

Gram-Negative Bacterial Protection in Beef and Dairy Production Systems: New Vaccine Technology Provides Cross-Protection With Immune Enhancement.

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Introduction:

In today's intensive beef and dairy production systems, one must recognize and address the potential negative impact of management practices which stress the animal. These stresses can predispose animals to gram-negative, opportunistic challenges resulting in severe losses in performance, morbidity and death. Housing animals under close quarters, extreme climatic conditions, abrupt nutritional changes, feed toxins, and other typical stresses associated with shipping of animals to the feedlot, can all result in a predisposition to opportunistic diseases. In the intensive dairy system, high producing cows may be more susceptible to gram-negative associated mastitis and/or salmonella and E.Coli infections. Opportunistic diseases may also be initially manifested as viral challenges. In the majority of these viral disease situations, the establishment of secondary gram negative infections and associated endotoxemias may result in reduced performance and death.

New Technology Provides Economically Viable Options For Gram-Negative Cross-Protection:

To prevent the above described disease conditions, the producer has in the past relied upon vaccination programs to protect against viral and bacterial infections and the use of antibiotic programs to ward off and/or eliminate bacterial insults already established. However, to effectively protect against all viral and bacterial challenges and the many thousands of different bacterial serotypes, one would have to literally administer thousands of vaccinations and utilize a very intensive antibiotic program. Even under the above described intensive

health management practices, complete protection would not be assured due to a myriad of bacterial culprits and constantly mutating serotypes. However, new technology has been recently invented and developed which may in fact provide complete protection from the typical gram negative secondary bacterial infections associated with viral disease development while stimulating the overall protection fighting capacity of the animal's immune system.

The concept involves the development of a proprietary, recombinantly produced Re-17 mutant bacterin coupled with an immune stimulation system comprised of an antitoxoid antigen. This vaccine cocktail stimulates and jump starts the animal's immune system such that both humoral (antibody production) and celllular (cellular killing) immunity may be successfully achieved, while cross protecting the animal against essentially all gram negative diseases.

The production of the Re-17 mutant bacterin involves the removal of the bacteria's oligosacharride side chains which results in the production of a bacteria with a naked outer core. (Figure 1.)

In a non-mutant bacteria, the antigenic response is normally targeted specifically at the O-side chains, and while this process results in specific protection, the protection is only limited to a specific bacterial serotype. By producing a mutant bacterin devoid of the O-side chains, scientists at IMMVAC, Incorporated, in conjunction with scientists at the University Of Missouri School of Human Medicine and The School Of Veterinary Medicine, have succeeded in removing those antigenic sites responsible

for a specific antibody production. The result is a bacterin which contains a naked core (cell wall) which is common to all gram negative bacteria and their many thousands of serotypes. The antigenicity of this recombinantly produced bacterin is now focused upon sites within the naked core which results in the bacterin stimulating universal cross-protection against essentially all gram negative bacteria and their serotypes. In addition, by combining an immune stimulation component to the system, the animal's immune system is enhanced and more efficient in providing both humoral and cellular immunity. Finally, since the system is comprised of an inactivated or killed vaccine, the herd veterinarian may administer herd health antibiotic programs, without compromising immunity development to the vaccine. Thus, maximum herd health management flexibility is achieved.

Scientific Evaluations Confirm Both Physiological Potency and Practical Effectiveness Of ENDOVAC-Bovi® With IMMUNE Plus:

Figure 2. depicts the effectiveness of this novel vaccination system, particularly the E3 immune system enhancing component in stimulating the overall immune response.

Insert Figure 2

Peripheral circulation of both B and T lymphocytes are enhanced with the bacterin plus anti-toxoid (E3 stimulation is administered). As predicted, antibody production is also increased (Figure 3).

Insert Figure 3

Using this novel vaccination system, a producer can achieve herd health protection as never before, while delivering significant profits to his bottomline. In controlled field studies¹ conducted at a major beef feedlot in the southwestern United States, 351 beef steers receiving ENDOVAC-Bovi were compared to a similar control group

receiving their normal vaccination and herd health management schedule. (Figure 4.)

