

Vaccination to Improve Reproductive Health in Wisconsin Beef Cattle Herds

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Vaccines are created from viral or bacterial components. The immune system sees killed or chemically inactivated microbes as antigenic protein. The humoral component of the acquired immune system responds producing antibody and some memory B cells.

Live and modified live vaccines (MLV) are alive, dehydrated in a pellet and reactivated once reconstituted. When injected, they replicate for a short period of time. This mild infection stimulates both humoral and cell-mediated components of the immune system. The amount of antibody initially produced is higher and remains elevated for longer periods of time than that produced by killed vaccine.

Multiple doses of killed vaccine generate the same titer level one dose MLV creates. Even though MLV can produce high, long lasting titers, it is still important to booster the primary dose. On any given day, for various reasons, 15% of the vaccinated population simply does not respond as well as the rest, so the booster is very important to achieve uniform herd immunity.

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The bovine reproductive diseases of concern in Wisconsin include

- Bacteria *Brucella*, *Campylobacter (Vibrio)* and *Leptospira*
- Protozoa *Trichomonas*, *Neospora*
- Viruses BVD and IBR

Brucellosis is a bacterial zoonotic disease found worldwide. Abortion storms of unvaccinated cattle may occur during their fifth to sixth month of gestation. Retained placenta and metritis occurs. *Brucella* infects bulls, causing orchitis, epididymitis, scrotal swelling, necrosis of testes and infertility.

Test and slaughter programs and the widespread use of vaccine have eradicated Brucellosis from most of the United States, including Wisconsin. States are deemed free when none of their cattle or bison are found to be infected for 12 consecutive months under an active surveillance program.

Those states which border Mexico struggle to control Brucellosis. Be wary of purchasing cattle from these areas. In order to purchase and move cattle between states, the destination state's testing requirements must be met. You may have experience vaccinating for Brucellosis if you sell replacement heifers of cows interstate.

Leptospirosis is a bacterial zoonotic disease found worldwide. *Leptospira* are enzootic in Wisconsin. *Leptospira* species, with 200+ associated serovars, infects and colonizes the kidney. Mammals infected with *Leptospira* will shed the organism in urine. This bacterium survives in cool water (standing water or ponds) for long periods of time. Animal and

human inoculation occurs from infected water splashing onto skin, face or mouth. *Leptospira* can penetrate mucous membranes or damaged skin.

L. hardjo-bovis and *L. pomona* are the most adapted species of cattle, infecting cattle of any age. Kidney colonization, especially with *L. hardjo-bovis* and an associated low antibody response reduces the ability of cattle to clear the organism. Carrier (reservoir) cattle are the major source of infection to the herd. Host adapted Leptospirosis produces subclinical disease often recognized as reproductive failure and return to service.

L. bratislava, *canicola*, *icterohaemorrhagiae* and *grippityphosa* are host adapted in other species (wildlife and rodents). Cattle are incidental hosts to these infections which provoke more vigorous renal disease and abortion. Surviving cattle have high antibody titers and reduced shedding of *Leptospira* for short time periods, but reinfection is likely. Young calves or calves exposed at birth to *L. hardjo-bovis*, *pomona* or *grippityphosa* develop mild renal disease known as 'red water' from the bloody urine produced. Infected calves often become chronically infected reservoirs for the herd.

Commercial vaccines available in the US include 5-way killed products for *pomona*, *canicola*, *icterohaemorrhagiae*, *grippityphosa* and *hardjo*. These 5-way vaccines give good protection against all *Leptospira* except *hardjo-bovis*. The *hardjo* in these products is *L. interrogans* serovar *hardjo*, which is present in Europe, not the US. Vaccination using the 5-way *Leptospira* products does not prevent renal infection, urinary shedding or fetal infection with US serovar *hardjo-bovis*.

To control reproductive diseases, the vaccine titer produced must be capable of protecting the fetus. The titer must be high enough to block placental transfer of the offensive agent. It takes multiple doses to achieve fetal protection using killed vaccines and most killed vaccines won't claim fetal protection on their label. Many live and MLV provide fetal protection.

Live and MLV may cause actual disease in stressed or unhealthy animals. The controlled mild disease created is not a threat to healthy animals. Other side effects of all vaccines include post-vaccination fevers or abortion. Post vaccination fever is a normal expected immune response. Fever contributes to abortion in stressed pregnant animals or those incubating concurrent disease.

Adverse reactions may occur with every product you choose. **READ THE LABEL AND FOLLOW IT EXACTLY.** Make sure your animals are in a proper plane of nutrition and not under stress when vaccinated. Work with your veterinarian to establish vaccination protocols for your farm.

