

Vaccinations for the Beef Cattle Herd

Vaccination programs for beef cattle herds are designed to protect the animals from diseases caused by infectious organisms such as viruses, bacteria, and protozoans. Vaccines stimulate an animal's immune system to produce a protective response against an organism. The immune system will then "remember" how to produce a response against the organism if it ever is infected with that organism. Vaccines cannot prevent exposure to infectious organisms, but they do increase an animal's ability to fight off an infection or lessen the severity of the disease if it occurs.

The majority of cattle vaccines are injected, although some may be given by other routes, such as intranasal and oral. Although antibiotics are also often administered via injection, treating an animal with one of these drugs is not a vaccination but rather a treatment once an infection has occurred.

Animal health product manufacturers go to great expense to obtain approval for vaccines from the U.S. Department of Agriculture. They must prove that the vaccine is safe and that it will do what the label claims it will do. See Extension publication ANR-1416, "Understanding Protection Claims on Vaccine Labels," for more information.

Vaccine trade names can be confusing; however, the label will always specify which diseases and microorganisms the vaccine provides protection against. Sometimes different terms used in the name can be confusing as well. Terms such as 4-way, 5-way, 7-way, or 8-way do not refer to any particular type of vaccine, but rather to the number of different subtypes of a microorganism in a vaccine. These terms are most often used for leptospirosis or clostridial disease vaccines, which contain several subtypes of the *Leptospira* or *Clostridium* organisms.



Types of Vaccines

Most vaccines contain either modified live, killed, or chemically altered organisms. If a vaccine is used correctly, whether it is modified live, killed, or chemically altered, it will increase an animal's resistance to disease, but each type of vaccine does have its limitations as well.

Modified live vaccines (MLV) contain a small amount of virus or bacteria that has been altered so that it does not cause clinical disease when used according to product label directions. However, the virus or bacteria can still replicate in the vaccinated animal resulting in a controlled infection. Recognition of the replicating organism by the animal's immune system stimulates an effective immune response. MLVs are mainly available for diseases caused by viruses, such as bovine herpes virus 1, the causative agent of infectious bovine rhinotracheitis (IBR), bovine viral diarrhea virus (BVDV), bovine respiratory syncytial virus (BRSV), and parainfluenza-3 virus (PI₃). Some MLVs are safe for use in pregnant cows **if you follow all label directions.**

Modified Live Vaccines	
<p>Advantages:</p> <ul style="list-style-type: none"> • One initial dose may be sufficient, but boosters are sometimes required. • Typically stimulate more rapid, stronger, and longer-lasting immunity than killed vaccines. • Less likely than killed vaccines to cause allergic reactions and post-vaccination lumps. • Usually less expensive than killed vaccines. 	<p>Disadvantages:</p> <ul style="list-style-type: none"> • Risk of causing abortion or transient infertility; therefore, MLV should generally be administered 6 to 8 weeks prior to the breeding season (read label directions). • Must be mixed on-farm and used within about 30 minutes.

Figure 1. Advantages and disadvantages of MLVs

However, if not used according to label directions, MLVs can cause abortion in pregnant cows (Figure 1). In addition, some MLVs are not approved for use in calves nursing pregnant cows because of the slight possibility that the calves could temporarily shed the vaccine virus and infect the cows. However, some MLVs can be safely used in calves nursing pregnant cows if the cows have been properly vaccinated according to label directions. MLVs are also safe to use in weaned calves, including replacement heifers.

Killed vaccines (KVs) and toxoids contain organisms or subunits of organisms that do not replicate or reproduce themselves in the animal following administration. KVs usually contain adjuvants, or added substances, that further stimulate the immune system to respond to the vaccine challenge. KVs are safe to use in any animal, including pregnant cows (Figure 2).

Chemically altered vaccines (CAVs) contain modified live organisms that are grown in chemicals that cause specific mutations of the organism. An example of chemically altered vaccine technology is temperature-sensitive (TS) vaccine organisms that cannot replicate at an animal's normal body temperature but can grow at the temperatures associated with the ocular (eye) or nasal mucosa. Because there is no systemic replication with TS vaccines, they are safe for use in pregnant animals (Figure 3).

