Doc Walker's Practical Tips on Vaccination

Most producers have asked their local herd veterinarian about cattle vaccination protocols. Unfortunately, the immediate response after hearing the recommendations is usually one of frustration because the producer has likely been told something different from what the last veterinarian told them.

I live in the Central San Joaquin Valley of California and am one of eleven owners in a 17-doctor, bovine veterinary practice. On any given day, you could ask any one of our veterinarians their opinion on vaccination protocols and you'll likely get 17 different answers. However, each protocol would contain most of the same basic types of vaccines.

William Walker, D.V.M.

This article will outline what I think are the most important vaccine types, proper timing of administration, some guidelines for using vaccines in general, and finally my own recommendation for a "generic" vaccination program. What follows are general guidelines to keep in mind when using any type of vaccine. The most important of which is to establish a good working relationship with a dairy herd health veterinarian of your choice. As you will see, developing a vaccination program that best fits your operation requires time and communication.

The Purpose

The basis of all vaccination programs is the prevention of disease. It is vitally important to understand that viral and bacterial diseases are the direct result of the interaction between an animal's immunity, or lack there of, and their environment or disease challenge. If it were possible to not have exposure to disease pathogens, immunity would be unneeded. Realistically, when animals are exposed to different pathogens there are two possible outcomes. The animal may not suffer from the disease and gain immunity via exposure. Or the animal will become sick, recover if able, and will likely be immune to later exposure.

The goal of any vaccine is to expose the animal to the disease-causing organism without creating an active disease process. Vaccines then, allow an animal to develop its own immune response without experiencing the disease.

However, it is important to appreciate that even when the appropriate immunity exists, if the exposure to any disease-causing agent is overwhelming or sufficiently different than the agent vaccinated for, the immune system will fail, even if you have vaccinated excessively. Remember, any disease-causing agent can overrun the immune system given the right environment.

As herd health specialists, we are trying to achieve a balance between immunity and exposure, while minimizing the risk of any one disease becoming a serious outbreak. To accomplish this it is important that we have a basic understanding of vaccines.

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Vaccine Types

There are two basic types of vaccines—modified-live and killed—and two general types of immune responses—cell mediated and humoral—that deserve brief review. The first vaccine type is modified-live or a virulent live vaccine (MLV) and the second is a killed vaccine.

Modified-live vaccines are live preparations of organisms that have been altered to ensure that active cases of the disease do not occur when administered, yet the organism injected does grow in the animal allowing it to stimulate immunity.

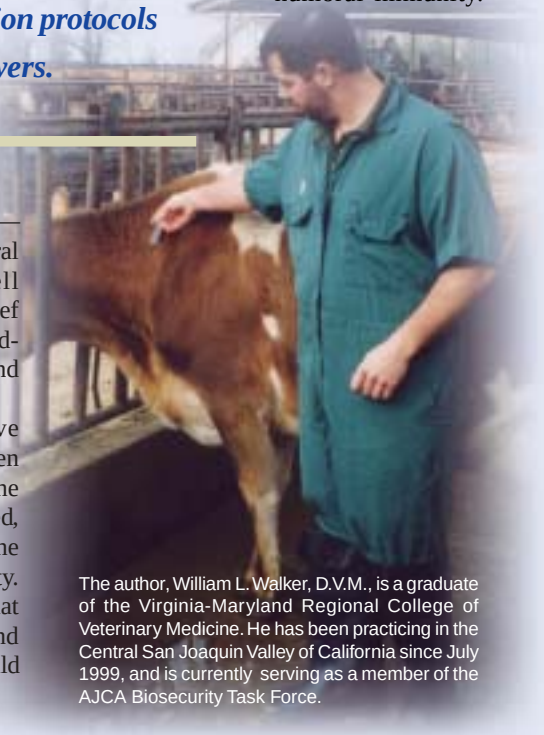
Killed vaccines contain pathogens that have been rendered totally inactive and cannot multiply in the animal, thus, should not cause disease when administered.

Modified-live vaccines stimulate both cellular and humoral (antibody) immunity, with cellular being the strongest response. Killed vaccines usually stimulate humoral immunity to a greater extent than cellular. The differences between the two immune responses are anything but simple and deserve some explanation.

Active Immunity

Cellular immunity involves a complex interaction of certain immune system cell types with foreign material that are found within cells (i.e. bacteria and viruses that invade cells). You may have heard of some of these cell types: macrophages, monocytes, t-helper cells, natural killer cells, and lymphocytes—often referred to as white blood cells.