New *hardjo-bovis* products are available using serovars present in the US and different technology which evoke humoral and cell-mediated immunity. A full year's protective titer level is achieved with these vaccines and they are licensed to prevent renal and fetal infection. These are available as stand-alone vaccines or incorporated into L5 combo products.

Underlying Leptospirosis herd problems are often diagnosed following third trimester abortions. The organism favors cool water and mud. It does not survive freezing in winter and desiccating in hot dry summers. Flooding helps spread the organism. The 5-way vaccines will prevent these abortion scenarios. Despite their label claim, killed 5-way *Leptospira* vaccines do not produce antibody titers lasting a full year. Booster every six months to provide yearlong protection.

With such a wide variety of wildlife exposure and carrier cattle in your herd, there is no way you can protect your herd against Leptospirosis without vaccinating. Administer the 5-way products prebreeding so high titer coincides with conception and embryo development. Boosters at pregnancy check (two-to four months post breeding) help protect from abortion and calf disease.

Do you need to add *hardjo-bovis* vaccines to your protocol? This depends on your herd level of *hardjo-bovis*. Herd serology gives a better diagnosis than testing individual cows or individual abortion cases. Consider the economics of herd serology; vaccination is probably cheaper and usually warranted.

Keep records and suspect sub-clinical Leptospirosis if you have early embryonic deaths (EED) occurring (many repeat breeding) or long calving intervals. Adding *hardjo-bovis* vaccine may increase your repro efficiency 2-3%.

***Campylobacter* bacteria were thought to be *Vibrio* organisms until the 1970s when they were reclassified to *Campylobacter*.**

A sexually transmitted disease (STD), carrier cows and bulls harbor this organism in the vaginal mucosa and surface tissues of the penis and prepuce. Infected bulls contaminate their bedding during urination, which exposes other bulls to infection. They transmit the organism from female to female and this is the only way females are infected. There are no signs of infection in the bull.

Biosecurity

- **Maintain natural immunity**
 - Proper nutrition: copper, selenium, zinc
 - Avoid overcrowding
 - Control internal and external parasites
- **Keep infectious agents out of the herd**
 - Purchase from well-managed, reputable herds
 - Test prior to purchase
- **Minimize spread of infectious agents**
 - Quarantine upon arrival
 - Identify and cull carrier animals
 - Isolate sick animals, bury/compost dead animals
 - Separate feed and manure handling equipment
 - Reduce exposure to wildlife reservoirs
- **Maintain acquired immunity**
 - vaccination protocols

In females, campylobacteriosis produces endometritis, which is hostile to the developing embryo. Initial infection may not interfere with conception, but rather causes EED. Infected females return to estrus 40-60 days after breeding. Suspect *Campylobacter* when prolonged calving season and reduced calf crop are occurring.

Infected females eventually clear the infection so that pregnancy may establish, but this resistance is temporary and re-infection is possible three to four months later. Others may never maintain a pregnancy. Still others, even though infected, are able to deliver a normal calf. All these females can serve as silent carriers to infect susceptible bulls and overall fertility never returns to its normal uninfected level. *Campylobacter* causes abortion during the fourth to seventh month of gestation.

Campylobacter (Vibrio) killed vaccines are available. To protect heifers and non-vaccinated cows, two doses are required four weeks apart, with the second dose given one month prior to breeding season. Revaccinate annually, one month before breeding season begins. Although not labeled for bulls, research has shown vaccination can cure the bull. Talk to your vet about vaccinating bulls.

Vaccination alone is not the sole measure of control. Practice herd bull biosecurity. When purchasing older bulls, require they be tested negative and be wary of rented or loaned bulls. **Using virgin bulls for one breeding season virtually prevents Campylobacteriosis.**

Trichomoniasis is another STD. Caused by protozoa, *Trichomonas fetus*, this organism localizes in the smegma (secretions) lining the penis, prepuce and urethra. It does not create lesions, nor affect semen or sexual behavior and is asymptomatic in the bull. Older bulls become permanent carriers. **Bulls less than four years old are thought to either recover spontaneously or are refractory to *Trichomonas*.**

The organism colonizes the vagina, uterus and oviducts of cows. While not preventing conception, vaginitis and endometritis occurs one to two months post infection. This creates a hostile environment for the developing embryo. EED and return to estrous occurs, creating a prolonged calving season and reduced calf crop.

After a variable period of infertility following initial exposure, cows may regain their fertility, even though they are bred by infected bulls. Cows generally rid themselves of the disease after 60-90 days sexual rest; bulls are unable to develop immunity.

Trichomoniasis is often introduced to the herd by infected bulls and is more of a problem in western states than it is here in Wisconsin. All purchased non-virgin bulls from Texas and other western states should be cultured or tested for *Trichomonas*.