Killed Vaccines and Toxoids	
<p>Advantages:</p> <ul style="list-style-type: none"> • Available for many diseases. • No risk of the vaccine organism spreading between animals. • Minimal risk of causing abortion. • No on-farm mixing required. 	<p>Disadvantages:</p> <ul style="list-style-type: none"> • More likely to cause allergic reactions and post-vaccination lumps. • Two initial doses required. • Slower onset of immunity. • Immunity is usually not as strong or long-lasting as MLV products. • Usually more expensive than MLV products.

Figure 2. Advantages and disadvantages of KVs and toxoids

Although vaccines will not cause the disease they are supposed to protect against, some animals may have a fever temporarily after vaccination. Some animals also may have swelling and soreness at the sight of injection. In some cases, animals may go off feed and decrease milk production for a few days.

Booster Vaccinations

For young animals being vaccinated for the first time, a second, or booster, vaccination is often required a few weeks after the first, or primary, vaccination. A booster vaccination is definitely required for killed vaccines to provide optimal protection. The label directions will indicate when and if a booster vaccination is required. Failure to give the booster at the proper time could result in an incompletely protected adult animal even if that animal is vaccinated every year thereafter.

The time between the primary and booster vaccinations is of interest to beef producers. Management considerations might make it difficult for some producers to give booster vaccinations within the time span called for on the label, which is often from 3 to 6 weeks after primary vaccination. When the USDA approves a vaccine, it does so only for the label directions that were tested by the manufacturer. Exceeding the label-recommended time span between the primary and booster vaccination may not make a vaccine ineffective, but it might make the vaccine less effective. Follow label instructions as closely as possible to facilitate development of maximum immunity in response to vaccination.

Chemically Altered Vaccines	
Advantages: <ul style="list-style-type: none"> • Share many of the advantages of MLV products. • Safety is similar to KV products. • Minimal risk of causing abortion. 	Disadvantages: <ul style="list-style-type: none"> • Two initial doses required. • Slower onset of immunity than MLV products. • Immunity is usually not as strong or long-lasting as MLV products. • Usually more expensive than MLV products. • Must be mixed on-farm and used within about 30 minutes.

Figure 3. Advantages and disadvantages of CAVs

Proper Handling of Vaccines

The best vaccine program will fail if the product is damaged by improper handling. For example, if the label says to store a vaccine at 35 to 45 degrees F, the vaccine should be refrigerated. Vaccines should not be allowed to freeze, nor should they be stored in direct sunlight.

Most MLVs must be reconstituted by adding sterile water to a dehydrated “cake” in a separate sterile vial. Once the water is added, the vaccine organisms are fragile and will be “live” for only a short time. As a rule of thumb, only reconstitute enough vaccine to be used in 30 to 45 minutes, and use a cooler or other climate-controlled storage container to protect reconstituted vaccines from extremes of cold, heat, and sunlight.

Keep needles and syringes clean to avoid infections at the site of injection. **DO NOT** use disinfectants to clean needles and syringes used to administer vaccines, especially MLVs. Even a trace or film of disinfectant in a syringe or needle can kill the live organisms and make the vaccine worthless. Follow product guidelines for cleaning multi-use vaccine syringe guns, but in general, after use, rinse thoroughly with hot water to clean the injection equipment, and then sterilize it using boiling water.

DO NOT mix different vaccines together in one syringe or combine other injectable drugs into the same syringe with vaccines. Although this method has been advocated as a method of reducing the number of injections, it could inactivate the vaccine because of incompatibilities with the other compounds.

Method of Injection

The only acceptable site for injection is in the neck, both for intramuscular (IM; in the muscle) and subcutaneous (SQ; under the skin) injections (See figure 4). Intramuscular injections of some products can cause significant muscle damage, so it is necessary to avoid injecting anything in the top butt or rump of the animal. Injection site reactions can cause damage to valuable beef product, and this muscle damage costs the beef industry millions of dollars a year from lost product and lower calf prices. All injections should be administered IM or SQ in the neck (Figure 4). Some product directions allow for IM or SQ administration, in which case SQ is the preferred method. Use only 18- or 16-gauge needles, ½ or ¾ inch long, to administer an SQ injection. Use only 18- or 16-gauge needles, 1 to 1½ inches long, to administer IM injections. Refer to ANR-1280, “Alabama Beef Quality Assurance: Administer Drugs Properly,” for more information related to proper drug administration.

