

THE FOOD ANIMAL VETERINARIAN

VIRGINIA-MARYLAND REGIONAL COLLEGE OF VETERINARY MEDICINE

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Dear Food Animal Practitioner,

A couple of practice opportunities:

- **Johne's Disease Risk Management and Herd Plans.** Many of you are Johne's Certified Veterinarians. I think we are all disappointed at the speed the Virginia Johne's program is moving. Just a reminder that the program is paying vets \$300 to administer the risk assessment and do the herd management plan. In addition it is paying the client \$100 for the process. Add the reduced fee for ELISA and fecal testing and this is the best deal in animal health! With a little more disposable time in your practices this summer consider making this a priority. Doesn't everybody have a few clients who would have you around for a few hours to teach them about Johne's Disease and biosecurity if they got paid \$100 to have you there? This has got to be as much fun as chopping brains out of dead cow's heads to get the bonus\$\$, right? I'm still lobbying to have all consignors to the BCIA bull test stations be at the management level in the program in order to consign bulls. Let's work together to make some progress on Johne's disease in Virginia!

- **The National Animal Identification System** marches ahead, even though it occasionally takes a step backwards. We are assured that Animal Identification Number (AIN) tags will be distributed this year. I am still convinced that for many practices selling these tags can become real practice builder. Sure, it will be a hassle, but so are many of the regulatory things that have been part of our practices for many years.

Here is the latest scoop on becoming a tag "reseller", the role I think most of us will want.

AIN TAG RESELLERS

The AIN tag reseller has a marketing agreement with an AIN tag manager instead of the manufacturer. He or she assumes the same responsibility as an AIN tag manager, validating PINs (*Premise ID Numbers*) and reporting the distribution of the AIN tags he or she ships or delivers to a premises. In order to be an authorized AIN tag reseller, the individual or firm must agree to abide by the following:

1. Complete the AIN tag reseller training provided by USDA; (*we'll schedule one in Virginia soon*)
 2. Distribute AIN tags only to a premises or entity that has either a PIN or NPN (*Non Producer Number*) and validate the accuracy of the PIN or NPN (*will be done on the internet*);
 3. Provide the validated PIN or NPN to the entity that ships the AIN tags when not completing the delivery themselves;
 4. Maintain a dated record of inventoried AIN tags received from an authorized AIN tag manager or another authorized AIN Tag Reseller, or returned from a premises, and have such records available to USDA upon request;
 5. Submit to the AIN Management System (*the web site that manages all this. Read about it at http://animalid.aphis.usda.gov/nais/downloads/print/AIN_reseller.pdf*) within 24 hours (or close of next business day), in accordance with prescribed protocols, a record of all AINs shipped or delivered; and
 6. Educate producers receiving AIN tags on the proper use of official animal identification devices.
- Hope you all have a very productive and safe summer.

W. Dee C. Kithen, DVM

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New Mastitis Treatment May Offer Alternative to Antibiotics

A new weapon could be on tap for fighting bacteria that cause mastitis, an inflammatory udder disease of dairy cows costing around \$2 billion annually in animal and milk-production losses.

In trials at ARS's Bovine Functional Genomics Laboratory, Beltsville, Maryland, scientists Max Paape and Douglas Bannerman showed that injecting the cows' mammary glands with the sugar Poly-x reduced mastitis infections at about one-twelfth the cost of antibiotics.

The sugar, a type known as a "polysaccharide," occurs naturally in the cell walls of certain yeasts. But when administered to nonlactating ("dry") dairy cows, the polysaccharide serves as a kind of biochemical bugle call that mobilizes the animals' immune system, especially to produce bacteria-killing white blood cells.

"Previous work at Beltsville indicated that increasing the cell count in milk will prevent infection," says Paape, a dairy scientist. "Poly-x increases the cell count in dry-cow secretions for the first 5 days of the dry period, thus preventing infection by bacteria."

Today's mastitis-control programs often use several measures, like diagnostic testing, sanitation, herd separation, animal culling, teat dips, and antibiotic treatment. For conventional dairy operations, antibiotics use can be expensive, costing about \$10 a cow, or \$45 million nationwide, Paape estimates. The practice is also controversial, with concerns focusing on the potential for environmental contamination and the emergence of antibiotic-resistant bacteria.

Paape and Bannerman see some advantages to using Poly-x as a natural alternative—the lack of residues being one. Another is the expense. A tube of antibiotic costs around \$2.50. By comparison, the ingredient cost for an experimental Poly-x treatment is only 20 cents.