Vaccinate high-risk cattle or those diagnosed with Trichomoniasis. Vaccines require two doses, two to four weeks apart with the second dose and all annual boosters be given four weeks be-

fore breeding. Vaccines are labeled for cows only; there is no label claim for efficacy in a bull.

***Neospora caninum* is another protozoa first reported to cause abortion on a New Mexico dairy in 1989.** Submit aborted calves for diagnosis and include testing for *Neospora*. This protozoa is common in Wisconsin.

Dogs are the definitive host of this protozoan parasite. Sexual maturity is reached in the dog and eggs are passed in dog feces. Infections in dogs are usually subclinical.

Cattle are incidental hosts of *Neospora*. Eggs are ingested and hatch in the intestine releasing infective asexual tachyzoites which migrate in tissue, producing tissue cysts. The cow will not appear sick. Tachyzoites cross the placenta harming the calf. Infections during the third month of gestation result in mummified calves.

Abortion occurs at any stage of gestation. Both endemic and epidemic abortion patterns are seen in herds infected with *Neospora*. Endemic herds have slightly greater than 5% elevated abortions rates which persist for years. Epidemic herds, which are less common, suffer abortion storms where the abortion rate is greater than 30% over several months.

Cows that abort once are likely to abort again. Calves acquiring infection during gestation which are born clinically normal have a 80-90% chance of being persistently infected. Congenitally infected heifer calves are capable of transmitting the infection to the next generation when pregnant, thus maintaining the infection in the herd.

Neospora infected cattle do not produce eggs and thus do not transmit infections horizontally to other cattle, but latent infection of larvae endures in cattle tissue (dead animals), including aborted fetus and placenta. Ingested larvae reach sexual maturity in the dog, producing more protozoan eggs.

Removal of all potentially infected tissues, such as aborted fetuses and placentas from the environment is important prevention of *Neospora* transmission. Properly dispose of dead cattle and tissues so that dogs and wild canines cannot ingest them. Preventing canine defecation in feed and water sources is also helpful.

There is no treatment and no vaccination available for *Neospora*. Control rests with herd biosecurity. Limit exposure to dogs and wild canines. Test the family dog and limit the dog's access to your herd.

Focus on reducing the numbers of *Neospora* infected cows in the herd and limiting the introduction of infected replacement cattle in the herd by testing all breeding females. Do not breed those positive for *Neospora*.

Bovine Viral Diarrhea (BVD) is ubiquitous in cattle populations. Its easy transmission, high antibody prevalence, frequent undiagnosed infection, variable incubation period and profound immunosuppression causes it to be the viral infection with the most economic impact.

BVD causes fever, diarrhea, erosions or necrosis of mucous membranes of the gastrointestinal tract. BVD often goes unnoticed unless oral erosions are observed.

BVD is often the cause of undifferentiated respiratory disease because fever, nasal discharge and rapid breathing are predominant symptoms. **The greatest economic consequence of BVD is due to the reproductive diseases it causes.**

Cattle are primary reservoirs of BVD and persistently infected cattle maintain virus in the herd. A variety of fetal abnormalities occur depending on the stage of gestation during which the cow is infected.

Vaccinating dams against BVD does not protect the fetus. Label claims of "fetal protection" do not mean the fetus is mounting an immune response to the vaccine. Vaccination increases circulating antibody and is the fetus's defense. We need the dam to have enough circulating antibody to neutralize BVD before it crosses the placenta. High titers can be created with multiple

doses of killed products or with one or two doses MLV per year .

Do not rely on vaccination alone to protect your herd from BVD. Herd biosecurity is necessary: purchase cattle including the bull who have tested clear of BVD. Screen your breeding herd and test breeding stock as calves, to cull persistently infected animals as soon as possible. All persistently infected cattle and calves should be euthanized.

Infectious Bovine Rhinotracheitis (IBR) is ubiquitous in cattle populations. Abortions happen months after a mild respiratory IBR blows through the herd.

Clinical symptoms of IBR include high fever, inappetence, rapid respiration and dyspnea (open mouth breathing). Profuse nasal discharge occurs along with hyperemia of the nostrils and muzzle ("red nose"). IBR induced conjunctivitis may be misdiagnosed as pinkeye.

Latent IBR infections in the Trigeminal Nerve can trigger IBR breaks when the animal is under stress. Vaccinate to produce disease blocking antibody before known periods of stress. Vaccinate pre-breeding to protect the developing fetus by increasing circulating antibody to neutralize IBR virus before it crosses the placenta.

