress for dairy cows in Kentucky. They include:

1. Natural or forced ventilation
2. Spraying
3. Providing cool drinking water
4. Evaporative cooling
5. Air conditioning

Some will work better than others or are more cost effective than others in Kentucky. In choosing any method, economics must be the bottom line in the decision-making process.

Ventilation

The most practical designs for freestall barns and other dairy housing in Kentucky use natural ventilation and are constructed with the best possible use of air movement in mind. Many problems with heat stress in dairies are due to poorly designed or oriented buildings. Often, additional side, eave or ridge openings can reduce or alleviate the problem. If orientation or location with respect to other buildings is a problem, then a mechanical assist from fans may be needed. Table 1 gives recommended openings for dairy freestall or loose housing.

TABLE 1: RECOMMENDED SIDEWALL, RIDGE AND EAVE OPENINGS FOR DAIRY COW HOUSING IN KENTUCKY.

Building Width (feet)	Eave Opening (inches)	Ridge Opening (inches)	Sidewall Opening* (feet)
20	2	4	2
30	3	6	2
40	4	8	2
50	5	10	2.5
60	6	12	3
70	7	14	3.5
80	8	16	4

NOTE: All openings indicated are continuous along the length of the building.

*For sidewall openings, these are minimums, more opening is desired for summer conditions if possible.

Buildings should be oriented with prevailing summer winds blowing across the ridgeline rather than along the ridgeline. If orientation of an existing building is a problem, or obstructions and/or silos or other buildings are within 50' of a naturally ventilated freestall barn, then providing proper opening areas will probably not be enough to provide good ventilation. In that case, fans can be installed in a racetrack pattern, sized at 200-300 cfm per head for air circulation (see Figure 2). The space between these fans should be about 25 times their diameter. Another option is to install a fan and perforated duct system to create an across and down air flow pattern (see Figure 3).

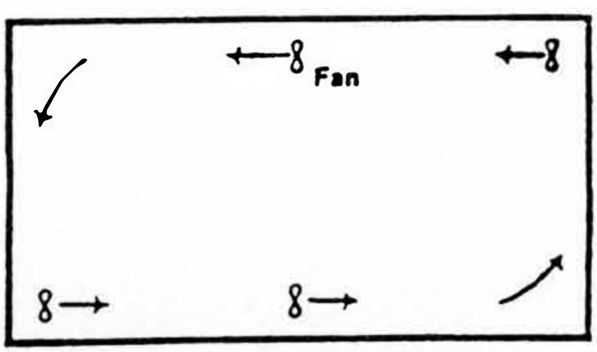

FIGURE 2: Top view of fans suspended in a barn creating air circulation in a racetrack pattern.

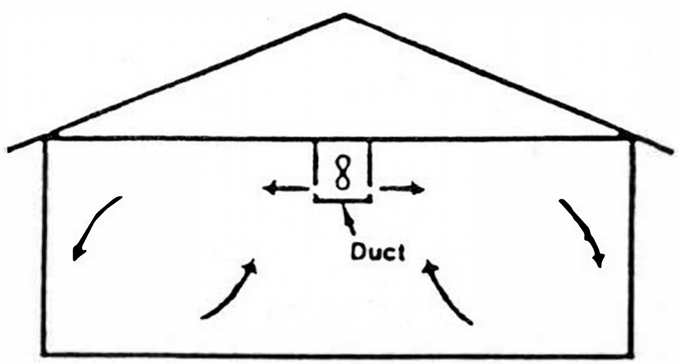

FIGURE 3: End view of air recirculation duct in a barn.

