Prepare for heat stress during winter months

Research

with
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WINTER, with its frigid temperatures, is an optimal time to begin thinking about developing heat-stress plans for the following summer. If you wait until animal performance begins to suffer because of high temperatures and humidity, it is often too late to do anything about it.

At the 2006 Allen D. Leman Swine Conference, B.R. Gramm and R.D. Nimmo of Phibro Animal Health and G.L. Allee of the University of Missouri presented a research report on the effect of virginiamycin on performance of heat-stressed finishing pigs.

They pointed out that high-lean growth pigs may be more susceptible to heat stress, and they found that total heat production (THP) in finishing swine was 26% higher in thermal neutral (TN) conditions than the current standards.

According to Gramm et al., metabolic heat production increases linearly with percent muscle in swine. The added heat production generated by the metabolism rate of high-lean genetics makes it more difficult for these pigs to maintain homeothermy in warm or hot environments, they said.

Threshold temperatures were calculated to be approximately 7.2°F lower for high-lean genetics than moderate-growth genetics, Gramm et al. reported.

Poultry producers have found that the benefits of adding virginiamycin (Stafac, Phibro Animal Health) to poultry diets is greater in heat-stress conditions than in controlled conditions, the group noted, pointing out that other researchers found that caloric efficiency improved in birds fed virginiamycin, which suggests that less energy is wasted on heat production.

Gramm et al. suggested that virginiamycin controls the massive proliferation of gram-positive gut microbes, which have been found to reduce performance in birds exposed to heat stress.

Gramm et al. conducted a swine study in the Brody Climatology Chambers at the University of Missouri to measure the effect of virgniamycin on performance in finishing pigs subjected to heat stress.

Effect of virginiamycin (VM) at 10 g per ton on heat-stressed barrows

	---TN---		---HS---		P values			Std.
Environment	Control	VM	Control	VM	Temp.	Trt.	Temp. x Trt.	error
Bodyweight, lb.								
Day 0	200.8	199.4	202.1	200.4	0.72	0.61	0.97	3.02
Day 28	271.1	274.1	246.1	249.6	0.01	0.47	0.96	4.35
ADG (lb.)	2.51	2.67	1.57	1.76	0.01	0.09	0.90	0.09
ADFI (lb.)	7.57	7.71	5.70	5.71	0.01	0.70	0.72	0.19
Feed:gain	3.03	2.89	3.66	3.28	0.01	0.03	0.26	0.10

Methods. Seventy-two finishing pigs (TR-4 x C22) weighing approximately 200 lb. were randomly assigned to treatment and environmental groups in a 2 x 2 factorial design, Gramm et al. said. Six replicate pens of pigs (three pigs per pen) were fed diets containing virginiamycin (10 g per ton) or no virginiamycin and exposed to TN or cyclic heat stress (HS) conditions in environmental chambers.

Experimental diets were fed for 14 days prior to and 28 days during placement in the environmental chambers. The TN chamber temperature remained at 73.4°F for duration of the 28 days. Temperatures in the HS chamber cycled between 98.6°F (11 a.m. to 7 p.m.) and 80.6°F to mimic fluctuations found between daytime and nighttime temperatures, Gramm et al. reported.

Bodyweights and average daily feed intakes (ADFI) were measured at study initiation (day 0) and termination (day 28).

Results. According to Gramm et al., the HS environment had a significant effect ($P < 0.05$) on ADFI, average daily gain (ADG) and feed conversion in that all were negatively affected by heat stress (Table).

Virginiamycin improved ($P < 0.09$) ADG in both the TN and HS environments (2.67 versus 2.51 and 1.76 versus 1.57 lb. per day, respectively), Gramm et al. reported. Virginiamycin did not affect ADFI in either environment.

As a result, they said, there was a significant improvement ($P < 0.05$) in feed:gain for virginiamycin-fed pigs in both environments (2.89 versus 3.03 and 3.28 versus 3.66, respectively).

Gramm et al. concluded that virginiamycin can help maintain growth performance in heat-stressed finishing pigs. This benefit most likely results from the antimicrobial activity of virginiamycin positively affecting the gut microflora and reducing heat increment in pigs, especially during periods of heat stress, they said.

(Virginiamycin is currently approved in swine at 10 g per ton for increased rate of weight gain and improved feed efficiency from weaning to 120 lb., to be followed by feeding at 5 or 10 g per ton to market weight, according to the *Feed Additive Compendium*, published by the editors of *Feedstuffs*.)

That and this

Marek's code. The genetic code for a virulent strain of Marek's disease virus (MDV) was cracked a few years ago. Now, to determine how best to cripple it and other infectious strains, Agricultural Research Service (ARS) scientists are working to decipher the genomes of several non-virulent vaccine MDV strains.

