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QTI™ ANIMAL HEALTH & NUTRITION

Clostridium perfringens: A Multi-Species Menace

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Key Points:

- *C. perfringens* has an economic impact estimated at $90 million.
- It's the toxins that *C. perfringens* creates that cause disease, not the bacteria itself.
- DFM's have been shown to be effective in reduction of *C. perfringens.*

Clostridium perfringens is possibly one of the most uniquely devastating bacteria on the planet. Consider this—it's arguably the most prevalent of the disease-producing bacteria. It's been found in almost every soil sample examined. It's been cultured from the intestines of insects and animals alike. Mammals from elephants to mice have been affected by its disease-producing capabilities. It produces a spore to protect itself from harsh environments. The sporulated form of some strains may withstand boiling temperatures for up to 10 minutes before the organism is inactivated.

Interestingly, it's not the bacteria, but rather the toxins the organism produces, that result in disease. Almost all pathogenic strains of *C. perfringens* produce several toxins, each with a differing effect on host tissues. Exposure to the toxins can cause disease symptoms within hours after exposure, which often results in tissue death. A sequel to the tissue destruction is the creation of a localized environment conducive to additional *C. perfringens* proliferation.

Leading Diagnosticians Note Destructive Capabilities

Diseases caused by *C. perfringens* range from food poisoning in man to enteritis and dermatitis in mammalian and avian species. The unique maliciousness of the toxins is articulated by Dr. Martin Ficken, noted pathologist at the Texas Veterinary Diagnostic Laboratory, College Station, TX. He states, "The most remarkable aspect of the diseases caused by *C. perfringens* is the highly destructive nature of the various toxins elaborated by *C. perfringens*."

One of the foremost veterinary diagnosticians in the Southeast, Dr. Joel Cline, Laboratory Director of the J. B. Taylor Diagnostic Laboratory in Alabama, notes the rapid effects of exposure to the pathogen. He states, "*Clostridium perfringens* and the toxins it produces can result in rapid progression of disease and a sudden increase in mortality."

Recent reports have estimated a 10% loss of swine neonatal productivity due to *C. perfringens* Type A infections (Baker et al. 2010). The incidence of subclinical necrotic enteritis in broilers caused by *C. perfringens* is estimated at 20%. The annual projected economic impact of this disease is estimated at 90 million dollars according to Skinner et al. (2010). An emerging disease in turkeys is clostridial dermatitis, which is often caused by *C. perfringens*. A 2012 survey by the National Turkey Federation found that over 42% of turkey farms in the U.S. have been affected by this disease.

Dr. Ficken, who has published numerous articles on clostridial diseases, further adds that the toxin producing capability of *C. perfringens* make this bacteria unique compared to other bacterial infections. "The disease effects of many other bacteria are associated with the cell wall of the bacterium. *C. perfringens* infection(s) can remain localized and still have devastating disease effects."

Clostridial Disease Control

Controlling *C. perfringens* has been a challenge for years. Producers have relied on antibiotics such as penicillin, bacitracin, lincomycin, tylosin and virginiamycin to treat clostridial diseases.

However, in the last 10 years, reports are surfacing that controlling *C. perfringens* diseases has become more difficult. Dr. Cline echoes this concern. He states that necrotic enteritis caused by *C. perfringens*, "is commonly diagnosed, and in my 15 years of experience I have noted over the last several years an increase in the number of necrotic enteritis cases presented to the laboratory."

Many theories have been proposed as to the cause of the disease increase and researchers are examining all aspects of the problem. However, most agree that as more producers raise livestock without antibiotics they no longer have the option of controlling the ravages of *C. perfringens* with these commonly used therapies.

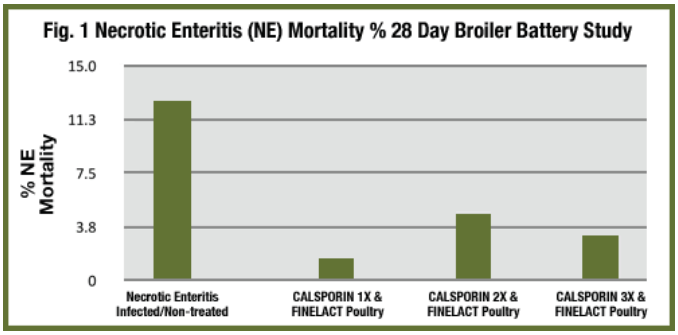
Direct-Fed Microbials Reduce the Challenge

The shift away from antibiotic interventions in current production practices has resulted in increased use of other control mechanisms. Direct-fed microbial products, known to change intestinal and environmental microflora, continue to gain popularity. *Bacillus subtilis* spores, as a direct-fed microbial and environmental intervention, has received considerable interest since a hallmark report was published by Maruta et al. in 1996. This study showed dramatic reductions in levels of *C. perfringens* in fecal samples of chickens fed $3x10^5$ CFU/g CALSPORIN® *Bacillus subtilis* C-3102."

An extensive study conducted in 2003 showed a continual reduction of *C. perfringens* in fecal samples from sows fed high levels of CALSPORIN. In this trial, a 5,000 commercial sow unit reported significant health problems in the sow herd and pre-weaned pigs. A step-down program of CALSPORIN inclusion into the sow rations was implemented, with initial inclusion rates at $2x10^7$ CFU/g feed.

The inclusion rate was reduced after one month and then again after one year, with a final dosing rate at $1x10^6$ CFU/g feed. At the time of the final dosing, the levels of *C. perfringens* in sow fecal samples were reduced by over 99.9%. Correspondingly, the number of preweaned pigs per sow increased by 5.7% and pre-weaned mortality rates dropped by 10.5%.

Recently, an important study in regard to clostridial control was reported by Quality Technology International, Inc. (QTI.) Lohrmann et al. (2013) showed that the effects of necrotic enteritis in broilers could be reduced by using two direct-fed microbial interventions. Differing levels of CALSPORIN coupled with a single treatment of *Lactobacillus reuteri* (FINELACT™ Poultry) were administered in a battery study of birds that were experimentally infected with necrotic enteritis. The CALSPORIN treated birds were given a base dosage rate of $3x10^5$ CFU/g starting at one day of age. Multiples of this dosage was given to two additional treatment groups. The FINELACT Poultry was administered through the drinking water at a dosage of $1x10^8$ CFU/bird during the acute phase of the disease. Results of this trial (Fig. 1) show a significant mortality reduction compared to the untreated, infected control group. This compares favorably to the group that received a therapeutic reference treatment of Stafac® 20g/ton, where no mortalities were observed.



Evidence is pointing to the fact that *C. perfringens* disease levels can be reduced with direct-fed microbial intervention. In studies reported here, either CALSPORIN alone, or in combination with FINELACT Poultry helped reduce the effects of the ubiquitous nature of this organism. Additional work is currently in progress to assess other clostridial-reducing components of QTI products.

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