# Why VACCINATIONS Fail

HERD HEALTH

*by* ***Troy Smith***


Show me a cow outfit, and I'll show you an operation where considerable time and plenty of money are spent to provide treatments for a myriad of bovine maladies. Every herd experiences infections, injuries and infirmities that require attention.

But when it comes to diseases with real profit-robbing potential, most progressive producers see greater value in an ounce of prevention than in a pound of cure. They prefer measures that keep their animals from becoming sick to those that treat animals already stricken. It's a commonsense approach to herd health management.

Seeking a positive influence on animal performance and carcass quality, while attempting to lower costs of production and to improve efficiency, many conscientious cowmen routinely vaccinate their cattle. And while modern vaccines do offer a measure of protection against certain diseases, animals sometimes contract a disease for which they have been vaccinated.

Who is to blame when vaccines don't work?

Before cussing the veterinarian or product manufacturer, producers should consider the possible reasons why optimum immunity was not achieved. The most common reasons are related to the biology of the animals vaccinated and the human factor.

## Passive interference

Jim Roth, a veterinarian with the Iowa State University College of Veterinary Medicine, says vaccine failure may occur because the animal was not able to respond appropriately to the vaccine. In young animals, it may be due to the presence of maternal antibodies. In other words, the passive immunity to disease that a calf receives from the cow may interfere with the calf's ability to respond to the vaccine.

Derived from colostrum, these antibodies in the young animal's circulation may neutralize or remove the vaccine antigen before it can induce an immune response. Typically, virulent disease agents are capable of breaking through maternal immunity earlier than modified-live-virus (MLV) or killed vaccines. This means that, even if a calf is vaccinated, a period of vulnerability may exist between the time it loses its maternal antibodies and it develops its own active immune response.

"Unfortunately, there is no rule of thumb for the age at which a baby calf should be vaccinated to expect an optimum response. It's just not that simple. Your own veterinarian, who knows your herd and its history, can advise you best," Roth says.

## Too late, too little

Disease after vaccination also may be due to the time lag in antibody production. It often takes two weeks after vaccination before an effective immune response will develop. Roth says some cases of apparent vaccine failure actually involve animals that were incubating the disease at the time of vaccination or that became infected shortly afterward but before the vaccine had time to induce immunity.

"In this situation, disease symptoms appearing shortly after vaccination (with MLV product) may be mistakenly attributed to vaccine virus causing the disease," Roth adds. "But modified-live vaccines have been attenuated to be of reduced virulence, and reversion to virulence is a rare event. However, attenuated vaccine strains may be capable of producing disease in immunosuppressed animals."

MLV vaccines are not recommended for use in animals with compromised immune systems, so products containing killed virus should be used if vaccination is absolutely necessary. A suppressed immune system, however, may cause failure of any vaccine. Roth says malnutrition, including deficiencies in energy, protein, vitamins and minerals (particularly copper, iron, zinc and selenium), can suppress immunity, as can parasitism, stress and concurrent infection.

"Vaccines licensed by the USDA (U.S. Department of Agriculture) have been tested to determine they are safe and effective. However, 'effective' is a relative term. It does not mean the vaccine will induce complete immunity under all conditions that may be found in the field," Roth warns.

"Testing is typically done on healthy, unstressed animals under good environmental conditions and with a controlled exposure to a single infectious agent. Vaccines may be much less effective when used in animals that are under stress, incubating other infectious diseases, or exposed to a high dose of infectious agents due to overcrowding or poor sanitation," he adds.

Even when vaccination produces immunity, it may be overwhelmed under certain conditions. The level of immunity typically peaks at two to six weeks after vaccination, then begins to decline gradually. Consequently, annual revaccination is often recommended.

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However, if an animal did not have a strong response to the initial vaccination due to stress at that time, or if it is stressed and challenged with a high dose of the disease agent several months later, there may not be enough residual immunity to the disease. Roth says this is particularly true of some killed vaccines, and more frequent revaccination may be warranted.

Efficacy of killed vaccines also may be challenged because of antigenic differences between the vaccine and strains of disease-causing agents found in the field. Put more simply, vaccines are developed to protect against specific strains of bacteria or viruses. But disease agents can mutate, resulting in variant strains for which the vaccine is not effective.

## User error

While unsolved mysteries of biology account for some instances of vaccine failure, improper handling and administration are significant reasons why vaccines may fail to induce the expected immune response in normal, healthy animals. Failure to store the products at refrigerated temperatures and exposure to light will inactivate most MLV vaccines. Even when stored properly, vaccines lose viability over time, Roth says.

"Residue from chemical disinfectants used on syringes and needles can inactivate modified-live vaccines, as can the use of improper diluent or the mixing of vaccines in a single syringe," he explains. "Multiple vaccines should not be mixed in a single syringe unless that particular combination has been adequately tested to ensure there is no interference."

Dale Grotelueschen, University of Nebraska professor of veterinary Extension and diagnostics, agrees that the human factor is a primary cause of vaccine failure. Recommending use of only federally licensed products, he urges producers to read and to follow label directions regarding storage and administration.

"Vaccines are developed and tested for safety and efficacy, but no product provides 100% immunity in all situations. Complete protection is too much to expect. There are reasons that we don't fully understand and some that we think we understand but can't control, but we should be able to control human error," he says.

To do so, Grotelueschen offers the following checklist:

- ►Keep vaccines chilled at 35°-45° F.
- ►Ultraviolet rays cause serious damage, so keep vaccines from sunlight.
- ►Avoid cleaning equipment with chemical disinfectants.
- ►Follow label directions for administration, using subcutaneous (sub-Q) injection whenever possible.
- ►Use sharp, sterile needles; and change needles frequently.
- ►Killed vaccines generally require a second booster shot in two to four weeks, so plan to follow up.

"And timing of vaccination is another important human decision. Remember that animals need time to respond, so try to vaccinate ahead of anticipated exposure to disease — those situations where cattle are commingled, shipped, or otherwise subjected to stress and high levels of exposure," Grotelueschen adds.

"Use the right product, and use it right. Vaccines augment good management but they won't replace it, so some producers may have to adjust their management systems to get the best return on their vaccine investment."