

# Vaccination Practices in Cattle

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## Abstract

Veterinary technicians should have an understanding of how vaccines work and diseases for which cattle are commonly vaccinated. When the immune system responds to stimulation by an antigen contained in a vaccine, the animal actively acquires immunity. Attenuated (modified-live) or killed viruses or bacteria are antigenic; certain pieces (subunits) of bacteria are also antigenic. Vaccines must be handled with care, as sunlight, heat and disinfectants will decrease efficacy of vaccines. Animals which are malnourished, poorly housed, or otherwise under stress will have a decreased benefit from vaccination, as their immune systems will not properly respond. Vaccines in cattle are most commonly used to prevent respiratory, reproductive and clostridial diseases. Tetanus and blackleg are clostridial diseases. IBR, BVD, PI<sub>3</sub> and BRSV are viral respiratory and reproductive diseases which are commonly combined in one vaccine; the IBR and BVD components may be modified-live or killed. Brucellosis is not a common disease, but vaccination of cattle against brucellosis, a zoonotic reproductive disease (“Bang’s disease”) greatly facilitates interstate shipment. Products are available to vaccinate cattle against just about every infectious disease they can get, but not all available vaccines have proven efficacy. Decisions regarding vaccines to use on a particular farm should be based on the risks, management and unique needs of the farm. When properly selected, administered and used in conjunction with sound management practices, vaccination is a valuable tool to help maintain herd health.

## Résumé

Les techniciens vétérinaires devraient connaître les principes de base de la vaccination et les maladies pour lesquels les bovins sont souvent vaccinés. L’animal acquiert activement une immunité lorsque le système immunitaire réagit à la stimulation d’un antigène présent dans un vaccin. Les bactéries ou les virus tués ou atténués (modifiés vivants) sont antigéniques de même que certaines parties de la bactérie. Les vaccins doivent être manipulés avec soin parce que la lumière du soleil, la chaleur et les produits désinfectants peuvent réduire leur efficacité. Les animaux qui sont mal nourris ou mal logés et qui sont généralement stressés ne vont pas bénéficier pleinement de la vaccination parce que leur

système immunitaire ne répond pas bien. Les vaccins bovins sont utilisés principalement pour prévenir les maladies respiratoires, reproductives et clostridiennes. Le tétanos et le charbon symptomatique sont des maladies clostridiennes. L’IBR, le BVD, le PI<sub>3</sub> et le BRSV sont des maladies virales respiratoires et reproductives qui sont souvent combinés en un seul vaccin. Les composantes IBR et BVD peuvent être modifiées vivantes ou tuées. La brucellose n’est pas une maladie commune mais la vaccination du bétail pour la brucellose, qui est une zoonose (la maladie de Bang), facilite de beaucoup le transport entre les frontières. Il existe des produits pour vacciner les bovins pour presque toutes les maladies infectieuses dont ils peuvent être atteints mais l’efficacité de plusieurs vaccins n’est pas bien établie. Les choix reliés à la vaccination dans une ferme particulière devraient reposer sur les risques, la régie et les besoins qui sont propres à la ferme. La vaccination, lorsqu’elle est bien choisie et administrée et utilisée en parallèle avec des méthodes de régie éprouvées, est un outil de valeur afin de garder la santé dans un troupeau.

## Overview of Immunology

Acquired immunity is essential for protection against infectious diseases. Immunity may be acquired actively or passively. As the name implies, passively acquired immunity does not require activity by the immune system; the animal passively receives specific immunoglobulins that the immune system may use in its defense against infection. Examples of this are the drinking of immunoglobulin-containing colostrum by newborn calves and the administration of immune serum by injection to horses that are at risk for the development of tetanus. When the immune system responds to stimulation by an antigen, it actively acquires immunity. The response may be the production of antigen-specific immunoglobulins (humoral immunity) or production of antigen-specific T-lymphocytes (cell-mediated immunity). An antigen is a substance that produces an immune response. An antigen may be a pathogen which causes disease, such as bacteria or viruses. Attenuated (modified-live) or killed viruses or bacteria are not pathogenic but remain antigenic; certain pieces of bacteria are also antigenic without being pathogenic. Modified bacterial toxins may also be used as antigens. The very first vaccine was cowpox, which

causes self-limiting lesions on the skin and is not a dangerous disease. A cowpox antigen is so similar to a smallpox antigen that infection with cowpox causes people to develop specific immunity to both diseases. The first vaccination was a purposeful infection with the mild disease, cowpox, to prevent the deadly disease smallpox. This is why the root word for vaccination is “vacca”, the Latin term for cow.

