



Cattle Producer's Handbook

Animal Health Section

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Vaccination and Immunization: Vaccination Programs for Cattle Operations

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Respiratory diseases, reproductive diseases, and neonatal diarrheas continue to “plague” animal owners! Producers may use three management options to combat these threats: (1) increase the resistance to the disease of the animal/herd (immunization and nutrition), (2) prevent the access of the disease to the herd (biosecurity), and (3) treatment. This discussion will emphasize immunization as applied via vaccination.

The basis of immunologic resistance is the recognition and disposal of an invading infectious organism by the immune system to prevent the establishment of infection and the development of disease. Vaccines have been developed to maximize the immune response of animals to resist and combat infectious disease. The same response is used to fight off a natural infection. The advantage of vaccination is the host animal does not experience the natural course of the disease.

Immunization involves complex molecular and cellular mechanisms that recognize an invading infectious agent (antigen) and produce specific immune responses (antibodies and immune cells and humoral and cell mediated immunity, respectively) to dispose of the invader. In addition, the immune system develops a specific memory (anamnestic response).

The anamnestic response permits the immune system to “remember previous encounters” and respond more rapidly and specifically when re-exposed to the invading agent, which is the premise for vaccination. The anamnestic response also recognizes lesser

amounts of an antigen than was required to stimulate the primary response. The response is much more rapid (1 to 5 days) than the initial response (7 to 14 days). Additionally, the memory response routinely results in more antibody production. ***Vaccination does not mean immunization!***

Vaccination Programs

Vaccination programs should be designed around the production system of each operation based on animal production programs, animal use, and disease history or problem. Two basic types of vaccines are available for use: (1) killed or inactivated vaccines and (2) modified live or attenuated vaccines. Vaccination programs are an integral part of a comprehensive herd health program!

Killed or inactivated vaccines contain the appropriate amount of antigen or foreign protein (called antigenic mass) in the inoculating dose to stimulate the immune system. However, these vaccines usually require two vaccinations over 2 to 4 weeks to fully stimulate the immune system and the memory response.

The immunogenicity of modern vaccines may be enhanced by the presence of chemical additives called adjuvants. Adjuvants are non-specific enhancers of recognition and processing of antigens and are commonly used in killed vaccines. Unfortunately, adjuvants may also increase the incidence of adverse vaccine reactions especially with repeated vaccinations. Some killed vaccines can now immunize with one injection.

Live vaccines produce the antigenic mass by multiplying within the recipient. Living organisms stimulate both humoral (antibody) and CMI (cell mediated

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Table 1. Model herd health program.

Group; Activity	#	Agent/disease	Vaccine	Route	Quantity	Notes
Calves						
Branding time Calves 60+/- days old	1	5-way viral*	MLV	SQ	2cc	MLV will immunize 40 to 60% of calves at this age
	2	Clostridial, 8-way	Bacterin	SQ	2cc	
Weaning	1	5-way viral*	MLV	SQ	2cc	Immunize those missed at branding, booster rest
	2	Clostridial, 8-way	Bacterin	SQ	2cc	
	3	Pasturella	Bacterin	SQ	2cc	If backgrounding! If required
	4	Brucellosis (Bangs)	Bacterin	SQ	2cc	
Heifers						
February 1	1	5-way viral*	MLV	SQ	2cc	Booster
	2	Clostridial, 8-way	Bacterin	SQ	2cc	Booster
	3	Vibrio and Lepto	Bacterin	SQ	5cc	Optional
April 1		Turn In Bulls				
September 1	1	Body condition score				Record
	2	Vibrio-Lepto	Bacterin	SQ	5cc	Optional
	3	Rota/Coronavirus/ <i>E. coli</i>	KV, Bacterin	IM	2cc	Optional
	4	5-way viral*	MLV	SQ	2cc	Booster
November 1	1	Body condition score				
	2	Evaluate nutrition				Feed testing
	3	Mineral supplement				Feed and/or blood tests
	4	Rota/Coronavirus/ <i>E. coli</i>	KV, Bacterin	IM	2cc	Optional
December 15	1	Body condition score				
	2	Preg check				
	3	Rota/Coronavirus/ <i>E. coli</i>	KV, Bacterin	IM	2cc	Optional
	4	5-way viral*	MLV	SQ	2cc	
	5	Clostridial, 8-way	Bacterin	SQ	2cc	
January 1 Begin calving	1	Dip navels				
	2	Colostrum			2 qt	Within 2 to 4 hours
	3	BO-SE		SQ	2cc	
Second Calf Heifers						
May 1	1	Body condition score				Record
October 1	1	Preg check				
	2	IBR, BVD, PI ₃ , BRSV	MLV	SQ	2cc	
	3	Clostridial, 8-way	Bacterin	SQ	2cc	
	4	Vibrio-Lepto	Bacterin	SQ	5cc	Optional
	5	Body condition score				
	6	Rota/Cornavirus/ <i>E. coli</i>	KV/ Bacterin	IM	2cc	Optional
	7	Parasiticide/Flukicide		SQ		Endectocide
Mature Cows						
Feb.-March	1	Vibrio-Lepto	Bacterin	SQ	5cc	Optional
	2	5-way viral*	MLV	SQ	2cc	
	3	Parasiticide				Good lice control and internal parasites
April-May	1	Flukicide			Drench	
	2	Turn in bulls				
September 1	1	Preg check				
	2	Clostridial, 8-way	Bacterin	SQ	2cc	
	3	Vibrio-Lepto	Bacterin	SQ	5cc	Optional
	4	5-way Viral	MLV	SQ	2cc	