Abortion follows IBR respiratory disease or conjunctivitis. Most fetuses are aborted during the last four months of gestation. The fetus may be expelled right away, or as much as 100 days later. Fetuses are dead in-utero for several days before expulsion and are often too decomposed for adequate diagnostic work-up. Serology of the dam may be more diagnostic.

IBR causes inflammation of the ovary which interferes with hormone production necessary to maintain pregnancy. Early embryonic death

Practicing biosecurity helps prevent disease introduction into your herd. 'Biosecurity' means keeping your animals secure from all biological threats. This begins with maintaining a healthy animal with proper nutrition. Minerals are important to support the immune system as is avoiding stress and minimizing parasite burdens. Parasites steal nutrients and are a source of chronic inflammation.

Isolate newly acquired animals from your herd for at least ten days; for many diseases, isolation is preferred for 30-60 days. Consult your veterinarian to determine isolation time for your situation. Isolation means no nose-to-nose contact, not sharing bunk or water sources or animal handling equipment. Make sure new animals' vaccination history matches that of your herd.

Diseases are also transferred from one farm to another by rodents, wildlife, birds, pets and vehicles. Humans move disease agents on their hands, clothes and shoes. Work with your veterinarian to maintain a biosecurity plan for your farm.

results when cows are exposed to IBR at breeding.

Live and MLV IBR virus also causes ovarian inflammation, arresting follicular development necessary to maintain pregnancy. Presence of MLV IBR in naïve animals will prevent failure of conception when these cattle are concurrently bred. Wait 30 days after vaccinating with MLV to breed these animals. Once vaccinated, the animal's immune memory is primed, and these deleterious effects on the ovary are no longer seen, so this subsequent 30 day rule will no longer apply.

Pay attention to use of MLV vaccines containing IBR injected into nursing calves. The induce mild infection may shed IBR from these calves to un-primed cows. The IBR may prevent her next pregnancy or cause her to abort an early pregnancy. Always read the label! It will tell you if the vaccine is safe for pregnant animals. MLV IBR is very safe to use when used correctly.

Nearly every respiratory vaccine product available includes IBR. Intranasal (both killed and temperature sensitive) vaccines produce mild disease to stimulate more complete immune response including nonspecific interferon to protect against IBR respiratory disease. Intranasal products do not produce circulating antibody to protect a developing fetus.

Repro Vaccination Protocol

- **Bacteria**
 - *Brucella*
 - *Campylobacter (Vibrio)*
 - ✓ **Leptospira**
 - **Protozoa**
 - *Trichomonas*
 - *Neospora*
 - **Virus**
 - ✓ **BVD**
 - ✓ **IBR**
- ✓ VCPR
 - ✓ Determine which diseases you need to protect your herd from
 - ✓ Tailor vaccination protocols to cow's life cycle
 - ✓ Pre-breeding
 - ✓ Preg check
 - ✓ Pre-weaning
 - ✓ Bull

This factsheet has discussed the common reproductive diseases in Wisconsin beef cattle. From this list it is clear: **all Wisconsin cow/calf herds should be vaccinated for Leptospira, BVD and IBR.**

Work with your veterinarian to establish effective vaccination protocols. Have facilities in place so you can conveniently handle your herd. You have several opportunities to vaccinate cows, calves and replacement heifers including 1) pre-breeding, 2) pregnancy check (exams at 45-60 days post-breeding provides time to diagnose

reasons for not-pregnant and to re-breed) and 3) pre-weaning. Pre-weaning vaccinations prime the calf for successful weaning and future reproductive performance and also provide opportunity for booster shots to the dam. Don't forget to vaccinate the bull.

Set your vaccination protocol to the farm schedule you already have. Vaccines are unlikely to be administered when the protocol is too difficult to follow.

All health products have use and storage directions printed on the label. Vaccines have withdrawal times. Keep records so you do not create violative residues at slaughter. Do not use expired vaccines. Monitor refrigerator temperature to ensure vaccines are stored correctly. "Use Entire Bottle" label directions require using the entire bottle once opened. Live and MLV must be used immediately when mixed. As you are vaccinating a group of animals, mix the bottles as you go, keeping them cool and out of sunlight as you work. Needles are single service items. Select proper needle size based upon viscosity of product being used and the size of animal being injected.

The key to properly using vaccines rests with the relationship you have with your veterinarian. This relationship is a good investment for you to make. Veterinarians are the purveyor of current knowledge and information regarding the prevention and treatment of diseases of your cattle. A veterinary client patient relationship (VCPR) establishes a veterinarian's knowledge about your animals and your management practices. The VCPR helps to prevent drug residues. The Food and Drug Administration requires a valid VCPR before prescription or extra label drug use may be administered. Most vaccines are available over the counter, but some diseases are better controlled with an extra-label (ELDU) use of vaccines.

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