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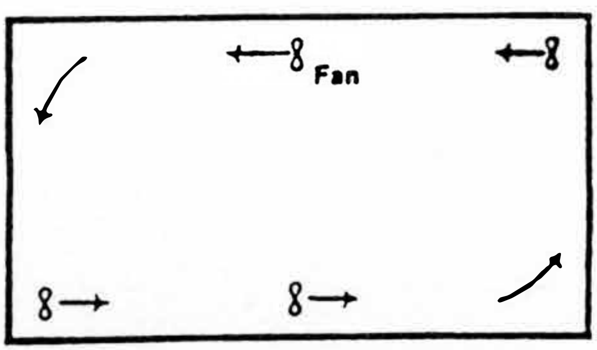

FIGURE 2: Top view of fans suspended in a barn creating air circulation in a racetrack pattern.

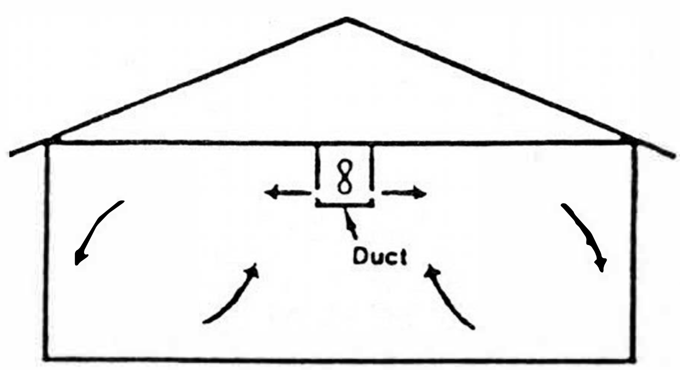

FIGURE 3: End view of air recirculation duct in a barn.

cooling pad efficiency is essential where the humidity level is high. Pads of concrete-coated bagasse, corrugated-fluted cardboard and aspen have high efficiencies. Rubberized hog hair, and compacted and aged aspen have low efficiencies

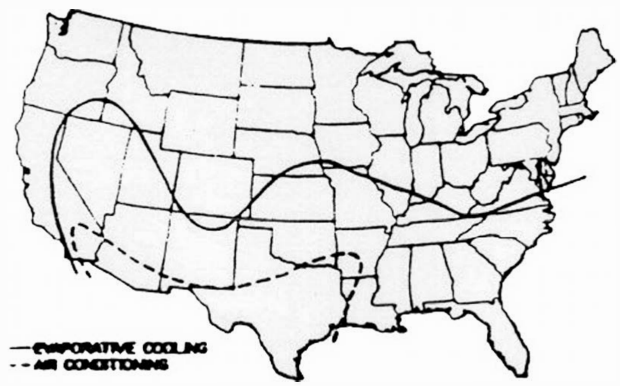

FIGURE 4: Areas of profitability for evaporative cooling and air conditioning for a 66 lb/day milk production level.

Another application of evaporative cooling for heat stress relief is roof sprinkling. Research has shown that about 4 gallon of water/100 ft^2 of roof area per hour were sufficient for cooling roofs in the Southwest. Effective roof sprinkling reduced the roof temperature to about the ambient temperature for a possible reduction of up to 50^oF. The challenges in roof sprinkling are to wet the entire roof and to keep the roof wet without excessive run-off. Effective roof sprinkling would provide the same conditions as insulation under the roof. Insulation in open buildings, however, is generally not practical and economical due to problems with bird and rodent damage. Therefore, roof sprinkling is possibly a more appealing alternative to insulation and could be readily adapted to existing structures.

Conclusions

Several factors are involved in reducing heat stress in cows on Kentucky dairies. The best place to start is with a well-designed free-stall or loafing barn that provides good air movement through the barn. The proper opening sizes allow such a facility to operate well. Roof, eave and sidewall openings can be increased in existing barns where heat stress is a problem.

Other means for cooling include spraying or misting (but not in the free stall or loafing barn), using fans, providing plenty of cool clean drinking water, evaporative cooling or air conditioning. The best means for cooling may involve one or a combination of these methods.

As in any system installed on a farm, the economics must be considered carefully before installing the system. For Kentucky farms, there are some lower-cost alternatives that can reduce stress in dairy cows, including increasing ventilation opening sizes, using fans if necessary and possibly spray cooling.

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