Insert Figure 4

summarizes the results of the study. Total weight gain of the vaccinates was increased by 5183 lbs, although this was not statistically significant. In addition, morbidity in the herd was significantly reduced as evidenced by a significant reduction in 1st and 2nd pulled calves requiring treatment. Of the five respiratory deaths that occurred due to bovine respiratory disease complex (BRDC), only one was a vaccinate animal. When the producer evaluated the cost of the herd health program associated with sick calves and pulled calves, it was concluded that herd health costs were significantly reduced in steers receiving ENDOVAC-Bovi compared to the control group receiving their normal vaccination program and herd health management program. Total cost improvement was \$12.50/head in those animals who received ENDOVAC-Bovi. These results were confirmed by Kennedy², 1995 (Figure 5).

Insert Figure 5

He concluded that the Re-17 mutant *Salmonella typhimurium* bacterin toxoid significantly decreased the respiratory disease morbidity and severity in vaccinated steers. Also, fewer deaths occurred ($p = 0.11$), fewer first and second pulls requiring medical treatment ($p < 0.005$) and overall herd health costs were reduced ($p < 0.005$) in the vaccinated group.

In studies conducted in dairy cows³, significant reduction in mastitis was observed in those cows who received ENDOVAC-Bovi. In addition recurrence of mastitis in specific cows who had previously suffered a bout of mastitis was significantly reduced in those animals who had received ENDOVAC-Bovi.

In calves headed for the feedlot and/or replacement heifers⁴, those animals who

received an early vaccination with ENDOVAC-Bovi, had significantly fewer bouts with gram-negative associated bacterial challenges and were overall healthier as evidenced by improved performance and a significant reduction in mortality and morbidity. In addition, significant reductions in herd health management costs were noted.

Recommended Vaccination Schedules:

Beef Cows, Dairy Cows & Their Calves:

For maximum, efficient protection, it is recommended that all beef cows be vaccinated 7-10 days prior to shipping to a feedlot with a 2 ml dose of ENDOVAC-Bovi. If logistics permit, a booster 10-14 days following the first injection is advised, however very good results and herd protection have been achieved with only one vaccination. Your herd veterinarian should be consulted to assist you in determining the best course of action.

In pregnant cows (beef or dairy), it is recommended that the dam be vaccinated with a 2 ml dose of ENDOVAC-Bovi 4 weeks prior to parturition with a 2 ml booster dose being administered one week prior to parturition. This practice will provide maximum immunity to the dam while providing significant passive immunity to the new-born calf. In the case of the dairy cow, significantly less mastitis will result.

The calf should be vaccinated with the following vaccination program⁴

- **Day 1:** **1 ml injection IM***
- **Day 4:** **1 ml injection IM***
- **Day 10:** **1 ml injection IM***

An additional injection is suggested to provide protection against *Pasteurella multocida* and *hemolytica*:

- **3-5 weeks:** **2 ml injection IM***
(*intramuscularly)

Summary and Conclusions:

In today's intensive beef and dairy production systems, the use of a new, proprietary, universal, cross-protective vaccine, effective against all gram negative bacteria may significantly protect the beef cow from secondary gram-negative challenges associated with environmental stress conditions and/or viral disease situations. When used as directed, the producer can save significant dollars by significantly reducing performance and mortality associated losses resulting from the above described disease challenges. In dairy animals, significant reduction in gram-negative associated diseases, including mastitis related challenges have been demonstrated when animals are properly vaccinated with ENDOVAC-Bovi. When used as directed by the manufacturer, the beef or dairy producer can achieve maximum health protection in their cows, calves and feedlot cattle while saving significant dollars on herd health costs and increasing profits through performance improvements derived from this vaccination system.

About the Authors:

Dr. Thomas J. Worthington is a doctor of veterinary medicine and owner and president of Chino Corona Veterinary Services, a consultant group serving the beef and dairy cattle industry in the western United States. Dr. David F. Calabotta has a Ph.D. in animal science and is the owner and president of Anitech, Inc., a business development firm specializing in the late stage commercial development of emerging, proprietary animal technologies.

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