For their studies, the researchers injected 40 nonmilking Holstein cows with Poly-x and 40 with antibiotics. When the cows' dry-off period ended, the researchers checked the animals for mastitis infections. "Cows injected with Poly-x had a net gain of 5 new infections at the beginning of the next lactation period, compared to 16 infections in cows receiving antibiotics," says Paape. He and Bannerman will submit the work for scientific publication.

ARS has applied for patent protection on their yeast-sugar treatment and is seeking a licensing partner to commercially develop and market it to conventional and organic dairy farmers alike. While several companies consider Poly-x with this prospect in mind, ARS is negotiating terms to exclusively license another, earlier antimastitis technology from the Beltsville lab—namely, the recombinant protein CD14, which binds to and neutralizes endotoxins produced by bacteria that cause mastitis. (See "An Udder Solution for Bossie's Woes," *Agricultural Research*, June 2002, p. 18.)—By Jan Suszkiw, ARS.

This research is part of Animal Health, an ARS National Program (#103) described on the World Wide Web at www.nps.ars.usda.gov.

Max J. Paape and Douglas Bannerman are with the USDA-ARS Bovine Functional Genomics Laboratory, Beltsville, MD 20705

An Eye Test for Barber Pole Worm

Efforts to keep the barber pole worm, *Haemonchus contortus*, from infecting goats and sheep have taken a harrowing turn of late.

The blood-sucking parasites, which thrive in heat and humidity and induce fatal cases of anemia and bottle jaw in small ruminants, have developed strong resistance to chemicals called "anthelmintics" - commonly used to control the parasites.

"This resistance is a result of treatment overuse, and it now threatens the entire goat and sheep population of the eastern United States," says animal scientist Joan Burke of ARS's Dale Bumpers Small Farms Research Center in Booneville, Arkansas. "The key now is to manage the worm's spread and to remain vigilant."

Burke and collaborators, with the Southern Consortium for Small Ruminant Parasite Control (SCSRPC) aim to make a simple test designed for spotting infected animals a key element of this vigilance. SCSRPC—made up of scientists, veterinarians, and extension agents—was formed in response to the threats posed by anthelmintic-resistant worms.

The test is called the FAMACHA eye color chart. Named after its developer, South African livestock parasitologist Francois "Fafa" Malan, it consists of a plastic card featuring five high-resolution photographs of the eyes of infected goats and sheep.

The photos focus on the shade of redness inside the eyelids, with each showing an animal at specific stages of *Haemonchus* infection. The card numerically designates each stage, with 5 representing severe anemia.

"It's the proportion of red cells to plasma that determines whether an animal is healthy or unhealthy," says Burke. "Since the worms are bloodsuckers, a heavy presence will be evidenced by a low ratio of red cells to plasma," and the eyelid will appear pale.

Burke warns that proper use of the chart is vital for gaining accurate results. Hence, one should not use it without being properly instructed, and only the actual charts—not copies—are to be used. "There are other factors, including other parasites, that can cause anemia," says Burke. "That's why using the chart properly—as well as being keenly aware of your flock management and of what environmental conditions the barber pole worm favors—is very important." But the FAMACHA chart's impact can be great. "By deworming only infested animals requiring treatment, producers can save money and greatly decrease development of resistance," says Burke, adding that the challenge now lies in finding the best means to apply the chart.

The FAMACHA test proved 92 percent accurate in a study Burke and other collaborators—including plant physiologist Mary Williams of ARS's Subtropical Research Station in Brooksville, Florida—conducted on 847 sheep and 537 goats in Arkansas, Georgia, Louisiana, Florida, and the U.S. Virgin Islands.

Information on obtaining a FAMACHA chart is available on the SCSRPC website, www.scsrpc.org. Non veterinarians can only purchase the chart if they have received training in its use. This research is part of Animal Health, an ARS National Program (#103) described at www.nps.ars.usda.gov **This work is part of outreach efforts against the barber pole worm by SCSRPC and USDA's Sustainable Agriculture Research and Education program.**
By Luis Pons, ARS, as reported in Agricultural Research, Feb. 2006

Comparison of Bacteria Populations in Clean and Recycled Sand used for Bedding in Dairy Facilities