Humoral immunity involves production of antibodies to extracellular foreign material, like bacteria and viruses that live outside the cell. The main cell types involved in production of antibodies are macrophages, plasma cells and B-lymphocytes. In general, immunity to viral diseases involves mainly cellular immunity because viruses tend to invade the inside of cells. Immunity to bacterial diseases tends to favor production of antibodies or stimulation of humoral immunity.



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Both types of immunity have a sort of "memory." In other words, once a vaccine is given, the immune system cells that respond to it begin to multiply and perform their functions yet have not reached their full potential. When booster vaccinations are given, cells previously stimulated by the vaccine multiply to a much greater degree or produce greater quantities of highly specific antibodies. This is called an anamnestic response or "memory" and is why it is crucial to give a timely booster for killed vaccines.

Passive Immunity

There is an additional classification of immunity, called passive immunity. Passive immunity is the absorption of antibodies from a source other than the animal's own body. A prime example of this is colostral transfer of antibodies from a cow to calf via colostrum.

Passive immunity is very important in the first few months of life because the calf is born virtually devoid of any active immunity to disease because of lack of exposure during development. The calf acquires passive immunity from colostrum that is specifically rich in antibodies.

These antibodies can only be absorbed through the calf's intestinal wall within the first 24 hours of life. This is why it is crucial to give colostrum as soon as possible after birth to allow for maximum absorption of antibodies. Essentially, colostrum is every calf's first and most important vaccination! Now that we have a basic understanding of vaccines, we can decide when to use them.

Colostrum is every calf's first and most important vaccination.

Vaccination Programs

Vaccinations should be given at appropriate times to enhance immunity before natural challenge occurs. Vaccinations given to dry and close-up cows should be timed to help enhance colostrum content of specific antibodies and reduce effects of disease challenge to the dam around freshening. Typical vaccines given at this time may include gram-negative endotoxin vaccines for mastitis, killed boosters of leptospirosis and viruses, and calf scour prevention vaccines.

Basic Vaccination Guidelines

1. Contact your herd veterinarian to establish a protocol that is appropriate for your herd before vaccinating. This can help avoid unnecessary costs and help facilitate proper timing and types of vaccines for use in your herd.
2. Vaccinate only healthy animals. Vaccines help prevent disease and are not usually used as a form of treatment.
3. Contact your herd veterinarian immediately with any case of suspected adverse reaction. If adverse reactions are noted, discontinue use of all products until the cause has been determined and the problem resolved.
4. Store vaccines according to label directions—usually means in a cold, dark place like the refrigerator.
5. Try to use the appropriate size bottle for the number of animals you are vaccinating. This will help to minimize entries into the bottle and thereby reduce contamination. *Vaccine bottles that are used multiple times over multiple vaccination periods have just as many chances for contamination to occur making the vaccine ineffective and dangerous.*
6. Modified live vaccines need to be used within a few hours after reconstitution. The unused portion needs to be discarded. Modified live products must not be given to pregnant animals—unless directed by the label—because abortion may occur. Intranasal products are the only exception.
7. Always read label directions. This will give you plenty of information on the type of animal to vaccinate, the dose, and route of administration.
8. Follow good beef quality assurance guidelines when injecting vaccines or any other product. Try to use subcutaneous instead of intramuscular route of administration if indicated by the label. Use neck musculature and skin for injections. Avoid dirty sites for injection because the needle can carry harmful bacteria into the body. *Do not mix vaccines into a common syringe and then inject.*
9. Avoid vaccinating animals during extreme heat conditions. There is an increased chance of adverse reactions, especially with gram-negative vaccines when given during high temperatures. Plan to vaccinate in the early morning hours when temperatures are low to moderate.
10. Avoid giving more than two vaccines at one time. Use of multiple products increases the likelihood of adverse reactions, especially with gram-negative bacterial vaccines.
11. Killed vaccine products usually need a booster dose within 2-4 weeks after the initial dose. Read the label and follow the directions to help maximize effectiveness of these products. Some products may only need annual boosters to remain effective.
12. Use vaccines that have solid research reports behind them to show effectiveness. Your veterinarian should be able to assess the effectiveness by looking at statistical significance of research trials. Vaccines vary in their quality and manufacturers vary with respect to reputation and ethics. Only use products from companies that you and your veterinarian are comfortable with.

Calves may be vaccinated based upon disease agents present in the herd. Most calves are vaccinated sometime close to weaning or before moving to group housing. Comingling calves in group-housing presents special challenges of stress due to different social interaction and concentration of disease.

Heifers should be re-vaccinated about 30-45 days pre-breeding and again at pregnancy diagnosis. Vaccination of springing heifers and dry, close-up cows should be performed especially if their colostrum is to be used for calves.

