

Vaccination of Beef Cattle: A Primer...

Robert M. Dyer VMD, PhD
Department of Animal and Food Science
College of Agriculture and Natural Resources
University of Delaware
Newark, Delaware, 19717-1303

Introduction: Goals and expectations of vaccination programs in beef cattle intended for show purposes

A comprehensive strategy to address disease problems in show beef cattle might entail evaluation of nutrition, vaccination strategy, biosecurity practices and disease surveillance programs. In as much as *proactive* program of vaccination can maximize protection of the show animal against specific diseases, vaccination remains as an integral component of any strategy to maximize disease resistance in the show animal. However, be aware the show violates one of the single most important concepts in disease prevention: mixing groups of animals causes disease problems. The reason is simple: when populations of animals are assembled from a wide variety of sources and herds, many disease causing agents are assembled together as well. Disease resistance as well as disease agents, are very different within each herd and therefore the general show population represents a mixture of pathogens floating about in a population of animals with no to very high levels of resistance to each disease agent. Realistically speaking, vaccination prior to assembly will never, ever guarantee infectious disease problems will not arise in the show animals either at the show or soon after the return home.

Realistically speaking, the greatest problem experienced by show animals is viral respiratory disease. The most common agents involved are Bovine Respiratory Syncytial Virus (BRSV), Parainfluenza-3 virus (PI-3) Infectious Bovine Rhinotracheitis Virus (IBR) and Bovine Viral Diarrhea Virus (BVD). Both IBR and BVD are also potent producers of abortion in beef cattle. Thus, the goal of any vaccination program in show beef cattle should be to maximize vaccine induced immunity against these three viral agents.

Vaccine induced immunity should start at a very young age and then be build upon up until weeks prior to the show season. Thus, a core program should be instituted early in newborns and boosted thereafter during several strategic times prior to the show season. Vaccination at the time of the show season or 1-2 weeks prior to the show season is never a good strategy to maximize immunity. In fact many studies show vaccine administration at a stressful time (show) while assembling a population of animals from a variety of sources (mixing animals) results in more disease problems.

Concepts and Principles behind an Essential Vaccine Program in Show Beef Cattle

Minimum Essential program: The minimal basic program should include Infectious Bovine Rhinotracheitis (IBR), Parainfluenza 3 virus (PI-3), Bovine virus diarrhea virus (BVD) Bovine Respiratory Syncytial virus (BRSV) and Leptospira interrogans.

Core Virus Vaccines and Vaccination programs.

Killed (inactivated) vaccines vs. Modified-live vaccines (MLV):

Killed Vaccines

Killed vaccines are considerably less problematic because they can be administered without concern for pregnancy status and are not readily inactivated by misuse. The trade off is the level of immunity is considerably poorer than that generated by live vaccines. Duration is shorter and efficacy is lower.

Inactivated vaccines are prepared with sufficient load of vaccinating agent (s) to directly stimulate the immune response. What is in the dose is all the animal will ever see during vaccination.

Most killed vaccines require a booster administered 2-4 weeks after the initial exposure. Other killed vaccines may require more frequent administration (3-4 times per year).

Killed vaccines generally provide an incomplete, less robust immunity.

Killed vaccines are not associated with vaccine induced problems like abortion.

Pathogens in killed vaccines cannot be shed to herd mates

MLV

Each dose of modified live vaccine does not contain sufficient load of pathogen to directly stimulate immunity. Injected pathogen must "infect, disseminate throughout the host and then replicate" to expand the pathogen load sufficiently to stimulate immunity. Therefore MLV vaccination is best thought of as controlled infection that the newly developing host's immune response brings under control as immunity develops. A strong immune response to the MLV clears the body of the pathogen load thereby establishing complete immunity.

Must be reconstituted with the appropriate diluents

Must be used within hours after reconstitution

Must be protected from environmental damage, before and during use

Heat, light, improper diluents all inactivate the live vaccine

Inactivated vaccines contain virtually no load of agent necessary to simulate immunity. Therefore, live agent must be administered to enable infection and expansion within the host to develop sufficient pathogen load to trigger an immune response. Administration of dead MLV vaccine prevents infection and expansion.

Can cause problems in vaccinates and exposed pen-mates or herd-mates. Live pathogen load can spread to the uterus or will be shed via the conjunctive, respiratory tract and gastrointestinal tract. Pregnant herd mates or immune deficient animals will become infected with the MLV pathogen and develop disease associated problems (e.g. abortion, death).

All producers need to be aware that modified live vaccines are readily destroyed by improper handling and shipping procedures. If the producer is unaware of handling procedures employed during delivery and storage of a modified live vaccines then they should never purchase the product. Modified live vaccines that sit on shipping docks, in warehouses or on delivery trucks are no longer efficacious. Assume all lay people will not understand the importance of maintaining modified live vaccines in refrigeration. Vaccines delivered in warm shipping boxes should be refused because they will no longer deliver the desired immunity.