Bedding samples were collected twice from commercial dairy free-stall facilities that used recycled sand and clean sand in both the summer and winter. Collection began on the day sand was taken from the pile (d 0) and placed in the free stalls, and continued for 5 to 7 additional days. The number of colonies per gram of bedding of gram-negative bacteria, coliforms, *Streptococcus* spp., and *Klebsiella* spp. were estimated for each sand sample as well as amounts of dry and organic matter. Clean sand (CS) and recycled sand (RS) had the same bacterial counts when compared at any sampling time. The mean counts of bacterial populations did vary over the course of the study in both CS and RS. There was a significant increase in bacterial counts from d 0 to d 1 for gram-negative bacteria, coliforms, and *Streptococcus* spp. in both winter and summer. Counts of gram-negative bacteria, coliforms, *Klebsiella* spp., and *Streptococcus* spp. did not differ from d 1 to 7 in the winter. Total counts of gram-negative bacteria did not differ from d 1 to 7 in the summer. On d 1 in the summer, coliform counts were lower than at d 5 to 7, and *Klebsiella* spp. counts were lower than on d 3 to 7. *Streptococcus* spp. counts were high on d 1 and were constant through d 7 in both winter and summer trials. The number of coliform and *Klebsiella* spp. in both CS and RS was below the threshold thought to cause mastitis during the sampling times. The number of *Streptococcus* spp. was high in both CS and RS during the sampling periods. Other management factors need to be identified to decrease the number of *Streptococcus* spp. in bedding. Recycled sand had a higher organic matter and lower dry matter compared with CS in winter and summer. The results for this study were obtained from multiple herd comparisons, and herd was a significant effect suggesting that different management systems influence the number and types of bacteria in both CS and RS.

J. Dairy Sci. 88:4317-4325, 2005, M. A. Kristula, University of Pennsylvania, School of Veterinary Medicine, W. Rogers, AET Consulting, Inc., Lititz, PA, J. S. Hogan, OARDC, The Ohio State University, OH and M. Sabo., 4 PO Box 43, Unionville, PA 19375, as reported in Veterinary News, January 2006, Penn State University, University Park, PA

Direct-Fed Microbial Supplementation on Ruminant Digestion, Health, and Performance of Pre- and Postpartum Dairy Cattle

Effects of supplementing direct-fed microbial agents (DFM) to dairy cows during the transition period were evaluated. Forty-four Holstein cows were fed close-up and lactating diets that did or did not contain 2 g of DFM/cow per d. Direct-fed microbial supplementation contained approximately 5×10^9 cfu of yeast and 5×10^9 cfu of bacteria (2 specific *Enterococcus faecium* strains) incorporated into a cornmeal carrier. Supplemented cows were fed the DFM 21 d prior to expected calving date through 10 wk postpartum. Cows supplemented with DFM had higher estimated ruminally available dry matter (DM) for both corn silage and haylage than did control cows. Supplemented cows consumed more DM during both the pre- and postpartum periods. In addition, those supplemented with DFM produced 2.3 kg more milk/cow per d than did nonsupplemented cows. There was no difference in 3.5% fat-corrected milk. Milk fat percentage was lower, but not depressed (4.76 vs. 4.44%) for cows receiving DFM. There were no differences in milk fat yield or milk protein percentage and yield. Cows consuming DFM had higher blood glucose postpartum, as well as lower β -hydroxybutyrate levels both prepartum and on d 1 postpartum. Plasma nonesterified fatty acid concentration was not statistically affected by DFM, but was numerically lower prepartum and higher postpartum for supplemented cows. This study demonstrated that targeted DFM supplementation enhanced ruminal digestion of forage DM. Early lactation cows receiving supplemental DFM produced more milk and consumed more DM during the pre- and postpartum periods. Cows consuming DFM, however, experienced a lower, but not depressed, fat percentage compared with nonsupplemented cows.

J. Dairy Sci. 89:260-266, 2006., J.E. Nocek, Spruce Haven Farm and Research Center, Union Springs, NY and W.P. Kautz, Chr. Hansen's Biosystems, Milwaukee, WI, as reported in Veterinary News, January 2006, Penn State University, University Park, PA

Where have all the Sick Cows Gone?

In 1996 I conducted a survey with Dr. Bill Sischo regarding biosecurity and strategies to help minimize the spread of infectious disease in Pennsylvania dairy herds. At that time we were particularly concerned with the relatively low concern most dairy producers appeared to have regarding infectious disease control or prevention programs in the face of dairy expansion. We presented that data at the 1997 National Mastitis Council meeting. Some interesting data included that 73% of the herds in that survey purchased cattle in the past 2 years. Of the cattle purchased 23% of the producers had some sort of screening protocol for any infectious disease. Some highlighted areas included 5% screened in some way for contagious mastitis organisms, 18% screened in some way for Johne's Disease, and 27% tested in some manner for BVD prior to adding new cattle to the herd. Only 7% of the dairy producers had any sort of effective way to quarantine animals prior to co-mingling new animals with the established herd.