Fresh cows should be vaccinated three to four weeks post freshening to provide enhanced immunity during the breeding period. Cows should be immunized again when diagnosed pregnant and during the dry and close-up period.

Any basic vaccination program should include immunization against clostridial diseases, respiratory viruses, and abortion causing bacteria and viruses. Let's examine briefly, what these diseases are specifically.

Clostridial Diseases

Clostridia are a group of bacteria that cause a variety of acute and often fatal diseases in cattle. There are seven or eight basic clostridial types that are vaccinated for with "seven-way or eight-way" vaccine. You may have heard of some of the following diseases: blackleg, malignant edema, bighead, necrotic hepatitis, bacillary hemoglobinuria, pulpy kidney, botulism, tetanus, enterotoxemia, and gas gangrene, all of which are caused by *Clostridia*.

Clostridia are very common in feces and soil and may exist in cattle tissue as spores—a dormant form of the bacteria. When some type of insult like reduced oxygen flow to a particular area of the body or through injection or excessive ingestion of *Clostridia* into a non-vaccinated animal happens, then clostridial diseases can develop.

Most clostridial vaccines are quite good at stimulating immunity and depending on your clostridial disease prevalence, few vaccinations may be needed over the animal's life. In general, it is a good idea to vaccinate cattle for clostridial diseases at four to six months of age, with a booster in three to four weeks. Annual re-vaccination may be sufficient after the initial series of vaccinations.

Respiratory Diseases

Respiratory diseases like pneumonia, are generally caused by either viruses or bacteria or a combination of both. The most common viruses are bovine virus diarrhea virus (BVDV), infectious bovine rhinotracheitis virus (IBR), parainfluenza virus type three (PI3), and bovine respiratory synctial virus (BRSV). The most common bacteria causing respiratory disease are *Manheimia hemolytica* (this used to be called *Pasteurella hemolytica*), *Hemophilus somnus*, and *Pasteurella multocida*. Two of the viruses (BVDV and IBR) and one of the bacteria (*Hemophilus somnus*) serve a dual role in that they can cause both respiratory disease and abortion.

Bovine virus diarrhea virus (BVDV) typically causes diarrhea and/or pneumonia as the primary clinical signs. BVDV is capable of extreme suppression of the immune system and therefore allows many other agents to secondarily invade the body and cause disease. BVDV occurs in two basic types—BVDV I and II— with two basic variants of these types—cytopathic and non-cytopathic.

Neither type nor variant is more dangerous than the other but accounts for sometimes varied protection in vaccinated groups. BVDV can also invade a fetus within the first 150 days of gestation (while still in the cow's womb) and cause the cow to abort or give birth to a calf that is persistently infected with BVDV.

Your veterinarian can help you avoid unneeded costs by developing a vaccination program using products that are effective, safe and given in a timely manner.

BVDV-PI calves typically are unthrifty, may not survive to adulthood, and serve as a reservoir of BVDV in the environment. Some BVDV containing vaccines have both types included, some only have one (typically type I BVDV) as there is some evidence that cross-protection may occur.

Infectious bovine rhinotracheitis virus (IBR) is a herpes virus that can cause genital and respiratory disease. IBR typically infects the trachea (windpipe), may cause reddened or ulcerated nasal passages, and abortion. Either concurrently with respiratory disease or after the disease has passed. Cases of pneumonia occur when IBR damages to the trachea, allowing secondary bacterial infections to develop. Genital disease typically manifests as ulcerated vulva/vaginal mucosa with rapid spread, and rare abortion.

Parainfluenza type three and bovine respiratory synctial virus (BRSV) are viruses that cause mild to moderate signs of coughing, fever, and increased respiratory rate. These viruses alone usually cause no major concern.

However, their role in predisposing cattle to secondary bacterial pneumonia may be more important. Like IBR these viruses damage the natural defenses of the cow's respiratory system allowing bacteria to do serious damage.

Abortive Diseases

Abortive diseases can be caused by viruses, bacteria, and many other non-infectious sources. We have already discussed some of the abortion causing viruses and bacteria under the respiratory disease section above (BVDV, IBR, *Hemophilus somnus)*.

A common bacterial cause of abortion is *Leptospirosis* or "Lepto." There are five basic serovars or varieties of leptospires that are vaccinated for: *L. hardjo, L. pomona, L. gryppotyphosa, L. icterohemorragiae,* and *L. canicola*. Other types of leptospires may cause abortion, but these are the most common.

Leptospires typically live in stagnant water—ponds, low muddy places in corrals, or old watering troughs. Wildlife, rodents, and acute or chronically infected cattle may carry leptospires and become a source of infection to other cattle and the environment. Immunity from leptospirosis vaccines varies, but typically lasts four to six months.