Recommended Core Viral Vaccines and Vaccination Programs in Show Beef Cattle to Minimize Disease Problems at the Show.

Viral Vaccine Schedules For Beef Cattle		
Group age	Vaccine	Comments
0-24 hours	none	Ingest good quality colostrum
1-2 weeks	PI-3 and IBR intranasal	Optional, but should use intranasal MLV vaccine. May help calves if respiratory problems exist in adults. May be inactivated by good quality colostrum.
4-6 months	PI-3, IBR, BRSV and BVD MLV	Producers should consider this the <i>first</i> effective vaccination of young stock. Induces a complete, robust immune response with memory.
9-12 months	PI-3, IBR, BRSV and BVD MLV	This booster is absolutely essential. Without a booster immunity from the first exposure is incomplete and ineffectual. Disease will break eventually in vaccinates not boosted as this time.
Pregnant and bred cows and heifers 40-60 days before parturition	Killed IBR, PI-3, BVD	Killed vaccines most appropriate-less risk of abortion in vaccinates.
Open cows	Killed PI3, IBR, BRSV and BVD most appropriate. MLV IBR, BVD, PI-3 and BRSV can be used carefully	Maximizes protection through pregnancy. MLV is safe in vaccinates but beware, highly stressed vaccinates could shed vaccine virus to pregnant herd mates and induce abortion. Administer between 20-45 days post partum.

Notes and Comments:

Heifers (birth to 6 months)

Colostrum, colostrum, colostrum administered at 10% BW within the first 24 (preferably 6-12) hours of birth. The window for colostrum absorption is a function of gut epithelium generated just before birth. After birth this specialized epithelium is never again produced. Instead it is replaced by normal epithelium lining all post partum animals for the rest of the life. Gut epithelium is continuously replaced nearly every 24 to 36 hours. Within 24 hours of birth epithelium endowed with the ability to absorb

colostrum immunity are reduced to 20-25% of levels at birth. Colostrum immunity is no longer efficiently absorbed at that low level of epithelial presence.

Best practice: provide 6 lbs colostrum within 1-3 hours of birth and an additional 5-6 lbs over the following 18 hours of birth.

Employ good quality colostrum

- high in disease specific immunity if generated by cows exposed to a well constructed vaccine program such as that described above
- stored properly to prevent break down of pathogen specific antibody

Bacterial Agents:

Bacterial diseases are not a primary problem at the show as these diseases (leptospirosis and clostridia problems) do not normally appear at the show. Never the less, any good vaccine program for show beef cattle should include these agents in addition to those listed above. A program is presented below that will generate very high levels of protection to show animals thereby minimizing the chances of encountering problems with these agents.

Core Bacterial Vaccines and Vaccination Programs.

Bacterial Vaccine Schedules for Beef Cattle		
Group	Vaccine	Comments
6 months	<p>Leptospira 5 way must include L. pomona, L. canicola, L. icterohaemorrhagica, L. grippotyphosa and L. borgpetersenii serovar hardjo.</p> <p>Clostridia 7 way (Optional)</p>	<p>Critical to start immunity early in young stock. Follow initial exposure with a 4 week boost. No boost----no protection! Reduces urine shedding of those born infected with L. borgpetersenii, serovar hardjo. Many 5 way vaccines may not contain the correct L. hardjo. They contain an L. hardjo strain of European origin that does not protect against urinary shedding and abortion due to L. hardj. Recently new vaccines generated from an Australian L. borgpetersenii serovar hardjo are becoming available and will generate the appropriate immunity.</p> <p>The Clostridia vaccine is recommended, starting in young stock.</p>
6 months	Leptospira borgpetersenii serovar hardjo (Type: hardjo-bovis)	See below. Initial exposure must be followed by a boost 4-6 weeks later. No boost leads to poor immunity and protection.
12 months	<p>Leptospira 5 way must include L. pomona, L. canicola, L. icterohaemorrhagica, L. grippotyphosa and L. borgpetersenii serovar hardjo.</p> <p>Clostridia 7 way (Optional)</p>	Boost at this time is essential to generate strong immunity to protect pregnancy. Thereafter an annual boost is required 30-60 days post partum for the rest of adult life.
Open Cows	Leptospira 5 way must include L. pomona, L. canicola, L. icterohaemorrhagica, L. grippotyphosa and L. borgpetersenii serovar hardjo	
40-60 days prepartum	Clostridium 7 way	Optional

Notes and Comments:

Clostridia vaccination is often practiced in most herds. Vaccination should start at 4-6 months with boost at one year followed by annual boost thereafter.