

Tunnel exhaust fans pull cool air through an enclosed dairy facility.



Angelica Chapa

Researchers Focus on **air quality** in Dairy Cattle Housing

By Charmain Tan Courcelle

MAFES researchers have initiated a new study to examine the effect of air quality on the health, performance and productivity of dairy cows.

Angelica Chapa, MAFES dairy scientist and MSU Extension dairy specialist, said enclosed free-stall barns with tunnel ventilation may help keep cows cool in Mississippi's hot and humid weather, but little is known about the effect of air quality on the performance of dairy cows in confined housing.

Gases, dust, odors and microbes can lower air quality within improperly ventilated, enclosed animal quarters. During the winter, the level of these air contaminants can increase as houses are further secured for heat conservation.

Chapa said previous research in the swine and poultry industries has shown gases, such as ammonia, and dust particles in the air can adversely affect the health of both the animals that are housed in enclosed facilities and the humans who work in these buildings.

"Exposure to ammonia and dust has been shown to increase the risk of respiratory diseases, including pneumonia, in pigs and chickens and to decrease animal productivity," Chapa said. "We want to know how environmental ammonia and dust affect dairy cow performance."

Ammonia is produced when nitrogen compounds in the urine and feces of livestock come in contact with air. Dust sources include both the housed animals and their feed. In free-stall barns, which are opened on all sides, circulation of fresh air prevents buildup of ammonia and dust. However, even with fans and sprinklers installed, dairy cows housed in free-stall barns in the South often suffer from heat stress because of hot and humid conditions. When cows experience prolonged periods of heat stress, they produce significantly lower quantities of milk.

Chapa will determine whether enclosed housing facilities with tunnel ventilation provide an economically practical alternative to traditional housing that ensures peak animal performance and productivity. She and her colleagues are establishing environmental and waste management practices to provide optimum cow comfort and performance within tunnel-ventilated dairy facilities.

In a tunnel ventilation system, air is cooled over cooling cells as it is pulled through the facility by fans. The system allows continuous air exchange, resulting in a cooler environment. Chapa said tunnel ventilation systems are used extensively in the swine and poultry industries, where they have been effective in cooling livestock and improving air quality. She said the benefit to dairy cattle is unclear because the confinement period for cows could be longer depending on the length of the lactation.

To answer this question, Chapa and other investigators will work with Holstein cows housed in the MAFES North Mississippi Dairy Housing and Environmental Quality Research Facility in Holly Springs. In this enclosed, tunnel-ventilated facility, they will monitor the effect of changing environmental ammonia levels on dairy cow physiology.

"Elevated levels of ammonia (in blood) can affect the metabolism of glucose, which is required for growth and milk production," Chapa said. "We'd like to see how naturally occurring environmental ammonia concentrations influence ammonia levels in plasma — the fluid component of blood — and animal productivity."

Blood samples from dairy cows housed in the tunnel-ventilated facility or in conventional free-stall barns will be collected to assess the overall health of the animals. This information will be compared with environmental data — temperature, humidity, ammonia, dust and odor levels — from the two types of housing to determine the impact of air quality on cow health.

Chapa and her colleagues will also evaluate seasonal effects on air quality and milk production and quality. As part of this work, they will determine whether additional management steps are required for a tunnel-ventilated dairy facility and whether it will be cost-effective.

"Cows housed in a tunnel-ventilated dairy facility have to perform at a level that justifies the economic investment," Chapa said.

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