Microbiologists Stephen Spatz at the ARS Southeast Poultry Research Laboratory in Athens, Ga., and Robert Silva at the ARS Avian Disease & Oncology Laboratory in East Lansing, Mich., have teamed up to compare non-virulent MDV strains used in vaccines.

MDV is the first cancer-causing virus for which a tumor-preventing vaccine was developed. In the U.S., most commercial chickens are vaccinated against MDV type 1 while inside the egg. In Europe, chicks are vaccinated when they are one day old. While these very successful vaccination programs, begun in the 1960s, have saved the industry billions of dollars, the MDV problem still persists.

That's because selective pressures imposed on the virus in vaccinated birds cause new variants to evolve that could pose a threat to the poultry industry. Because the virus is constantly evolving, new vaccines have to be developed to keep them in check.

To investigate the differences between the variants, Spatz and Silva initiated a comparative genomics research program. It involves determining the DNA sequenc-

es of various MDV strains. Some of these are non-virulent ones used as commercial vaccines, while others cause severe disease in chickens. By examining the differences between these strains at the DNA level, the two researchers hope to identify the genes involved in virulence.

Once these genes have been identified, improved vaccines containing modifications in the virulence genes can be engineered and used to protect chickens against current disease-causing MDV strains, as well as against future strains.

Catfish vaccination. New vaccination processes could improve the efficiency and effectiveness of catfish vaccines, according to a study by ARS scientists in the agency's Aquatic Animal Health Research Unit in Auburn, Ala.

Diseases like enteric septicemia and columnaris cost the U.S. catfish industry an estimated $50 million to $70 million per year.

ARS molecular biologist Craig Shoemaker, microbiologist Phillip Klesius and aquatic pathologist Joyce Evans invented two vaccines to immunize catfish against these diseases. The vaccines were patented and licensed to international vaccine manufacturer Intervet for distribution.

The team received technology transfer awards from both ARS and the Federal Laboratory Consortium for their efforts. Now, new research is showing how the vaccines should be administered for maximum influence.

Both vaccines can be given to channel catfish eggs about 24-48 hours before hatching, a recent study found. This suggests that they can be successfully vaccinated during the "eyed-egg stage," when they are still in the hatchery — and long before they're exposed to pond pathogens.

Currently, fish are vaccinated when they are 10 days old in the trucks that transport them to the ponds where they will be raised.

The study also proved that the two vaccines could be administered simultaneously, making the treatment more efficient. This is beneficial as both pathogens frequently appear in the same ponds.

The 10- to 15-minute process is easy, safe and effective, ARS said. The catfish are still protected against the disease 140 days after immunization.

Effective vaccines have multiple benefits, the most important of which is improved fish health. Vaccinated fish also require fewer chemicals and antibiotics to fight disease. They also grow faster than non-vaccinated fish, which translates into higher profits for farmers. One study estimates that fish farmers can increase their profits by about $2,000 per acre using vaccines like these.

Mushroom lectins. Wide use of a mushroom extract to protect poultry against a major parasitic disease is now closer, thanks to an ARS scientist and her South Korean colleagues.

The researchers — led by immunologist Hyun Lillehoj at the ARS Animal Parasitic Diseases Laboratory in Beltsville, Md. — developed a technique for controlling coccidiosis, which costs the world's poultry industry billions of dollars in losses annually.

The new method is the subject of a patent application. It introduces mushroom lectins to birds via injection into developing embryos or through drinking water. Once administered, the lectins spur a protective reaction against coccidiosis in the gut.

Coccidiosis is caused by parasites of the genus *Eimeria* that infect the intestinal tract and are transmitted between birds through infected feces. Often most severe in birds that are young or whose disease immunity has been weakened by other infections, the disease can cause bloody diarrhea, severe dehydration, substantial weight loss and death.

Lectins are carbohydrate-binding proteins found in animals and plants. They stimulate disease-fighting cells by binding to their sugar residues, inducing the release of potent immune-system proteins called cytokines.

Lillehoj and scientists at South Korea's Chungnam National University and Rural Resource Development Institute used lectin extracted from *Fomitella fraxinea*, a wood-rotting mushroom seen mostly on black locust tree stumps. They injected it into 18-day-old embryos to activate their innate immune systems and later challenged the newly hatched chicks with coccidiosis-causing parasites.

The treatment significantly protected chickens against coccidiosis-associated weight loss and reduced fecal shedding of live parasites. This particular lectin is usually prepared under less-stringent conditions than other mushroom compounds that produce a similar effect, making its commercial production more feasible, ARS pointed out.

This research is described in a recent issue of the journal *Poultry Science*.