

Maximizing a Cow's Immune Response
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Infectious disease remains a major cause of loss of production and profits affecting the cattle industry. The bovine respiratory disease complex, calf scours and other infections such as blackleg and infectious abortions such as trichomoniasis and leptospirosis continue to be primary infectious diseases of concern.

A producer has three management options to consider in an attempt to alter the effects of infectious disease within their herd; increase the resistance to the disease within the herd, prevent the access of the disease to the herd, and or treat infected animals.

The only direct means a producer has to affect infectious disease resistance is through vaccination. Successful vaccination results from the stimulation of the acquired immune response. The acquired immune response involves; (1) the recognition of the invading antigen, viral, bacterial or parasitic, (2) the production of specific antibodies and immune cells to dispose of the antigen, (3) the development of a memory for each antigen. The key components of an immune response are:

- *Antigen recognition* - The interaction of the invading foreign antigen with specific cells of the white blood series and the subsequent stimulation of the appropriated component of the immune system to produce an immune response.
- *Humoral immunity* - The production of specific antibodies that appear in the blood.
- *Local immunity* - The development of specific antibodies at the surface of the respiratory, urogenital and GI tracts.
- *Cell mediated immunity* – The production of specific immune cells that kill or remove infected cells or remove bacteria from the site of infection.
- *Memory* – Permits the humoral and cell mediated immune systems to remember previous encounters and respond rapidly and specifically when re-exposed to an invading agent.
- *Antigenic mass* - The quantity of antigen that must be present to be recognized as “foreign” before the immune system will respond.

Factors which can affect the immune response are the nature quantity and route of administration of an antigen. Protein is the major stimulant for the immune response and the larger and simpler the protein the better the recognition. Viral proteins are usually better antigens because they are simple and abundant. Bacteria routinely have multiple and complex antigens and these antigens are often associated with fats and sugars which are poor stimulators of the immune response. The route of administration also affects the immune systems response. Exposure of a mucosal surface such as the gut lining or the respiratory tract will stimulate a local immune response, Vaccination with an intramuscular or subcutaneous administration will stimulate the humoral and often the cell mediated response.

Vaccines consisting of killed or inactivated antigens must have the appropriate antigenic quantity present in the inoculating dose to stimulate an effective response.

Certain types of vaccines may require multiple inoculations to stimulate the “memory” of the immune system. Live vaccines produce the necessary antigenic quantity to stimulate an immune response by multiplying within the recipient. Killed or inactivated vaccines deliver a higher dose of antigen compared to modified live vaccines. Modified live vaccines generally stimulate a more complex and higher immune response involving both the humoral and cell mediated components. Adjuvants or chemical additives within vaccines aid or enhance the immune response by being nonspecific enhancers of the recognition and processing of the antigen.

The total immune response includes resistance factors that all animals are born with called “natural resistance.” Natural resistance includes physical and physiological barriers or functions of the body and is critical for survival of all species of animals. The natural barriers include things such as intact skin, mucous membranes, intestinal motility, gastric juices, saliva, sweat etc.

Optimizing the immune response and minimizing stress and nutritional deficiencies has a direct and positive impact on the production and profitability of an enterprise. Limiting or decreasing the effects of infectious disease on livestock is always better and usually cheaper than treating a disease within a herd. Developing a quality long lasting immune response within the breeding herd will pay economic dividends for a beef cattle producer. Producers should consult with their herd veterinarian when developing a vaccination program for their herd. Their herd veterinarian is the best resource a ranch has regarding the health and welfare of their herd.