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# **COW SENSE CHRONICLE**

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### **KILLED, MODIFIED LIVE, CHEMICALLY ALTERED, OH MY!**

As summer begins its journey into fall, planning ahead for fall chores like pre-weaning vaccinations for calves might start to appear on to-do lists in cattle country. This month, I'll focus on the differences and similarities among killed, modified live, and chemically altered vaccines.

Just what is a vaccine, anyway? A definition I like to use in class is this one: a suspension of attenuated or killed microorganisms or the antigenic proteins derived from them. That might sound a little overwhelming, so let's look at each piece separately. In this case, the suspension is a liquid that contains particles (microorganisms or proteins from them) that are mixed with the liquid but are not dissolved in it. Attenuated means altered, usually in a way that makes something less severe. Modified live vaccines contain attenuated microorganisms. Killed vaccines contain killed microorganisms. Antigenic means that a substance causes an immune response. Vaccines with this formulation contain a protein from the microorganism that is source of the immune response. In order to produce a sufficient immune response, killed vaccines generally include a large amount of organisms and ingredients called adjuvants. An adjuvant helps create a stronger immune response in the animal's body by increasing the stability of the vaccine in the body. Common adjuvants in killed livestock vaccines include aluminum hydroxide or oil. The major advantages of killed vaccines are safety and stability of the product.

Modified live vaccines contain whole pathogens that have been altered (attenuated) such that they can't cause clinical disease but can still infect and multiply within the animal. The animal's immune system recognizes the presence of the replicating pathogen to yield an enhanced immune response, negating the need for adjuvants. In general, the immunity produced by modified live vaccines typically lasts longer than the immunity produced by killed vaccines. The major advantage of modified live vaccines is a broader scope and duration of protection because the animal is exposed to all stages of the replicating virus or bacteria. Modified live products require mixing of lyophilized (freeze-dried) vaccine cake with provided diluent and should be used within an hour of mixing.

Chemically altered vaccines contain modified live organisms that have been grown in a media containing adjusted levels of certain chemicals that cause specific mutation of the microorganism. Temperature sensitive organisms are one example of chemically altered vaccine technology. Temperature sensitive organisms lose the ability to multiply at the animal's normal body temperature but can grow at the temperatures present in eye or nasal mucosa. Thus, if a chemically altered vaccine is given by a route other than direct contact with the mucous membranes, little or no immunity is stimulated. The immune response produced is similar to modified live products, but the duration of immunity is not considered to be as long. The major advantage of chemically altered vaccines is they are safe to use with pregnant animals because there is no systemic replication of the vaccine organism.

Successful vaccination depends on three critical factors: an effective vaccine, a functioning immune system, and administration of the vaccine before exposure to the disease. A vaccine may be ineffective if it is mishandled, if a booster is required but not given, or because of antigenic differences between the vaccine and field strains of the microorganism to which an animal is exposed. An animal's immune system may be unresponsive to vaccination because of age: a young calf's immune system might not be fully functional at the time of vaccination, or antibodies from maternal colostrum still present in the calf inactivated the vaccine. Inadequate nutrition may also cause an animal's immune system to be unresponsive to vaccination. Two other reasons for vaccine failure include that the animal was incubating the disease when vaccinated and that the duration of immunity after vaccination was inadequate.

In closing, here are my top 10 tips for effective vaccination:

1. Read and follow label directions. If you are unsure, consult your veterinarian or call the vaccine company directly before using the product.
2. Follow proper Beef Quality Assurance guidelines.
3. Sterilize equipment between uses. Modified live vaccines are sensitive to disinfectants, so do not use chemical disinfectants in syringes or needles for modified live use.
4. Refrigerate and store vaccines as directed on the label. Be sure appropriate temperatures for the vaccine are maintained when they are away from the refrigerator. The temperature of the vaccine should be at least as important (if not more important) than the temperature of the beverages.
5. Keep vaccines out of sunlight, even when in the syringe.
6. Mark syringes to avoid mixing or incorrect dosage.
7. Mix only enough vaccine to be used in one hour or less.
8. Choose correct needles for the job, and replace often.
9. Keep records of vaccinations used.
10. Good sanitation, management and nutritional practices are necessary to achieve the best results from vaccination programs.