In the ensuing almost decade since that survey and following Foot and Mouth in England, BSE, the events of 9/11, and threats of agro terrorism, scientific and lay journals have contained numerous articles trumpeting the virtues and need for better biosecurity on our farms. Members of the Veterinary Science Extension recently completed the initial analysis of data regarding current biosecurity trends on PA dairy farms. Surely with the nearly constant cry for better biosecurity a contemporary survey would show dramatic improvement vs. the 1996 survey. Well, unfortunately at the first glance of the survey results the dairy industry has a long way to go to ensure biosecurity even against common, relatively easy to diagnose domestic diseases.

Looking at some of the same parameters as the 1996 survey many biosecurity deficiencies are still evident. In our recent survey, 90% of dairy producers purchased herd additions in the past 5 years. Of those producers who purchased animals 7% did any screening for contagious mastitis pathogens, 25% did some sort of screening for Johne's, and only 27% did any sort of screening for BVD. Only 23% instituted any sort of quarantine for herd additions. It must be that the dairy animals of the 21st Century are exceptionally hardy and free of disease. Conversely it may be that as food animal practitioners we need to change, improve, or modify the message to help producers realize the economic and animal welfare benefits and become proactive in disease prevention.

This represents a tremendous opportunity for large animal practitioners. There is no other farm consultant better qualified to institute and monitor an effective biosecurity program. Nearly every large animal practitioner has had several, perhaps even many clients who have suffered tremendous losses in animals or income following the importation of an infectious agent onto a farm usually with a purchased herd addition. In today's ag economy many food animal producers are going to buy animals. For the veterinary community this is a challenge and an opportunity. How can veterinarians help producers design screening and testing protocols to allow purchases as needed, while employing more sophisticated diagnostics and animal management strategies to minimize the spread of infectious diseases?

David Wolfgang, Extension Veterinarian, PSU, as reported in Veterinary News, January 2006, Penn State University, University Park, PA

Protozoa: An Animal Research First Protozoa Bolsters Bacterial Virulence Inside Animals

ARS scientists have found that an antibiotic-resistant strain of *Salmonella* becomes especially virulent when tucked inside protozoa in the rumen, or first stomach, of cattle. Protozoa are one-celled predatory organisms that engulf and destroy most bacteria.

This breakthrough finding at ARS's National Animal Disease Center (NADC) in Ames, Iowa, represents the first time that disease-causing bacteria have been found to gain strength from interaction with protozoa inside animals. It suggests that naturally occurring digestive tract protozoa may be a place where dangerous bacteria can also lurk and develop.

The Ames scientists also found a way to combat this virulent *Salmonella* strain by use of a cleansing process, called "defaunation," which rids the rumen of protozoa.

"We've known for a long time that protozoa exist in cattle," says NADC microbiologist Mark Rasmussen, who teamed with veterinary medical officer Steven Carlson to lead this study. "Indeed, protozoa benefit the cow. They assist it with digestion."

"We'd never thought of protozoa as being reservoirs of disease in animals. But we found that there's something about being inside the protozoa that turns on certain defense mechanisms that the bacteria later use to cause infection."

Carlson and Rasmussen conducted this research with postdoctoral molecular biologist Zoe McCuddin and microbiologist Sharon Franklin. All are in NADC's Pre-Harvest Food Safety and Enteric Diseases Research Unit.

Salmonella is one of the leading causes of foodborne illness in people. The bacteria can be traced to poultry, beef, pork, and other foods of animal—and plant—origin. In animals, salmonellosis is usually a self-limiting diarrheal disease not requiring antimicrobial therapy. But antibiotics are needed when severe diarrhea or systemic infections occur. "Unfortunately, many *Salmonella* strains have become resistant to many antibiotics," says Carlson.

A Sickening Relationship

The Ames scientists studied the relationship between rumen protozoa and *Salmonella*'s virulence and resistance to antibiotics.

Carlson explains that some bacterial pathogens, including *Salmonella*, appear to resist destruction while inside protozoa. "Not only may the protozoa be a holding place for certain pathogens," he says, "but they seem to create a 'survival of the fittest' scenario for the *Salmonella* that leads to more virulent pathogens."

According to Rasmussen, the strengthening of disease-causing bacteria while they occupy protozoa is a phenomenon that's been known since independent studies revealed a probable role of protozoa in strengthening *Legionella*. That bacterium causes Legionnaires' disease, an airborne pulmonary affliction that got its name when an outbreak in 1976 killed 34 people at an American Legion convention in Philadelphia.