*IBR, BVD 1 & 2, BRSV, PI₃

immunity) immune responses and generally stimulate a higher level of immunity because they produce more antigen(s) through the replication/multiplication process. Immunization with living organism vaccines can be blocked by the presence of preformed antibodies such as colostral antibodies.

Antigens that are presented to the immune system via intramuscular or subcutaneous inoculation stimulate the immune response at similar rates and levels. Oral, or intranasal, immunization stimulates local immunity in the respiratory and GI (gastrointestinal) tracts.

The immune system (both natural resistance and acquired immunity) requires the animal to be in an adequate nutritional state so all cellular and molecular functions are capable of recognizing and responding to limit the invading antigen (agent). Stress has a major depressant factor on the immune response by the release of glucocorticoids that inhibit the molecular and cellular functions.

Nutritional, physical, and mental stresses have an adverse effect on the animal's ability to respond immunologically. Management of stress from environmental conditions and rough or improper handling and inadequate nutrition are significant influences in maximizing the immune response of cattle. In some areas a heavy parasite load may interfere with the immune response.

No matter the vaccination program in use, producers should always:

FOLLOW ALL LABEL GUIDELINES

**FOLLOW ALL
QUALITY ASSURANCE GUIDELINES**

The most common vaccine failure is failed administration, which results in the sporadic incidence of disease in vaccinated animals—the cow that was missed in the chute! A second common failure is the inability of the animal to respond to the vaccine administered and all of the earlier mentioned factors come into play. The individual animal's system, however, is the key to the response or lack of response for reasons animal health specialists cannot define.

Vaccine handling is a significant contributor to vaccine failures. All vaccines should be kept in a cool, dark environment. Live product vaccines should also be utilized within 1 hour after preparation! Delivery systems (syringes and needles) must be chemically and biologically clean. Lastly, products must not be mixed either in the bottle or in the animal.

Additional Reading

- Paul, W. E. 1989. *Fundamental Immunology*. 2nd ed. Raven Press, New York, NY.
- Reeves, G., and Ian Todd. 1996. *Lecture Notes on Immunology*. 3rd ed. Blackwell Science, Cambridge, MA.
- Tizard, Ian R. 2004. *Veterinary Immunology; An Introduction*. 7th ed. W. B. Saunders, Philadelphia, PA.

Bovine Vaccines

- Respiratory diseases
 - IBR, BVD 1 & 2, BRSV, PI₃
 - Pasteurellas, Hemophilus, Mycoplasma
- Reproductive diseases
 - IBR, BVD 1 & 2, Trichomonas, Brucella, Leptospirals, Canphylobacter (*Vibrio*), Neospora
- GI diseases
 - Rotavirus, Coronavirus, Clostridia C & D, *E. coli*, Salmonella
- Others
 - Pinkeye (*Moraxella bovis*), Foot rot (*Fusobacter necrophorum*)
 - Warts (*Papillomavirus*)
- Sudden death
 - Clostridials

Core Vaccine Requirements

The vaccines that should be given every year to all animals:

- IBR, BVD, BRSV, PI₃
- Clostridials
- Of course, Brucella, only once (and only eligible heifers)

Optional Vaccines

These vaccines can be incorporated in specific programs depending on need:

- Scours vaccines—via the dam
- Pasteurellas—Feedlot bound
- Trichomonas—Bull testing is better
- Vibrio—Infertility problem, vaccinate pre-breeding
- Lepto—Third trimester abortions problem, vaccinate mid-preg or preg check
- Foot rot
- Pink eye—fly control is important
- Warts—rarely indicated because the infection is self-limiting and sporadic

