Recommended Vaccination and Management Practices for A Successful Herd Health Program

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Take Home Messages

- Successful vaccination programs must be planned to meet the needs of a specific farm.
- There is a difference between vaccination and immunization.
- The most successful vaccination programs utilize both modified live and killed vaccines.
- A calf's first vaccination is critical to activate the immune system.
- A good vaccination program must be scientifically correct and still be compatible with the management practices on the farm.
- Vaccination is the insurance policy for a healthy herd.

Introduction

Vaccination is an essential component of any infectious disease control program for dairy farms. It is likely to be most effective when it is planned to meet the particular needs of a farm. Vaccination programs have been employed in Western Canadian dairies for a number of years with very good protection against some diseases and quite poor protection against other diseases. This has created considerable confusion with regard to the best protocol. It is important to remember that for most diseases the relationship between the infectious agent and the host is sufficiently complicated that vaccination cannot be expected to provide complete protection. The vaccine increases the animal's resistance to disease, but that resistance can be overwhelmed if good management practices are not followed (5). Setting up a vaccination program means determining:

- What diseases to vaccinate against.
- Who will most benefit from vaccination.
- When will the animal most need the protection that vaccines provide.

Achieving Protective Immunity

There is a difference between vaccination and immunization.(5) Vaccination is the act of administering the vaccine. Immunization is the animal's response to vaccination and it is immunization that actually protects against disease. We must recognize that a protective immunity not only requires the presence of circulating antibodies (humoral immunity) but also requires cell-mediated immunity (the actions of sensitized T lymphocytes) and mucosal immunity (the presence of antibody on mucosal surfaces).(5) In general, humoral immunity is felt to be particularly important in protection against extracellular phases of systemic viral and bacterial infections and in protection against toxin induced diseases. Cell mediated immunity is particulary important in protection from intracellular bacterial pathogens, intracellular phases of viral infections, fungal diseases, and protozoal diseases. Antibody on mucosal surfaces is important in protecting against those bacterial and viral diseases where the organism must attach to epithelial surfaces in order to produce disease. Therefore, the nature of each specific disease determines which type or types of immune response are necessary to provide protective immunity. It is therefore necessary for a vaccination program to produce good humoral, cell mediated and mucosal immunity if it is to provide optimum disease protection.

The Debate of Modified Live vs. Killed Vaccines

There are two basic types of vaccines: the modified live vaccines and the non-infectious or killed vaccines. "Modified live vaccines in general give the best systemic and local, cellular, and humoral immunity that can be achieved by a vaccine."(6) However, they do have some significant disadvantages. They can't be administered to pregnant cattle or cattle in contact with pregnant animals (except for IBR-PI3 intranasal vaccine). In addition, they may cause a mild reaction and should only be given to healthy animals not exposed to stress. On the other hand, killed vaccines do not contain live viruses or live bacteria and can be used on pregnant cows. However, the major disadvantage of this type of vaccine is that they induce an immune response that is of shorter duration and require booster vaccinations at precise intervals for the initial immunization or no protective immunity will be established. Some researchers feel that the cell mediated and mucosal immunity produced by killed vaccines is not as good as that produced by modified live vaccines.(6)

There continues to be a great debate over whether to use modified live or killed vaccines in dairy herd vaccination programs. Certainly we must consider whether we are vaccinating against bacterial or viral agents and also whether the host animal is open or pregnant. It appears that the best solution to this debate is to design a vaccination program that utilizes both and captures the advantages that are characteristic of each vaccine type. In Western Canadian dairy herds, the use of modified live vaccines, as part of the viral vaccination program, has been slow to become accepted due to the perception of a slightly greater risk of sickness in newly vaccinated animals. We must acknowledge this slightly greater risk, however, in view of the necessity to use a modified live vaccine as part of the program to provide the best protective immunity against a number of viral diseases, the use of such a vaccine is highly recommended.