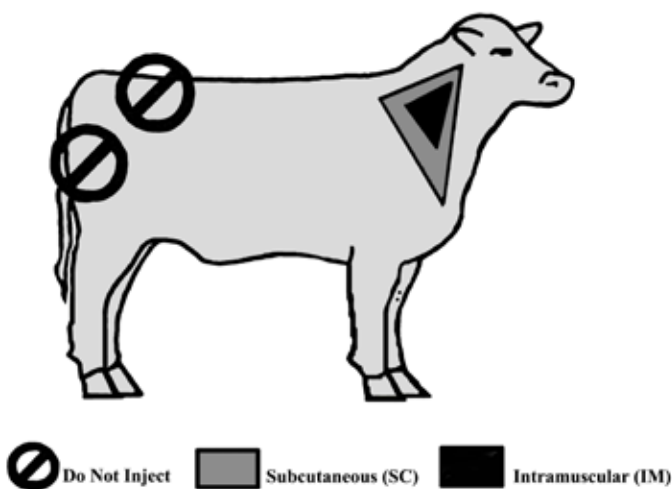


Figure 4. Use neck for injections. Do not inject in rump or leg.



Importance of Nutrition

Vaccination alone will not guarantee a healthy herd. In order for a vaccine to work, the animal's immune system must be able to respond to it, and for an immune system to respond, an animal must receive proper nutrition. Proper nutrition includes energy and protein as well as mineral supplementation.

Some calves that have been properly vaccinated with excellent vaccines have still died in the feed yard because their preshipment mineral nutrition was deficient. Minerals such as copper, selenium, and zinc are required in very small amounts in the diet; however, if the forage is deficient in some of these elements and they are not supplemented in a diet or a free-choice mineral mix, the immune system may not function correctly. Review your forage, supplement, and mineral nutrition programs with your Extension agent, Extension nutrition specialist, or your veterinarian to ensure that you are meeting the herd's needs.

Vaccinating the Right Animal at the Right Time

To determine the best time to vaccinate animals in your herd, first write down the breeding and calving seasons, and then schedule vaccinations and other management events. Most recommended vaccines are best given at specific ages and/or at specific times as related to management and reproductive cycles. For example, blackleg is a rapidly fatal disease of calves.

Calves should be vaccinated for blackleg by 3 to 4 months of age when the temporary immunity from the dam has declined and the calf's immune system can respond to the vaccine.

When protecting cows against reproductive diseases, it is often best to vaccinate at least 6 to 8 weeks prior to the breeding season to allow time for development of a protective immune response. However, if vaccinating cows to increase the amount of antibodies in colostrum against diseases such as calf scours, you may need to vaccinate 1 to 4 months prior to calving. Vaccine timing varies from product to product, so always follow vaccine label directions with respect to vaccine administration timing to maximize product efficacy.

Vaccinating for Diseases That Are a Routine Threat

Vaccines are available for many disease conditions. However, many diseases are not a routine threat to most beef herds, and some vaccines are not sufficiently effective to justify their use. Therefore, only a few vaccines are included in a routine vaccination schedule. The glossary of conditions and terms at the end of this publication lists both routine and not-so-routine infectious diseases and vaccines for them.

Vaccinations for Different Animals in the Herd

Every cattle operation will have unique vaccination requirements based on individual herd goals, so the following guidelines for vaccinating cattle may not be applicable in all situations. The best use of these guidelines is as a starting point to develop an effective vaccination protocol with your herd-health veterinarian and/or Extension agent. When appropriate, ensure that products are safe for pregnant animals and for calves nursing pregnant cows. Properly store and administer vaccines according to label directions; adhere to designated meat withdrawal times; booster primary vaccinations when recommended, and follow all Beef Quality Assurance (BQA) guidelines.

