

Vet Call

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Immunization Strategies Part II

Herds require different classes of immunity for protection from different organisms. The type of vaccine, route of administration — in the muscle, under the skin, into the nostril — and adjuvant characteristics affect the type of immune response produced.

Two types of vaccine are currently used in beef cattle, modified live (attenuated) and killed (noninfectious).

Modified live vaccines (MLVs) utilize microorganisms altered in such a way that they no longer cause disease yet retain the properties that induce a protective immune response. MLVs don't contain enough of the disease causing agent to immunize an animal unless the organism can replicate in the host. An effective local immune response requires a live replicating vaccine and cannot be produced by noninfectious (killed) vaccines.

Because MLVs multiply in the host, they more closely resemble real infections and generally produce a stronger and more durable protective immune response than killed vaccines.

MLVs may also induce interferon production in the first few days after immunization, providing additional early protection against some viral infections. However, MLVs do have disadvantages. Certain ones can induce immunosuppression, may be shed into the environment, and may revert to virulence or cause abortion in pregnant animals who have never been in contact with the organism before.

Killed vaccines cannot replicate and are unable to cause infectious disease in immunosuppressed individuals. However, to

induce a protective response, killed vaccines require a large dose, multiple immunizations and the use of adjuvants which can cause tissue irritation at the injection site. These factors substantially increase the cost of inactivated vaccines and the probability of local and systemic vaccine reactions.

In addition, killed vaccines generally produce weaker immune responses with a shorter duration than the immune response produced by MLVs.

Adjuvants are added to inactivated products to increase their effectiveness in stimulating protection. One method adjuvants use is to stimulate certain types of white blood cells. Another method of enhancing the immune response is to ensure the vaccine organism remains in the body for a prolonged period of time. This can be done by incorporating the vaccine organism in insoluble adjuvants such as oil. A number of new adjuvants that appear to facilitate cell mediated responses are under investigation.

Bacterins (killed bacterial vaccines) are generally less effective than viral vaccines and provide short-lived, partial immunity. The immune response required for protective immunity to bacteria is more complex than that required to protect against viruses.

Proper handling of vaccines is essential for the development of immunity. MLVs are particularly sensitive to improper storage, but exposing killed vaccines to freezing temperatures, excessive heat or ultraviolet light may also result in reduced effectiveness. All vaccines should be stored according to the manufacturer's recommendation.

Dried products should be used immediately after reconstitution and not exposed to sunlight or temperature extremes. Different

vaccines (even from the same manufacturer) should not be mixed in the same syringe unless directed by the manufacturer's instructions. Syringes used to deliver MLV products should be rinsed thoroughly after chemical sterilization or be sterilized by boiling to avoid having traces of disinfectant in contact with the vaccine.

Immune Response Failure

Even if a vaccine is handled properly and it induces an immune response, it's not uncommon for an immune response induced by a vaccine to fail in protecting the herd from the chosen disease. This failure can occur when:

1. The herd produces a humoral response to the vaccination, but a cell mediated response is necessary for protection.
2. The part of the organism that the herd builds an immune response against does not help destroy the organism.
3. The infectious agent exposed to is different from that immunized against.
4. The protection induced by the vaccine wanes after a period of time so that a low to moderate exposure to the organism can overcome the herd's defense mechanisms.
5. An immune response is overwhelmed by an extreme exposure to a particular disease-causing organism.

A major stumbling block to veterinarians trying to develop scientifically sound immunization programs is the fact that to be certain a protective immune response is stimulated, one must know which specific antigens and what aspect of the immune response are responsible for protection for a given disease. This information is not available concerning most reproductive diseases.

Modified Live Vaccines

Provide longer duration and more complete immunity than non-infectious vaccines
Stimulate cellular and secretory immunity
Do not require multiple vaccinations
Often do not require revaccinating or require fewer revaccinations during life of the animal
Rarely cause hypersensitivities, but may cause illness in certain individual animals or revert to virulence

Killed (Non-infectious) Vaccines

Provide short-lived systemic immunity
Cellular and secretory immunity is poor
Require multiple vaccinations for immunity
Often require re-vaccination to ensure immunologic memory
Often cause hypersensitivity reactions
Cannot cause disease even in immunologically compromised animal