"The process has been shown with free-living protozoa in places such as water-cooling towers and ponds," says Rasmussen. "Now, here at NADC, we've seen this process for the first time at work inside an animal."

A Particularly Virulent Strain

The scientists focused on an *S. enterica* strain named DT104. "That's a multiresistant, hyperpathogenic foodborne pathogen believed to be more virulent than its antibioticsensitive counterparts," says Carlson. "Calves infected with antibiotic-resistant DT104 are 13 times more likely to die when compared to calves infected with antibioticsensitive versions of this strain."

He says that, while factors causing DT104's hyperpathogenicity have not been completely identified, the strain seems to owe its resistance to multiple antibiotics to an integron – or gene cluster-structure designated as "*Salmonella* genomic island 1" (SGI1). Its genes encode resistance to five different antibiotics.

The Ames researchers examined 38 *Salmonella* strains. Only those possessing SGI1 were found to be more virulent, as measured by a dramatic increase in their ability to invade intestinal cells after exposure to protozoa.

"We now believe that DT104's enhanced invasive ability is the result of an overactivation of invasion genes while within the challenging environment inside the protozoa," says Carlson. "The hyperinvasive DT104 is then released from the rumen protozoa after normal digestion and travels into the intestine."

The defaunation technique came about from efforts by the researchers to counter this troublesome sequence. "It's a chemical process in the rumen that's similar to deworming," says Rasmussen. "Potentially, we can clean the animals out and eliminate the hidden bacteria on a regular basis." He says that fewer DT104 cells were recovered from tissues of infected animals when protozoa were destroyed through defaunation.

"This shows that if rumen protozoa are a significant reservoir of resistance and virulence, periodic defaunation of the bovine rumen may be warranted. And while protozoa are a normal part of rumen microbiota, their temporary removal doesn't appear to harm the animals."

Rasmussen says this study likely represents an initial step toward discoveries with wider implications.

"There are many different organisms known as intracellular pathogens, and we want to see whether they go through the same process," he says. "The Salmonella study was our first look into this phenomenon inside animals."

"What we've done is expand the view of how Salmonella works and devise a possible strategy against it," McCuddin adds. "Defaunation has stoked interest in the livestock and dairy industries as a preventive measure. But the overall study may have opened the door to understanding other pathogens."

Luis Pons, ARS, as reported in Agricultural Research Feb. 2006. This research is part of Food Safety (Animal and Plant Products), an ARS National Program (#108) described on the World Wide Web at www.nps.ars.usda.gov, Steven A. Carlson and Mark A. Rasmussen are at the USDA-ARS National Animal Disease Center, Ames, IA 50010-0070

Stocking Density and Feed Barrier Design Affect the Feeding and Social Behavior of Dairy Cattle

The objectives of this study were to: 1) evaluate how stocking density at the feed bunk affects feeding and social behavior of dairy cows; and 2) determine if this effect is further influenced by the type of feed barrier used. Thirty-six lactating Holstein cows, allotted to 4 groups, were subjected to each of 4 stocking density treatments and 2 feed barrier treatments. Initially, 2 groups were assigned to a headlock barrier, and 2 groups to a post-and-rail barrier. Each group was then exposed to 4 stocking density treatments (0.81, 0.61, 0.41, and 0.21 m/cow, corresponding to 1.33, 1.00, 0.67, and 0.33 headlocks/cow), in 4 successive 10-d treatment periods. After these periods, the feed barriers were switched between groups and the 4 stocking density treatments were readministered. Time-lapse video was used to quantify feeding, standing, and aggressive behavior at the feed bunk. Daily feeding times were greater and duration of inactive standing in the feeding area was less when using a post-and-rail compared with a headlock feed barrier. Feeding time decreased and inactive standing increased for both barrier designs as stocking density increased at the feed bunk. Cows were displaced more often from the feeding area when the stocking density was increased, and this effect was greater for cows using the post-and-rail feed barrier. Cows ranked lower in the social hierarchy at the feed bunk were displaced more often when feeding at a post-and-rail barrier, particularly at high stocking densities. Therefore, we recommend avoiding overstocking at the feed bunk to increase feeding activity and reduce competition. Use of a barrier that provides some physical separation between adjacent cows, such as a headlock feed barrier, can be used to further reduce competition at the feed bunk.

J. Dairy Sci 89:1261303, 2006, J.M. Huzzey, T.J. DeVries, P. Valois and M.A.G. von Keyserlingk Animal Welfare Program, Faculty of Land & Food Systems, The University of British Columbia, Vancouver, Canada, as reported in Veterinary News, January 2006, Penn State University, University Park, PA

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