



Heat Saps Cows' Energy

The heat that saps many Arizonans' energy during the summer collects a toll from Arizona dairy cows, too, a toll partly measured in lost gallons of milk.

A new system using quick showers and a cooling breeze for cows waiting in holding pens before each summertime milking can lower the body temperature of overheated cows back near normal. The system can easily pay for itself in increased milk production on dairies in hot, dry climates, say University of Arizona researchers.

UA agricultural engineer Dr. Frank Wiersma designed the system. Finding cost-effective ways to cool cows in summer has been a priority in his work for more than two decades.

He and UA dairy specialist Dennis Armstrong are monitoring holding-pen cooling systems this season at Arizona Dairy near Higley, Del Rio Dairy near Cashion, Schuberg Dairy near Higley, Stotz Dairy near Buckeye, and Baca Linda Dairy near Litchfield Park.

Modern dairy cows work in high gear to produce 10 to 12 gallons of milk per day. Their high metabolism makes them "walking furnaces," says Wiersma. The body heat helps keep them productive in cool climates, but means stress in hot weather. Their body temperatures start

Cows in a holding pen at Arizona Dairy, awaiting their turns in the milking parlor, are cooled by sprinklers and by large fans that move moist air out and dry air in.
(Photo by Allan Fertig.)

to climb above normal when the air temperature stays above 85 to 90 degrees Fahrenheit.

Most of Arizona's 175 dairy operations are within 50 miles of Phoenix, where summer temperatures commonly top 105 degrees in the day. The air often stays warmer than 85 degrees all night, so cows do not get a chance to cool off fully before the next day's heat. In those conditions, their body temperatures can stay 2 to 4 degrees above normal for weeks at a time.

"The stress is cumulative," says Armstrong. "A cow in 105 degrees in May or June is not in as much stress as the same cow in the same heat in August, because the early months take a lot out of her by late summer."

When the air is hotter than the cow, the only way for her to shed excess heat is by evaporation from her hide and from moist surfaces of her air passages as she breathes.

Less Milk and Fewer Conceptions

When the cow cannot shed excess heat, her metabolism must slow down. She eats less and she gives less milk. Per-cow production of milk drops by 20 to 30 percent in the Arizona summer. The heat stress also causes problems in conceptions and pregnancies. Successful pregnancy rates for Arizona dairy cows bred in winter average 50 to 55 percent, but in summer the success rate drops to 5 to 10 percent.

Dairies' simplest way to protect cows from heat is to block the sunlight with solid overhead shades in the outdoor corrals where the cattle spend most of their time. The shaded areas are left open to natural air currents, which help relieve the cows' own body heat.

However, corral shades are not enough under very hot conditions. In the past, many alternatives for extra cooling have been tried with mixed results, including messy wallows and expensive air refrigeration.

Wiersma began showing positive results about 15 years ago from evaporative coolers mounted under corral shades. Now, 15 to 20 percent of the dairy cows in the state have evaporative cooling in their corrals.

Corral cooling nearly halves the summer heat's effect on milk production, turning a 20 to 30 percent drop into one of just 10 to 12 percent, according to several years of UA tests. It also pulls the summer success rate for pregnancies up to 20 to 25 percent.

Though practical, evaporative coolers for each corral shade are expensive, so Wiersma has looked for additional systems for cooling cows. He identified the situations where heat stress is at its worst.

On most dairies, cows spend 15 minutes to an hour in a holding pen two or three times each day waiting for their turn in the milking parlor. Most holding pens add to the cows' heat stress in summer because the pens are crowded and hot. Cows are sprayed briefly from underneath to clean udders, but the enclosed air quickly becomes steamy. No more moisture can evaporate to cool the cows.

"If you try standing in the middle of one of those crowded holding pens on a hot day, you find out fast that the heat is right on the borderline of unbearable," says Wiersma.

Changing a Steam Bath to a Cool Shower

To change the holding-pen wait from a steam bath to a cool respite, Wiersma's design adds overhead sprinklers and large fans that bring in dry outside air. The sprinklers douse the waiting cows for about 30 seconds



Cows are wetted for cooling when they walk through the gate to their corrals from the milking parlor at Schuberg Dairy near Higley. (Photo by Frank Wiersma.)

Frank Wiersma adjusts a gate at Schuberg Dairy so that cows will turn on a shower as they pass through. (Photo by Allan Fertig.)



every five minutes. The flow of dry air evaporates moisture from the cows' hair and skin, making their body surfaces quite cool.

For an initial investment of \$8,000 and annual operating costs of about \$1,500, this system increased milk production by about a quart of milk per cow per day last summer. Season-long, that adds up to about \$17,500 worth of milk for a dairy with 500 cows, the average for Arizona.

At least 20 dairies in the state have already installed similar systems. "It may well become a standard practice for Arizona dairies," says Armstrong. Dairymen from about half of the dairies in the state saw Wiersma's system at Del Rio Dairy during a UA demonstration day in May.

The system should be effective even in more humid areas where corral evaporative coolers are impractical, say the researchers. The holding-pen system is less expensive than corral systems, and provides more direct cooling by evaporation from the animals' hides, rather than just cooling the air around the animals.

Some of the systems give cows a little extra cooling after milking. As each cow leaves the milking parlor, she trips an automatic sprinkler that gives her one last spray. Evaporation in dry air outside cools the cows for about 15 additional minutes.

Armstrong and Wiersma are also testing shades over cows' feed mangers. Cows that do not have to stand in the sun for daytime feeding eat more and produce more milk than cows with unshaded mangers. With a shaded place to eat, cooled cows that are returning from milking stop and eat after summer milkings. That is normal during cooler weather, but uncooled cows with unshaded mangers tend to skip the feeding stop after summer milkings. When they eat less, they give less milk.

Cows that get no cooling before milking have body temperatures averaging about 104 degrees from noon to midnight in the summer. Cows that get the cold showers have body temperatures of about 102, instead. Wiersma measured the temperatures at milking times, but believes the lower temperatures for the cooled cows indicate effects that last for hours, because internal body temperatures change slowly.

"Those cows that are sprinkled spend a far more comfortable day in the summer than those that are not," he says.