Vet Call

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Immunization Strategies to Decrease the Risk of Infectious Pregnancy Wastage in Beef Cattle

Part I Immunology Basics

In this and the next three issues of the Angus Journal, *I hope to expose you to the rather complicated subject of immunology and how the beef industry can utilize available vaccines to decrease the incidence of pregnancy wastage. This is a complex area of study for veterinarians because immunologists have not been able to provide concrete conclusions to all the questions we would like answered. Also, new technology is emerging (such as the use of vaccines given in the feed) which will change some of the current vaccine recommendations. Even though there is room for disagreement about the details of how best to utilize vaccines, I hope these articles will provide you with some insight into the strengths and weaknesses of vaccines and the role they play in immunology.*

A sound immunization program is built upon effective vaccination of replacement heifers and herd security to control exposure to other cattle. If producers are able to build strong immunity in heifers against the pregnancy wastage causing diseases, herd protection is greatly enhanced even if the rest of the vaccination program is not ideal. If, on the other hand, the vaccination program for the mature cow herd is very thorough but the heifer vaccination program does not build long-term protection, herd protection is greatly compromised.

Numerous vaccines have been developed for the control of disease in cattle. The challenge in developing an immunization program is to select the correct vaccines and to deliver them in the best fashion and at the correct times to create a response that will protect the herd. In order to develop an effective herd immunization program, vaccines must be used by applying the principles of immunology.

Principles of Immunology

Two parts of an animals defense system can be stimulated by vaccination, the humoral (or antibody system) and the cell mediated system. Both the humoral and cell mediated systems require two to three weeks to reach optimal function after the first exposure to a disease or its vaccine. Upon second exposure to the same disease, the response is much more rapid; this is called the anamnestic response and is the protective principle upon which vaccination is based.

The immune response is further separated into two compartments; systemic (throughout the body system) and mucosal (on mucosal surfaces such as the linings of the lung, urinary tract and reproductive tract). Protecting the herd from infection on mucosal surfaces such as the reproductive tract is especially difficult for the immune system. This is because most antibody classes responsible for humoral immunity and white blood cells responsible for cell mediated immunity are not found on mucosal surfaces.

Vaccines given in muscle or subcutaneously usually result in some form of systemic immune response, while vaccines or disease organisms placed on a mucosal surface induce mucosal immunity. An example of mucosal immunity is the use of intranasal, modified live, Infectious Bovine Rhinotracheitis (IBR) virus vaccine against respiratory disease.

The response needed by the animal's body to protect against pregnancy wastage-causing organisms varies by disease. Protection may be due to the presence of circulating antibody (humoral immunity), cell mediated immunity, the presence of antibody on mucosal surfaces (mucosal immunity), or a combination of these factors. Cell mediated immunity is particularly important for protection from intracellular viral infections such as IBR and Bovine Viral Diarrhea (BVD), and from protozoal diseases such as trichomoniasis.

Animal Factors of Immunology

Numerous factors can influence the animal's defense system and thus affect the immune response to vaccination. Factors to be considered in designing an effective vaccination program include: the blocking effect of antibody found in colostrum, the age of the animals in the herd, the herd's general nutritional condition, and the effect of infections already present in the herd. All of these factors affect the individual's and herd's immune status.

One of the most common problems associated with vaccination is maternal antibody interference with active immunization. This interference occurs when antibody made in the cow and passed to her calf in colostrum binds to the organisms given to a calf when it is vaccinated. This clears the organisms from the calf's body before it can stimulate an immune response. Colostral antibodies that neutralize the BVD or IBR virus may be detected for six months or longer. There is evidence that early vaccinations given in the presence of maternal antibody may have value in "priming" the immune response although antibody production is not detected.

Because an immune response requires extensive cell division and protein production, the general health and nutritional state of the herd is important for successful immunization. Vaccination will fail to protect a herd if it already has the organism at the time of administration.

Inadequate nutrition, including deficiencies of protein and micronutrients such as copper and zinc, will restrict immune responses. Herds under stress due to transportation, weather, disease or other environmental stressors are poor subjects for immunization because the immune response will be diminished.

These principles of immunization are important to keep in mind as we continue to discuss using vaccines to avoid pregnancy-wasting disease in next month's issue.