Your herd prevalence of leptospirosis abortions and presence of risk factors such as wildlife, rodents, and stagnating water may necessitate vaccination with leptospirosis vaccine up to six times per year for maximum protection. In general, two to three times per year seems to be effective in most situations.

Hemophilus somnus is a rarely encountered respiratory/abortive disease. It commonly causes pneumonia in younger feedlot animals. *H. somnus* may also lead to a condition called thrombotic meningoencephalitis or TME. Vaccination for this organism should be based upon whether or not you have diagnosed it in your herd, in my opinion.

Bull-bred herds should consider vaccinating for trichomonosis and vibriosis. Trichomonosis is caused by a protozoan parasite called *Tritrichomonas foetus* that typically causes infertility and uterine infections post breeding. It is carried by bulls in the crypts of the prepuce and is spread through breeding.

Vibriosis is a bacterial infection with *Campylobacter fetus*. Vibrio usually causes excessive repeat breeding and is carried by cows and also spread by the bull via breeding. These two diseases are typically not vaccinated for but should be, especially if diagnosed in the herd. Routine testing of bulls before they are allowed to breed is an absolute must to prevent introduction of these diseases into your herd.

Keep in mind also, that diagnostic testing is not perfect and multiple samples may need to be taken to ensure adequate proof that infection—especially trichomonosis—is not present in bulls. In my experience, these diseases are rarely present and therefore rarely vaccinated for because of the nearly exclusive use of artificial insemination for a majority of Jersey herds.

CLASS or AGE	REASONS	VACCINE TYPE
Newborn calves	Provide initial passive immunity to the calf	Colostrum (ideally high quality, pasteurized, and free of disease-causing organisms
Pre-weaning calves *two weeks before weaned or moved to group pen*	Initial exposure to pneumonia and abortive disease agents	MLV IBR, BVD, PI3, BRSV, 5 strains of Lepto
Weaned calves *three weeks after weaning*	Booster for pneumonia and abortive disease agents. Initial exposure to clostridial disease agents	MLV IBR, BVD, PI3, BRSV, 5 strains of Lepto, Clostridial vaccine
Pre-breeding heifers *about 30-45 days pre-breeding*	Booster for pneumonia and abortive disease agents. Booster for clostridial diseases	MLV IBR, BVD, PI3, BRSV, 5 strains of Lepto, Clostridial vaccine
Pregnant heifers *when diagnosed pregnant*	Booster for pneumonia and abortive disease agents	Killed IBR, BVD, PI3, BRSV, 5 strains of Lepto
Pregnant heifers *30 days before calving*	Booster for pneumonia and abortive disease agents. Booster for clostridial diseases	Killed IBR, BVD, PI3, BRSV, 5 strains of Lepto, Clostridial vaccine
Fresh cows *three to four weeks after freshening*	Booster for pneumonia and abortive disease agents	MLV IBR, BVD, PI3, BRSV, 5 strains of Lepto
Pregnant cows *when diagnosed pregnant*	Booster for pneumonia and abortive disease agents	Killed IBR, BVD, PI3, BRSV, 5 strains of Lepto
Dry cows *when dried off*	Booster for pneumonia and abortive disease agents	Killed IBR, BVD, PI3, BRSV, 5 strains of Lepto
Close-up cows *two to three weeks before calving*	Booster for clostridial diseases	Clostridial vaccine

Table 1 A generic vaccination program recommended by Dr. Walker. Every producer should tailor a vaccination program specific to their herd with the help of a veterinarian.

There are several basic types of diseases that need to be covered in a vaccination program. However, vaccination programs are a dynamic process because of emergence of novel diseases on a farm and continually updated research data. My generic vaccination program for herds using artificial insemination is outlined in Table 1.

Summary

Wow! What a load of information there is to know and we have only covered the most basic of the basics. It is important to review and remember a few key points from this information.

First, every disease is the result of the interaction of an animal's immunity and the environment or exposure to the disease-causing organism. Whatever we can do to both enhance immunity, through vaccination and reduce exposure, through segregation, proper nutrition, proper housing, ventilation, cleanliness, and so on, will help to prevent or minimize the impact of herd diseases.

Vaccination programs are a dynamic process because of emergence of novel diseases on a farm and continually updated research data.

Second, there are a few basic diseases that our vaccination program should cover, with other vaccines given based on presence or risk of exposure.

Third, there are a few rules to remember when using and handling vaccines so that we do not reduce their effectiveness.

Finally, please remember to contact your veterinarian before starting a vaccination program. Your veterinarian can help you avoid unneeded costs by developing a vaccination program using products that are effective, safe and given in a timely manner.