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Johne's Disease Update

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29

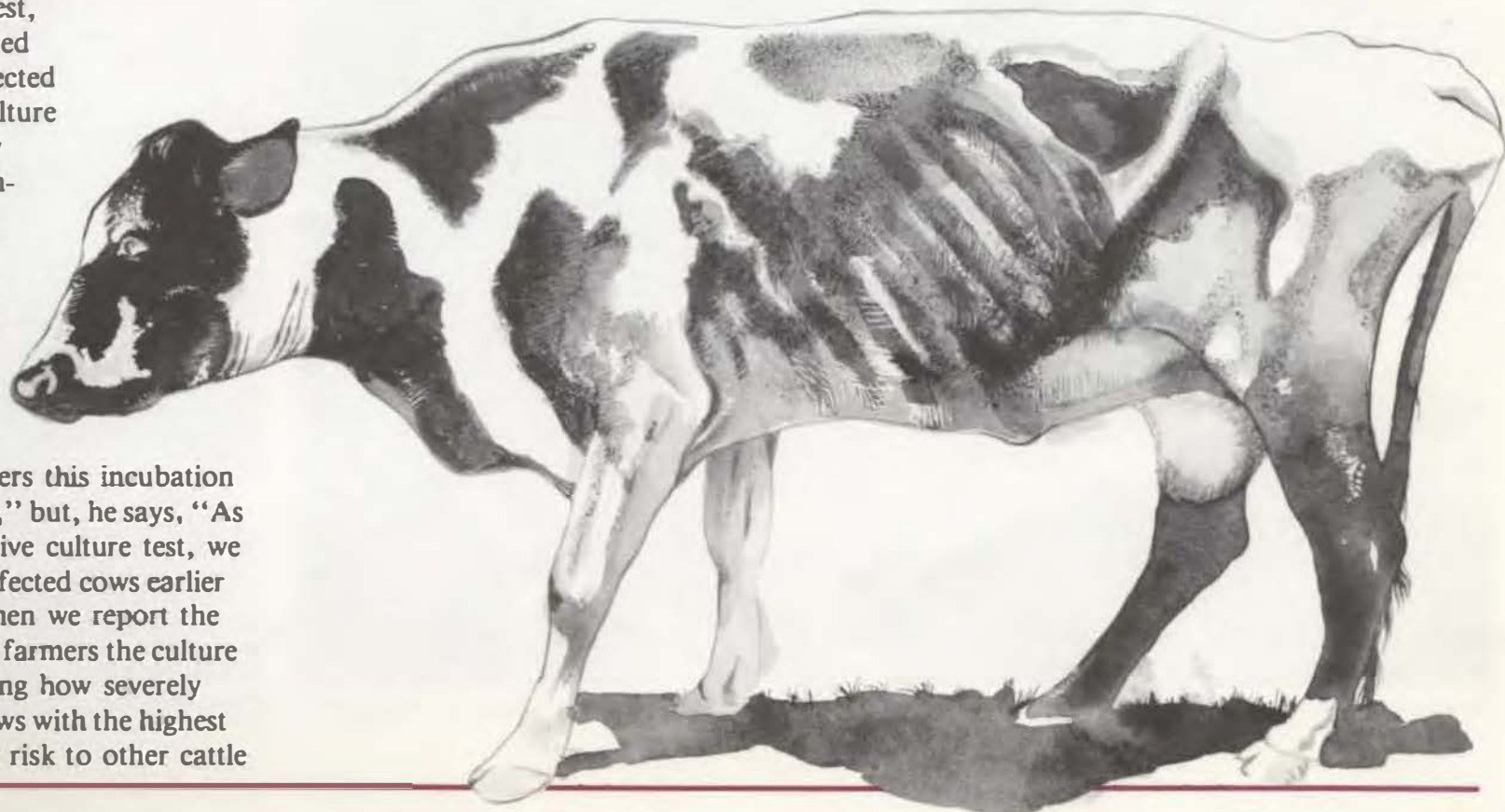
Johne's Disease Update

Managing dairy cattle is a cinch. Just give the herd acres of vegetation and a clean place to sleep, and use creme-de-la-creme milking equipment, and no problem.

There is a problem, though, by the name of Johne's (pronounced Yo-neeze) disease, caused by *Mycobacterium paratuberculosis*, a wasting illness that infects numerous cattle herds in Pennsylvania and throughout the USA and the world.

The good news is that promising strides are being taken by Dr. Robert H. Whitlock, Marilyn M. Simpson Professor of Equine Medicine, and Dr. Raymond W. Sweeney, Assistant Professor of Medicine, at New Bolton Center. They have utilized a powerful culture test that is three times more sensitive than that being used by most state agricultural specialists. Even with the more sensitive test, only 25-35% of all infected cattle in a herd will be detected on the first herd fecal culture test. This test is currently considered the "gold standard" test and is clearly superior to all currently available blood or serum tests. The bad news is that fecal culture testing requires a 12- to 16-week incubation period.

Dr. Whitlock considers this incubation time a "major frustration," but, he says, "As we develop a more sensitive culture test, we should be able to detect infected cows earlier than with other tests. When we report the results of our test, we give farmers the culture results as a score indicating how severely infected the cattle are. Cows with the highest score present the greatest risk to other cattle



especially calves and should be eliminated from the herd quickly. Cows with lower scores do present a risk to others but can be held in the herd until the farmer is able to sell the animal and obtain a replacement heifer. So farmers have weeks, or several months because the risk of transmission from adult cow-to-adult cow is slow." He also hastens to say that the disease poses virtually no risk to humans because it is not thought to be a human pathogen, and because pasteurization kills the organism.

