

Timing of Vaccination in Estrus Synchronization Systems

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The use of vaccines in cattle at or around the time of estrous synchronization and artificial insemination is periodically blamed for poor results. The purpose of this paper is to review the physiological effects of modified live and killed vaccines, and the potential that these products may have for affecting the results of estrus synchronization programs. Additionally, I will provide some recommendations on the timing of vaccination.

Modified Live Vaccines

Modified live vaccines consist of an organism that has been “attenuated” such that the animal should develop an immunological response to the vaccine without actually getting the disease caused by the organism. Modified live viral vaccines replicate in cells and actually “mimic” the natural infection.

Killed Vaccines

The killed vaccines that are used around the start of the breeding season may include viral, bacterial and protozoan organisms. Killed vaccines are adjuvanted. Adjuvants are compounds that enhance the immunological response to an antigen. Adjuvant is derived from the Latin *adjuvare*, meaning "to help". There are a wide range of compounds that have been used as adjuvants. Gram negative bacterins contain endotoxin or lipopolysaccharide.

Vaccine Reactions

1. Anaphylaxis

Injection of antigen and its combination with antibody may cause release from the cells (especially mast-cell fixed basophils) of physiologically active substances such as histamine, serotonin, acetylcholine and heparin. These may act on smooth muscle and blood vessels and cause anaphylactic (hypersensitivity) shock. While this is a risk with any product, it is relatively rare.

2. Endotoxin

Endotoxin or lipopolysaccharide (LPS) is a component of gram negative bacteria and in gram negative bacterins such as leptospirosis and vibriosis vaccines. It also has adjuvant properties for both humoral and cell-mediated immunity. It may be toxic and pyrogenic (cause a fever). In lactating dairy cows, milk drop after vaccination has been associated with the number of gram negative bacterins administered at one time. This is thought to be due to the amount of lipopolysaccharide and the animal's response to it. Low-dose administration of lipopolysaccharide has been shown to reduce feed intake, elevate temperature and increase cortisol levels¹.

3. Adjuvant Reactions

Vaccines that are adjuvanted with aluminum hydroxide or oil tend to cause reactions at the site of injection. These vaccines may also cause reductions in feed intake².

4. Modified Live Viral “Sweat”

Modified live vaccines do cause a “reaction” in the animal. The virus replicates in cells in the animal and stimulates an immune response. The reaction to the vaccine may not be visible to an observer, and may result in only mild physiological responses.

Vaccine Licensing

USDA-APHIS-VS has the regulatory responsibility for vaccines in the US. The Center for Veterinary Biologics regulates veterinary biologics (vaccines, bacterins, antisera, diagnostic kits, and other products of biological origin) to ensure that the veterinary biologics available for the diagnosis, prevention, and treatment of animal diseases are pure, safe, potent, and effective³. While products are evaluated for safety prior to licensing, the safety evaluation does not cover every potential use of the vaccine.

Common Use of Reproductive Vaccines

Infectious organisms that cause reproductive loss typically do so by causing early embryonic death or abortion. Vaccines designed to prevent losses from these diseases are widely used in the beef cattle industry, and frequently, these vaccines are administered near the start of the breeding season⁴.

A program used in many cow-calf operations has been to use a vaccine with modified live infectious bovine rhinotracheitis, bovine virus diarrhea, parainfluenza 3, killed five-way leptospirosis and campylobacter fetus. This vaccine was typically used about 30 days prior to the start of the breeding season. Alternatively, some producers would use an all killed vaccine with the same antigens. Since this vaccine could be used in pregnant cows, it was more commonly used when cows were examined for pregnancy, or when cows received their “scour” vaccination precalving.

More recently, vaccines that have all modified live virus...infectious bovine rhinotracheitis, bovine virus diarrhea, bovine respiratory syncytial virus and parainfluenza 3 virus as well as five-way leptospirosis and campylobacter fetus have been licensed for use in pregnant cows. This labeling provides the producer with more flexibility.

Estrus Synchronization and Artificial Insemination Programs

Most producers use estrus synchronization systems to provide for more economical methods of artificially inseminating cows and heifers. Artificial insemination is used because it allows the producer to access genetically superior, proven sires. Simply stated, a producer that invests in an estrus synchronization and artificial insemination program is anticipating “higher value” pregnancies. Therefore, any management practices that either contribute to higher pregnancy rate, or potentially reduce pregnancy rate must be evaluated in a different light.

Recommendations

1. **Use vaccines according to label recommendations.**
2. **Avoid any management procedure, including vaccination, that may stress females and potentially affect reproductive success for three weeks prior to breeding and three weeks after breeding.** While the labels of cattle vaccines may not restrict their use during this time period, the potential exists for lessened response to estrus synchronization programs and/or reduced fertility.

References

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