### Vaccine Basics

Because modified-live viruses multiply in the vaccinated animal, they tend to produce immunity with fewer administrations of the vaccine when compared to killed vaccines. In order to preserve this quality, modified-live vaccines must be handled with care. Modified-live vaccines must be used at once after they are reconstituted from the lyophilized (powdered) form in which they are purchased. Sunlight, heat and disinfectants will all kill modified-live organisms, decreasing the efficacy of the administered vaccine.

Even the most effective vaccines have risks and limitations. In order to respond to the vaccine antigen(s) and develop immunity, the animal being vaccinated must have a functioning immune system. Animals which are malnourished, poorly housed, or otherwise under stress will have an impaired response to vaccination. In very young animals, maternal colostrum interferes with the ability to react to vaccine antigens.

### Vaccination to Prevent Specific Problems

Vaccines in cattle are most commonly used to prevent respiratory, reproductive and clostridial diseases. Probably the best known clostridial diseases are tetanus and blackleg, which are caused by *Clostridium tetani* and *Clostridium chauvoei*. Clostridial diseases are common and often rapidly fatal. Clostridial vaccines usually contain antigens for numerous clostridial agents and/or their toxins, and are often referred to as “7-way”, “8-way”, or blackleg shots.

Pathogens which can cause reproductive problems (infertility and/or abortion) include infectious bovine rhinotracheitis (IBR), bovine viral diarrhea virus (BVD or BVDV), and leptospirosis (also called “lepto”). In addition to reproductive tract infection, IBR can also cause respiratory disease. BVD virus can also cause pneumonia, digestive system disease, abortion and immunosup-

pression. Leptospirosis, which is caused by microbes in the genus *Leptospira*, is most commonly associated with late-term abortion. Beef herds may also vaccinate against the diseases trichomoniasis (“trich”) and campylobacteriosis (“vibrio”), which are spread by bulls and cause reproductive problems.

Respiratory diseases include bovine respiratory syncytial virus (BRSV), which may cause pneumonia in calves, and parainfluenza 3 (PI<sub>3</sub>), which by itself causes only mild disease but is considered to increase the risk for the development of more serious respiratory disease due to other pathogens. In addition to respiratory disease, *Histophilus somni*, formerly known as *Haemophilus somnus*, may cause septicemia with sudden death or reproductive problems. *Mannheimia hemolytica* and *Pasteurella multocida* are also respiratory pathogens.

IBR, BVD, PI<sub>3</sub> and BRSV are commonly sold together in one vaccine, in which the IBR and BVD components may be modified-live or killed. There are many brands of this combination out there, usually with names meant to indicate strength or protection more than which antigens are contained in the vaccine. These may be referred to as “4-way” or “5-way” vaccines. The IBR/BVD/PI<sub>3</sub>/BRSV vaccines usually come in several varieties containing some combination of the viral antigens and *Leptospira* and/or *Histophilus* antigens.

No discussion of commonly used vaccines would be complete without a mention of brucellosis or “Bang’s” vaccination. Brucellosis is not a common disease, but vaccination of cattle against brucellosis greatly facilitates interstate shipment. *Brucella abortus* causes abortion in cattle and undulant fever in humans. It should also be mentioned that vaccination against severe mastitis caused by gram-negative pathogens, such as *Escherichia coli*, has become very common on dairy farms.

In addition to the commonly used vaccines mentioned above, products are available to vaccinate cattle against just about every infectious disease they can get (with more or less success), including footrot, heel warts, ringworm, pinkeye, gram positive mastitis, Johne’s disease, *Mycoplasma* and neonatal diarrhea. Decisions about which vaccines to use on a particular farm should be made in consultation with a veterinarian and based on the risks, management and unique needs of the farm. When properly selected and administered, and used in conjunction with sound management practices, vaccination is a valuable tool to help maintain herd health.