Since Johne's disease is responsible for annual losses of more than \$1.5 billion for dairy farmers and several million for beef farmers, an entire industry is intently following the work at New Bolton Center. The economic losses may come from decreased milk production, premature culling genetic losses and increased susceptibility to other diseases.

Dr. Sweeney recently completed a study that indicates the Johne's organism can be passed from cow to fetus. Probably 10 percent of lightly infected cows, and perhaps 25 percent of heavily infected ones, pass on the disease through the placenta to the unborn calf. He also looked at samples of milk and found that eight to 10 percent of Johne's-positive cows shed the organism into the milk. Calves, which take in one gallon of milk each day, or several gallons each week, are thus exposed to the disease through both the placenta and the milk.

Relying on these observations, Dr. Sweeney now recommends that farmers cull, or separate, calves from the adult herd and provide them with an uncontaminated source of milk, of which milk replacer is one good source. Colostrum should be obtained from culture negative cows or calves can be fed a commercially available artificial colostrum.

At a recent seminar for producers, veterinarians and agribusiness representatives, Dr. Whitlock explained that, by repeated culture and culling infected cows, farmers can work toward obtaining a Johne's-free herd. He describes the many unusual features of the disease:

- long incubation: two to eight years from infection to onset of clinical signs
- lack of a good diagnostic test to detect early infections
- tendency for infected animals to shed mycobacteria years before they show external signs of disease
- lack of treatment for infected animals
- availability of a vaccine of marginal value
- the organism's ability to persist in the environment for months
- lack of complete understanding of transmission of the disease among cattle
- prolonged culture time: 12 to 16 weeks
- tendency for fecal cultures to be contaminated with bacteria and fungi
- unknown role of deer in the transmission of the disease

Diagnosis. Fecal culture is the most widely accepted diagnostic test, having no false-positive results when conducted properly. The problems are the difficulty of handling specimens, the 12- to 16-week incubation period, the contamination of samples, and the lack of sensitivity: less than half of infected animals may be detected on a single test. By concentrating the sample, the Penn team has tripled the sensitivity rate compared to the earlier suspension techniques.

Despite the improvements in culture sensitivity, though, the major disadvantage remains the prolonged incubation period; in some laboratories, storage capacity is limited for handling large numbers of long-term samples.

So the researchers at New Bolton Center have investigated more rapid tests, especially blood tests. However no blood or serum tests offer the nearly 100% specificity of the fecal culture test which also has reasonable sensitivity. Another promising new test is the DNA probe. Mycobacterial organisms in the test specimen are lysed to release DNA, and the

double-stranded DNA is cleaved. Enzyme- or radio-labeled DNA segments known to hybridize with *M. paratuberculosis* DNA are added, and the labeled, hybridized segments are detected. Using Polymerase Chain Reaction technology, a small number of DNA segments in the test specimen can be reproduced many-fold, increasing the sensitivity of the test.

The major advantage of this test is its speed: 36 to 48 hours, compared to 12 to 16 weeks. It also eliminates the need for viable organisms that will grow in culture and for sample decontamination procedures. This test may be commercially available in 3-6 months.

Transmission. Most often, Johne's disease is transmitted when newborn calves consume milk, colostrum or feed that has been contaminated with manure containing the Johne's organism. Sometimes calves suckle teats that are contaminated. (Even if the farmer washes the outside of the udder, the bacteria may be lurking inside the udder.) All young calves are susceptible to manure from any infected adult, too.

Although Johne's can be transmitted to animals six to 24 months old or older, this occurs uncommonly on most farms, Drs. Whitlock and Sweeney believe.

Once a calf is infected, it takes several years before clinical signs, primarily weight loss and diarrhea, develop. The time lapse between infection and the appearance of clinical signs depends primarily on two factors:

1. The age at which the calf was first infected (newborns are most susceptible) and
2. The dose of organism ingested (a larger dose initiates a faster onset of signs).

It is commonly believed that after the first two years of life, infected animals shed Johne's organisms in their manure, and may shed for years before exhibiting any clinical symptoms.

This disappointing situation carries its own unhappy consequence: If a "carrier" is sold, the unsuspecting purchaser may be blindly importing the pernicious disease into a previously healthy, clean herd. Dr. Whitlock, a recognized expert on Johne's, frequently is asked what farmers should do when buying cattle. His answer is straightforward.

"Check for possible Johne's," he says. "Be especially careful when buying pregnant heifers. Remember: At least half of herd owners with Johne's do not realize they have it. Therefore, "Let the buyer beware."

"Inquire about animals with weight loss or diarrhea," he advises. "Ask the seller's veterinarian to provide a certificate that, to the best of his or her knowledge, Johne's is not present on the farm of origin."

Eradication: A case experience. In 1983 the owners of a Guernsey herd noticed weight loss and chronic diarrhea in one animal. When their veterinarian's testing revealed the cow was infected with Johne's, the owners submitted fecal samples so cultures could be obtained on the entire population.

The initial herd testing reported 16 of 42 adult milking cows had Johne's. In subsequent tests of the 26 initially-negative cattle, 13 more were found to be infected. Dr. Whitlock worked with the owners, who made a long-term commitment to eradicate Johne's from the herd. The owners began a semi-annual fecal culture on all animals over six months of age. They also implemented strict procedures to limit the spread of the organism. Specifically they:

- disinfected the maternity stalls before each calving
- immediately separated the calves from the dams
- constructed calf hutches and a heifer barn well separated from the adults
- promptly sold animals identified as positive for Johne's

These procedures enabled the dairy farmers to nearly eliminate the infection from the herd, although nearly 70 percent of the adult cows were infected. Dr. Sweeney also recommends that farmers with a Johne's situation should dispose of manure on cropland, not pastureland and feed artificial or pasteurized colostrum to calves particularly in heavily infected herds.



Looking down on cow with Johne's Disease

Susan Perloff