▪ The Importance of a Calf's First Vaccination

In setting up a herd health vaccination program, it is particularly important to give special consideration to the first vaccination that a calf receives in its life. This is important because the immune system must be activated so that it can effectively produce a protective level of immunity. For viral diseases in particular, this involves the use of a single dose of modified live vaccine or two doses of killed vaccine given at a precise interval. Following this initial priming, an annual booster vaccination of killed vaccine will be effective. However, one vaccination per year using non-infectious vaccine is of no value unless the animal received the proper initial vaccination protocol at some previous time period. A number of researchers have indicated that they consider the single dose of modified live vaccine to be superior to two doses of killed vaccine for the first immunization that a young calf receives.(6) As mentioned earlier, the most effective vaccination program is one which is planned to meet the needs of a specific farm. There will therefore be much variation in the programs used throughout the country and they may be equally effective providing the basic principles are followed.

▪ Diseases for Vaccination in Western Canada

IBR

- Infectious Bovine Rhinotracheitis
- Caused by a Bovine Herpesvirus 1
- Associated with diseases of the respiratory and reproductive tract
- Characterized by coughing, eye and nasal discharge, high fever, inflamed mucous membranes, and often abortion in the second half of pregnancy

PI3

- Parainfluenza 3
- Caused by a Paramyxovirus
- Associated with subclinical respiratory infections causing secondary bacterial pneumonia
- Characterized by coughing and clear eye and nasal discharge

BRSV

- Bovine Respiratory Syncytial Virus
- Caused by a Pneumovirus of the Paramyxovirus family
- Associated with lower respiratory tract infections causing secondary bacterial pneumonia
- Characterized by labored breathing due to interstitial pneumonia with resulting edema and emphysema
- Occurs predominantly in young calves and may have high morbidity and high mortality

BVD

- Bovine Virus Diarrhea
- Caused by a Pestivirus of the Flaviviridae family
- Terminology associated with the disease includes the clinical description of: Peracute, Acute, or Mucosal Disease; the Biotype description of: Cytopathic or Noncytopathic; and the Genomic description of: Type I or Type II.(8) The terms cytopathic and noncytopathic refer to the ability of the virus to kill cells in a cell-culture system. Most viruses isolated from cattle are noncytopathic, however, both forms cause clinical disease.

Acute Form

The traditional acute form of BVD was first described in the 1940's and was characterized by profuse diarrhea, coughing, nasal discharge, depression, anorexia and the development of ulcers on the mucous membranes. Morbidity was usually high and mortality was low if the body was able to generate a good immune response.

Mucosal Disease

In the 1980's, Bolin and colleagues described a clinically severe persistent BVD virus infection in calves.(8) This form of disease occurred when a fetus was infected before 125 days of gestation with noncytopathic BVD virus. The fetus recognizes the BVD virus as itself and does not respond with an immune response. The resultant calf is considered to be a "PI CALF" since it is born

with lymphocytes infected with BVD virus.(8) It remains asymptomatic until maternal colostral antibody has waned and a cytopathic strain of BVD virus infects it. This combination results in the very lethal form of BVD known as mucosal disease.

Peracute Form

Another unique form of BVD was documented in the 1990's. This was a clinically peracute form with subsequent high mortality in adult cattle as well as calves and it was reported in eastern Canada and the northeastern United States.(8) Clinical signs included persistent bleeding from injection sites, haemorrhages and ulcers of oral mucous membranes, bloody diarrhea, severe depression, anorexia, and rapid death. Blood tests reveal a severe thrombocytopenia in cattle infected with this unique virus which is classified as a Type II genotype of the BVD virus.

Haemophilus somnus

- Haemophilus Somnus Disease Complex
- Caused by a gram-negative bacteria
- Associated with a systemic disease that can involve the nervous, musculoskeletal, circulatory, and respiratory systems either singly or together.
- Characterized clinically by bronchopneumonia, pleuritis, polyarthritis, and ITEME.

