VET CALL

Vaccine Developments Improve Safety and Efficacy

New developments in commercially available vaccines are intended to improve safety, efficacy and convenience. Several vaccine lines are available in various combinations of antigens and new antigens are being added to broaden coverage and make "one-vaccine" programs possible.

Manufacturers of killed vaccines are working hard to improve safety and efficacy by developing and incorporating better adjustments into their products. Results are already on the market in the form of lower dose, less reactive clostridial vaccines. Similar technology is being used to enhance immune response to pasteurella and IBR-BVD vaccines.

Another area of intense research that is beginning to pay dividends is sub-unit vaccines. Specific antigens important in the disease process are identified, isolated and characterized. These specific microbial proteins are then chemically separated and concentrated or produced in large quantities by recombinant DNA techonology to make a vaccine that is safer. It doesn't contain toxins from bacterial cultures and is more specific because the immune response is directed at only the portion of the microbe that causes this disease. Safer more effective pasteurella vaccines containing both cell antigens and toxoids are one example.

Methods to change live virus and bacteria so they induce immune response without causing disease are the basis for modified live vaccine (MLV) production. New techniques for modifying living microbes are producing MLV vaccines safe enough for pregnant cows.

Perhaps the most exciting new vaccines are the common core antigen vaccines used against *E. coli* mastitis in dairy cows. Few feedlot cattle suffer from coliform mastitis, but consider the possibilities for this technology. Vaccines are based on the fact that all gram negative bacteria have a common internal (core) protein that is exposed to the immune system during the early phase of infection when bacteria reproduce rapidly. This core antigen is purified and concentrated in a vaccine. These vaccines improve immune response and reduce reactions from endotoxin that is present when the whole bacterial cell is used to make vaccine. Adding a toxoid stimulates protection against both the bacteria and endotoxin. All gram negative bacteria produce disease by releasing endotoxin as they die and all gram negative bacteria contain this core antigen.

It seems likely we will see similar technology used in the near future to immunize against several diseases of great interest to cattle feeders. Gram negative bacteria that may be susceptible to common core vaccine technology include *Pasteurella hemolytica* and *multocida (shipping* fever), *Hemophilus somnus* (pneumonia and sudden death), *Salmonella* (enteritis and pneumonia), *Moraxella bovis* (pinkeye), *Klebsiella* (pneumonia) and *Leptospirosis* (septicemia and kidney infections).

New insights into the workings of the immune system impart new considerations of the way we use vaccines. Great debate over the advantages of modified live versus killed vaccines becomes pointless as we increasingly understand how each type of vaccine stimulates immune response and how specific microbes cause disease. Each vaccine has advantages and disadvantages in given situations. It remains for the cattle producers and veterinarians to recognize these and choose the vaccine that best protects against the diseases of concern given the class of animals and the management system.

Modified live vaccines use small amounts of live organism that must reproduce in the host animal to stimulate an immune response. In the absence of maternal antibody, MLV can immunize with a single dose. Immunity from MLV lasts from months to life. MLV will stimulate at least a partial immune response in younger animals. MLV can stimulate all types of immune response and in general are better against microbes that penetrate cells such as pasteurella, hemophilus and respiratory viruses. MLV are less likely to cause vaccine reactions but certain antigens (BVD) can depress immune response.

On the down side, most modified live vaccines are not safe for pregnant females. Since the agent is still alive, reversion to virulence is a remote possibility. Concurrent infection, previous immunization and use of antibiotics with bacterial vaccines all impair response to modified live vaccines.

Killed vaccines stimulate immunity using a large mass of antigen and adjuvants that prolong exposure or promote a greater immune response. The presence of maternal antibody obliterates response to killed vaccines. After maternal immunity has disappeared a minimum of two doses at least two weeks and no more than eight weeks apart are required to immunize. Immunity is relatively short, lasting from several weeks to a year. Killed vaccines stimulate primarily humeral antibody production and protect best against agents in the blood stream.

Because of the large mass of antigen, killed vaccines stimulate a better booster response in previously immunized cattle and are superior to MLV for producing colostral antibody. Though reversion to virulence is impossible with killed vaccines, many contain the entire killed organism plus any toxins present in the culture media making vaccine reactions — fever, depression, reduced production, allergic reaction — much more common. Killed vaccines tend to be more expensive than modified live.

Recommendations for developing vaccination programs depend on the amount of information we can obtain about cattle we intend to immunize. Since every animal differs in the amount of maternal protection it receives, young animals should be vaccinated first with modified live vaccines to try to stimulate all types of immunity as early as possible. Animals that have been properly immunized initially will respond better to killed vaccines than to modified live.

Duration of protection varies with agent and vaccine type but in general, virus immunity outlasts bacterial. Response to MLV lasts longer than to killed vaccine. Special classes of animals — young, pregnant, badly stressed — limit the selection of vaccines available.

The objectives of a vaccination program are to:

1. Produce an immune response similar to natural infection.
2. Protect the host from clinical disease and reinfection.
3. Provide prolonged protection (for the functional life of the host).
4. Minimize side effects from vaccination,

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