Nursing calves:

- 7-way clostridial (blackleg)
- IBR/BVD/PI₃/BRSV
 - IBR = infectious bovine rhinotracheitis
 - BVD = bovine viral diarrhea
 - PI₃ = parainfluenza₃
 - BRSV = bovine respiratory syncytial virus
- Calftooth vaccination against brucellosis for 4- to 10-month-old heifers if recommended by herd veterinarian.
- Consider a leptospirosis 5-way vaccine for future replacement heifers and bulls.

Preconditioned feeder calves:

- IBR/BVD/PI₃/BRSV
- 7-way clostridial (blackleg)
- *Mannheimia haemolytica*
- *Pasteurella multocida*

Breeding animals (replacement heifers, cows, and bulls should generally be vaccinated at least 6 to 8 weeks prior to the breeding season so that immunity is high during the breeding season):

- IBR/BVD/PI₃/BRSV
- Leptospirosis 5-way
- Vibriosis (*Campylobacter fetus*)

Remember, these guidelines are just a starting point for developing an effective vaccination protocol with your herd-health veterinarian and/or Extension agent. You must still decide which product to use based on understanding a particular vaccine's expected level of protection (see ANR-1416, "Understanding Protection Claims on Vaccine Labels") and the different types of vaccines available (KVs, toxoids, MLVs, or CAVs). Your veterinarian and Extension agent will have the best advice for your particular operation, but this information will assist you in developing and monitoring your herd's vaccination program.

Conclusion

Work closely with your veterinarian and/or Extension agent to customize a vaccination program for your cow herd. A veterinarian may add or delete vaccinations that are generally recommended for most herds in your location. In addition, a veterinarian can offer objective advice on specific vaccine products. By being involved in the design of the herd-health production calendar, a veterinarian will be better able to help prevent disease and deal with it if it occurs. Remember to always properly store and administer vaccines according to label directions, adhere to designated meat withdrawal times, and follow all other Beef Quality Assurance (BQA) guidelines.



Glossary of Conditions and Terms

Anaplasmosis

An often fatal infectious disease of cattle caused by a microscopic parasite of red blood cells, spread by ticks or horsefly bites or by reusing needles or instruments between animals. A vaccine is available in some states with a conditional USDA license, but unless the risk is high, a routine vaccination for anaplasmosis is not recommended.

Bacterin

A bacterial vaccine.

Blackleg

A highly fatal disease of young cattle caused by one type of *Clostridium* bacteria. See Clostridial disease.

BRSV (Bovine Respiratory Syncytial Virus)

A virus that can cause severe, acute respiratory disease, especially in young cattle.

Brucellosis:

An infection resulting in abortion in females and inflammation and damage to the testicles in males, caused by the bacterium *Brucella abortus*. Also known as Bang's disease. See Calfhood vaccination.

BVD (Bovine Virus Diarrhea)

A disease caused by bovine viral diarrhea virus (BVDV), resulting in numerous problems, such as damage to the digestive and immune systems, pneumonia, abortions, calf deformities, and others. Incomplete vaccination programs, such as those omitting a needed booster vaccination, have led to BVD outbreaks in some herds.

Calfhood vaccination (official calfhood vaccination)

Vaccination against *Brucella abortus* for heifers between approximately 4 and 10 months old (the exact age for official calfhood vaccination is state specific). Calfhood vaccination must be administered by a federally accredited veterinarian (most large animal veterinarians are federally accredited). Calfhood vaccination against *Brucella abortus* is not mandatory in most states. Animals given the official calfhood vaccination are marked in the right ear with an official orange ear tag and a special tattoo. The tattoo consists of an R designating the strain of the vaccine (RB51), a V-shaped shield in the middle, and then a number denoting the last digit of the year of the vaccination. For example, calves vaccinated against *Brucella abortus* in the year 2012 would have RV2 tattooed in the middle of the inside of the right ear. The decision to have heifer calves vaccinated for brucellosis should be based on the advice of the herd's veterinarian and depends on the marketing plan of the herd.

