

## **The Limitations of Vaccinations**

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A well designed and implemented vaccination program is a key element to progressive dairy management. However, it is important to understand and appreciate the limitations of this herd health tool. No vaccination program can fully prevent disease in the face of poor animal husbandry. Vaccines do not prevent infection. Rather, they prime the immune system to provide a rapid and effective response following infection. This limits multiplication and spread of the infectious agent and lessens tissue damage. The result is decreased disease severity and decreased transmission to other animals.

Many management factors can limit the effectiveness of vaccination including nutrition, environmental conditions, exposure to disease, and vaccination administration. Protein, energy, minerals and vitamins are all required to develop and maintain a strong immune system. Specific vitamins and minerals associated with optimal immune function include vitamin A, vitamin E, selenium, copper, and zinc. Harsh or stressful environmental conditions can have significant detrimental effects on immune function. In addition, crowding and poor sanitation increase the exposure to infectious agents which can overcome even high levels of immunity. These factors contribute to the increased disease rates associated with climate changes, weaning, herd expansion, shipping or other changes in animal management. Sometimes we have control over these variables, however, often they are beyond our control. Thus, it is extremely important that we try to maximize the benefits of vaccination by proper use and administration.

Two very common causes of vaccine failure are inappropriate storage and administration. Most vaccines should be stored in the refrigerator and may lose their effectiveness within 12 hours of storage at room temperature or less than one hour in extreme heat or direct sunlight. Vaccines that require mixing prior to use are usually only good for 12 hours or less. Appropriate administration of vaccines to all susceptible animals, including bulls, is critical in developing herd immunity. Recent surveys indicate that 80-90% of producers routinely vaccinate their animals, most producers fail to vaccinate all susceptible animals or do not follow specific labeled directions such as providing proper boosters. These studies indicate that up to 70% of dairy herds are inadequately vaccinated simply because of improper management.

Vaccine efficacy is also determined by the unique characteristics of the specific diseases. Bovine viral diarrhoea (BVD) is a prime example. Recently it has been demonstrated that there are two antigenically distinct groups of BVD viruses, type 1 and type 2. Both can cause the same disease syndromes including respiratory disease, acute BVD, mucosal disease, abortion, and other chronic reproductive losses. Most current BVD vaccines include only BVD type 1 virus antigens. While the modified live BVD type 1 vaccines confer protection from clinical disease with type 2 viruses, the killed virus vaccines that contain only type 1 antigens provide only limited protection against type 2 viruses. This is why more vaccine producers are including BVD type 2 antigens in their killed virus vaccines. In spite of vaccination, it is critical to realize that persistently infected cattle

continually expose other cattle to BVD. This means that as immunity declines following vaccination, there is a period of time where individual animals are potentially susceptible and exposed. Infection in these animals generally results in decreased reproductive efficiency including infertility, early embryonic death, abortions, and additional persistently infected calves but not other signs of disease. Thus, elimination of BVD from a herd requires not only an adequate vaccination program but also the identification and removal of all persistently infected cattle.

Infectious bovine rhinotracheitis (IBR) virus can also persist in spite of vaccination. Essentially all animals are infected with IBR early in life and the virus goes dormant within nerve cells. When animals are stressed, the virus can become active again and either cause disease in that animal or be spread to other susceptible animals. The goal in vaccination for IBR is to maintain enough immunity so that these episodes of reactivated virus do not cause clinical disease. Another respiratory virus of concern is bovine respiratory syncytial virus (BRSV). Calves up to 6 months of age are at the greatest risk of developing severe disease from BRSV. Unfortunately, they are the one group for which vaccination provides only limited protection. Maternal antibody in the colostrum does not protect calves from BRSV and interferes with successful vaccination. Thus, most calves remain susceptible until vaccination at 6 months of age.

It can not be stressed enough that while vaccines are an important management tool in preventing infectious diseases, they have their limitations. It is extremely important to manage the exposure and introduction of disease into a herd as well as try to optimize herd immunity. In the next issue, we will talk about biosecurity and some of the diseases we can try to eliminate and keep out of a dairy herd.