Calf Diarrhea

- Bacterial, Viral, or Parasitic
- Causes in calves less than six weeks of age include E. coli, Rotavirus, Coronavirus, Salmonella, Cryptosporidium, Coccidiosis, and BVD.
- The conventional calf scour vaccine provides protection for E. coli, Rotavirus, and Coronavirus.
- The vaccine is given to cows prior to calving to provide antibody protection through the colostrum. The ingestion of an adequate volume of colostrum soon after birth is essential to provide systemic immunity for the calf.
- E. coli usually causes diarrhea in calves 1-5 days of age while Rotavirus results in scours in the 1-4 week age group and Coronavirus at 1-6 weeks of age.

Coliform Mastitis

- Acute and Peracute Coliform Mastitis

- Caused by a gram-negative bacteria whose outer membrane contains large amounts of lipopolysaccharide or endotoxin which in turn causes severe endotoxemia and often death in dairy cattle.
- The vaccine is a bacterin-toxoid containing a genetically stable rough mutant strain (J-5) of E. coli. Vaccines prepared with these rough mutants result in exposure of the bacterium's naked core to the host's immune system and hence are called core antigens.(4)

▪ Suggested Herd Health Vaccination Protocol

Good compatibility with most dairy management systems can be achieved by selecting two major vaccination days approximately six months apart (one in the Spring and one in the Fall). This works very well for calves and heifers. Only dry cows and a few specialty groups require vaccination outside of this protocol.

2 months

- Modified Live BRSV
- *This vaccination is usually given just prior to movement of calves from hutches or individual pens to larger group pens.*

4-12 months

- Intramuscular Modified Live IBR, PI3, BVD, BRSV, and Killed Hemophilus & 7 Way Clostridial.
- **This vaccination cannot be given to pregnant animals or cattle exposed to pregnant animals.**
- *This group should consist of open heifers older than 4 months and being vaccinated for the first time (except for BRSV)*

12-18 months

- Intramuscular Killed IBR, PI3, BVD, BRSV, Hemophilus, and 7 WAY Clostridial.
- **This vaccination can be given to pregnant animals.**
- *This group should consist of open or pregnant heifers vaccinated at least once with modified live virus vaccine.*

18-24 months

- Intramuscular Killed IBR, PI3, BVD, BRSV, Hemophilus, and 7 WAY Clostridial.

- **This vaccination can be given to pregnant animals.**
- *This group should consist of open or pregnant heifers vaccinated once with both modified live and killed virus vaccine.*

Lactating Cows

- Intramuscular Killed IBR, PI3, BVD & BRSV.
- **This vaccination can be given to pregnant animals.**
- *This group should consist of open or pregnant cows which have been vaccinated at least once with modified live virus vaccine followed by regular boosters of killed vaccine.*
- *These vaccines have shown a small impact on milk production & therefore some dairymen prefer vaccinating at dry-off.*
- *For cows with an unknown vaccination history two vaccinations using a killed vaccine given three to four weeks apart is necessary to provide protective immunity.*

Dry Cows - Calf Scour Vaccine

- Intramuscular scour vaccine for Escherichia Coli, Rotavirus, & Coronavirus in newborn calves.
- *This vaccination should be given 6 weeks and 3 weeks before calving for the first time and then a single dose 3 weeks before calving for subsequent calvings.*
- *Good colostrum management is necessary to maximize the immune protection in the newborn calf.*

Dry Cows - Coliform Mastitis Vaccine

- Intramuscular J5 Bacterin-Toxoid vaccine for Endotoxic Coliform Mastitis.
- *The immune protection is short lasting and therefore two doses are required at about 6 weeks and 3 weeks before calving.*
- *This vaccine may also be given to lactating cows during high risk periods such as hot humid weather.*
- *A small milk production drop can be expected after vaccination.(3)*

▪ Conclusion

A well planned vaccination program is an essential component of any herd health infectious disease control program. It is particularly important with the increased incidence of such diseases as BVD and the great increase in dairy

cattle movement across the country. The success of a vaccination program will depend on the correct timing and use of a variety of vaccines, the correct handling and administration of the vaccines, and a vaccination program design which is compatible with the management practices on the dairy. This will ensure that the vaccination program is not only a routine procedure but also a good immunization program.

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