

Making Sense of Vaccine Types

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In order to keep cattle healthy, a variety of management practices can be used to increase an animal's immunity and decrease exposures to pathogens. The proper use of vaccinations can be an important tool in increasing an animal's immunity. The first step in increasing immunity through vaccination is selecting the appropriate vaccine for the class of animals, the stage of production, and the disease against which you are trying to protect.

A vaccine contains an *antigen* made from a specific disease-causing organism that the animal mounts an immune response to. Therefore, it is important that the vaccine contains the proper antigen that you are trying to protect against. Furthermore, some disease-causing organisms may have several strains or serotypes, and vaccines may not be cross-protective for all types and strains. A good example of this can be found with leptospirosis. While many combination leptospirosis vaccinations are available, protection against some abortion-causing strains such as *Lepto hardjo-bovis* may require a separate vaccine.

Killed versus modified-live vaccines

The safety, efficacy, and speed of effectiveness of a vaccine are influenced by the type of vaccine used. There are two basic types of vaccines, killed and modified-live (ML). Both types of vaccines have been proven to stimulate immunity in cattle, and both can have an important role in protecting your herd. Many combination vaccines have components of both killed and ML antigens, so it is important to read the label of your vaccines to know what you are using.

Killed vaccines contain an inactivated or killed antigen that is incapable of replicating within the animal's body. Bacterins and toxoids are vaccines made from killed antigens. Killed vaccines are generally considered to be safer than modified-live vaccines because they do not contain a live antigen capable of actually reproducing or causing disease in the animal. However, because an *adjuvant* is added to a killed vaccine to stimulate the immune response, and more antigen is used to make the vaccine, more adverse reactions such as tissue inflammation may be seen. A killed vaccine requires a second booster dose to maintain immunity, usually 2-4 weeks following the initial vaccination, in addition to yearly revaccination. Since the vaccine uses a killed antigen component, protection is not as broad as what you would expect following natural infection or vaccination with a modified-live product. Killed vaccines have an advantage in that they do not have to be



Many combination vaccines have components of both killed and MLV antigens, so it is important to read the label of your vaccines to know what you are using. Furthermore, some antigens can come in both killed and ML forms.

reconstituted, and therefore are more stable for longer periods of time when properly stored. You can use one dose of vaccine without having to use up the whole bottle.

Autogenous vaccines, also known as “self” or custom vaccines, are those produced from bacteria or viruses isolated from sick animals. Autogenous vaccines are produced by isolating the disease-causing organism, killing the organism, and adding an adjuvant to make the vaccine stable and stimulate an immune response. Autogenous vaccines commonly used in livestock include pinkeye (*Moraxella spp.*) and wart (papilloma virus) vaccines.

Modified-live or attenuated (weakened) vaccines contain live antigen that can replicate in the animal and more closely mimic a true infection response. Therefore, ML vaccines tend to provide better immune response and protection. ML vaccines have the potential to cause a mild infection, and may not be safe to use in all classes of animals such as pregnant or nursing cows. However, these cattle in fact can be safely vaccinated with ML vaccines when label directions are strictly followed. ML vaccines give a much longer and broader immunity with one dose since the virus replicates and behaves more naturally than killed antigens. In contrast to the killed products, ML vaccines must be reconstituted and must be used within hours of mixing. They are also more sensitive to temperature and light variations. ML vaccines are marketed in specific dosages of 5, 10, 20, etc. therefore some product may be wasted when vaccinating an odd number of animals.

There are two types of ML vaccines, replicating and non-replicating. The replicating vaccines must replicate in the animal’s body before immunity is increased. One dose is usually sufficient to provide long-lasting protection in the animal. Failure of the antigen to replicate, which can occur due to improper handling or administration, will mean a failure to stimulate immunity. The non-replicating ML vaccines do not actively replicate in the body and require a second booster dose.

Mucosal vaccinations are ML vaccines that stimulate a localized immunity on the mucosal surface of the animal such as the nasal passages or GI tract. Mucosal vaccines can actually prevent infection with certain agents, thus decreasing spread, shedding and transmission to other animals. Because they are a ML vaccine used directly at the site of attachment, mucosal vaccines tend to provide a quicker protection to cattle, but protection tends to be short-lived unless a booster is given. Mucosal vaccines are widely used in cattle at high-risk for disease such as stocker cattle and neonates.

Using the right vaccine

As you can see, there are advantages and disadvantages to both types of vaccines. Many combination vaccines have components of both killed and MLV antigens, so it is important to read the label of your vaccines to know what you are using. Furthermore, antigens can come in more than one form. One such example is *Clostridium tetani*, the organism that causes tetanus in livestock. The *C. tetani* is commonly found in the multivalent clostridium vaccines used for “blackleg” as a killed antigen or toxoid. Used in this manner, protective immunity may take weeks to develop, given that boosters are

properly administered. On the other hand, a modified-live *C. tetani* vaccine, also known as an antitoxin, is also available. When you need immediate protection, such as following banding/castration or a puncture injury, you would want to administer a *Clostridium tetani* antitoxin. When performing your routine vaccinations in a healthy animal, a toxoid will generally suffice.

Every cattle operation is unique and faces different herd health risks on a day-to-day basis. There are no “cook-book recipes” for vaccine use. It is also important to remember that vaccination is only a part of good herd health management, and other factors such as good nutrition and biosecurity must be considered. Your herd veterinarian is the most qualified person to consult when making vaccine decisions based on a risk management approach. There are many vaccine choices available to the cattle producer, and selection of the right product at the right time is crucial for the protection of your herd.