Clostridial disease

Fatal disease of young cattle caused by one of the *Clostridium* bacteria. Blackleg is the most well known, but other clostridial diseases are also highly fatal. Currently, the most commonly used clostridial vaccination in cattle is the 7-way type, which protects against *Clostridium chauveoi* (blackleg), *Clostridium septicum*, *Clostridium sordelli* (malignant edema), *Clostridium novyi* (black disease), and three types of *Clostridium perfringens* (enterotoxemia).

Coronavirus

A virus that can cause diarrhea (scours) and dehydration in young calves. Some scours vaccines given to pregnant females will contain coronavirus. Vaccination of the pregnant dam raises the level of antibodies to coronavirus in her colostrum, the first milk she produces which is suckled by the calf after it is born. Antibodies from colostrum provide the calf's immunity for the first few weeks and months of life.

E. coli

A bacterium that can cause a life-threatening infection and diarrhea (scours) in newborn calves. Some scours vaccines given to pregnant females will contain *E. coli*. Vaccination raises the level of antibodies against *E. coli* in the dam's colostrum milk suckled by the calf after it is born. Antibodies from colostrum provide the calf's immunity for the first few weeks and months of life.

Histophilus somni

A bacterium that can cause respiratory, nervous system, and reproductive diseases.

IBR (Infectious Bovine Rhinotracheitis)

A disease caused by a herpes virus, resulting in respiratory signs, reproductive failure, and abortions. The disease is sometimes called red nose and often initiates the shipping fever complex. Many IBR vaccines include additional respiratory viruses such as BVDV, BRSV, and PI3.

Intramuscular (IM)

Injection in the muscle, that is, with a needle penetrating directly into the muscle, usually at least 1 inch.

Leptospirosis (5 varieties)

A bacterium causing kidney disease, abortion in pregnant females, and sickness in calves. The five varieties of *Leptospira* most commonly found in cattle include *hardjo*, *icterohaemorrhagiae*, *canicola*, *pomona*, and *grippityphosa*. Breeding animals should be vaccinated with a 5-way lepto vaccine once a year before the breeding season. Leptospirosis vaccine is often combined with vibriosis vaccine.

Mannheimia haemolytica

A bacterium causing shipping fever pneumonia, often after infection with one of the respiratory viruses such as IBR, PI3, BRSV, or BVDV. Newer vaccines containing the leukotoxoid portion of *Mannheimia haemolytica* are more effective than the older vaccines, which did not provide adequate protection.

Pinkeye (Infectious Bovine Keratoconjunctivitis, or IBK)

An infection of the eye caused by infection with the bacterium *Moraxella bovis*, spread by flies. Higher incidence of pinkeye may occur in herds not vaccinated against IBR virus. Pinkeye vaccines are available.

PI₃ (Parainfluenza-3 virus)

A virus that can cause respiratory disease.

Rotavirus

A virus that can cause diarrhea (scours) and dehydration in young calves. Some scours vaccines given to pregnant females will contain rotavirus. Vaccination of the pregnant dam raises the level of antibodies to rotavirus in her colostrum, the first milk she produces which is suckled by the calf after it is born. Antibodies from colostrum provide the calf's immunity for the first few weeks and months of life.

Subcutaneous (SQ or subq)

Injection under the skin, not deep into the underlying muscle. If approved as a route of injection on the vaccine label, subcutaneous injection is just as effective as the intramuscular route and is the preferred route to avoid muscle damage.

Toxoid

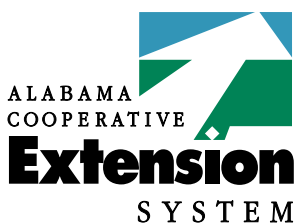
A vaccine that protects against a bacterial toxin.

Trichomoniasis

A protozoal disease caused by *Trichomonas foetus* and transmitted during breeding, resulting in failure of early pregnancy, an extended breeding season as females come back into heat, and abortion. A vaccine is available to raise the resistance against *Trichomonas foetus* in the breeding herd.

Vibriosis:

A bacterial disease caused by *Campylobacter fetus* subspecies *venerealis*, resulting in failure of early pregnancy and an extended breeding season as females come back into heat. Vaccinate breeding bulls and females at least once a year before the breeding season. Vibriosis vaccine is often combined with leptospirosis in one vaccine.



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