BEEF CATTLE REPRODUCTIVE HERD HEALTH

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The gestating fetus is the most susceptible individual within a cow –calf operation. Many of the pathogens that result in fetal disease and abortion cause transient and/or asymptomatic disease in the dam. Pathogens must first infect and replicate in the dams system prior to infecting the fetal compartment. Therefore, its helpful to conceptualize the dam as the last protective barrier between pathogen and fetus and the practices of immunization and biosecurity as mechanisms to strengthen the distance between them. There are 2 pathways pathogens enter the fetal compartment; hemotegenously or through the blood and ascending from the vaginal cavity through the cervix. Preventing the systemic replication of hematogenous pathogens is aided by the ease with which systemic immunization achieved.

Parenteral vaccines can produce robust and durable immunity and protect the cow and fetus more efficiently. Ascending infections on the other hand, avoid the central immune system by replicating and spreading along mucosal barriers. Improving mucosal immunity is a more difficult challenge, and consequently vaccines targeting this subset of pathogens tend to be less effective.

The term vaccination refers to act the injecting antigen into an animal and does not necessarily mean that immunization or the induction of durable and effective immunity will occur. Producers and veterinarians too often take for granted that 100% of animals in a herd will respond and overlook impediments to immunization, such as poor timing, poor immunocompetance of individuals, poor vaccine handling, or the potential for overwhelming disease pressure. The type of vaccine is also critical in shping the character of the immune response. Modified live vaccines are attenuated pathogens and that behave like wild-type virulent pathogens in that the transiently ‘infect’ and replicate in the animal. As such, MLV produce robust cellular and humoral immunity, greater recruitment of long-lasting memory cells, and require fewer doses to induce immunity. They also should be considered virulent for some individuals and gestating fetuses. Use of modified live viral vaccines in naïve pregnant cattle may induce abortion of the fetus. Likewise, use MLV can cause oophoritis or inflammation of the ovary which may result in damage to the developing oocyte. Consequently, producers should be careful using these vaccines in naïve animals within approximately 30 days of breeding. Killed vaccines, on the other hand, are inactivated by heat or chemically, cause relatively less diverse and short lived immunity, but because they cannot replicate are considered far safer for pregnant and breeding cattle.

A new lifetime immunization model is being applied in European herds and early adopters in the US dairy industry where immunization practices are carried out in the context of the animals entire productive life. In this model, a foundation of robust immunity is provided through use of MLV in calves and young adults at a time when they are not pregnant and there is no risk of abortion. Then once confirmed a heifer is confirmed pregnant a killed vaccine product is used to boost antibody titers and memory cells above what can be obtained through

the use of only one type of vaccine. The concept builds on the immunologic response of prime-boost, where in an animal that has produced effective immunity in response to one type of vaccine is immunized against the same pathogens but with a different type of vaccine or antigen preparations.

The timing of immunization is critical to success when acknowledging that some vaccines only produce short-term immunity. Knowledge of the when each pathogen induces abortion is helpful in planning when and how to immunize the cow herd. Most abortifacient agents induce early embryonic death (< 45 days of gestation) and/or mid-gestation (up to 180 days of gestation). With the exception of certain *Leptospira* strains and MLV BVDV and IBR immunization, most vaccines induce an immunity of approximately 6 months. Therefore, pre- breeding early pregnancy immunization (perhaps in concert with pregnancy diagnosis) is an optimum time to administer vaccines. General recommendations for specific pathogens and classes of cattle are provided below, but each herd should considered their own disease risk, disease prevalence, and logistics in order to expand these recommendations.

Cows and Bulls, 4 – 6 weeks prior to breeding

1. Viral respiratory vaccines including BVD 1 and 2, IBR, BRSV, and PI3. Killed vaccines would be employed here in the prime-boost model.
2. Bacterial reproductive vaccines including 5-way *Leptospira* and *Campylobacter (Vibrio) fetus.*
3. Clostridial vaccines also known as 7 – way or 8 – way blackleg vaccines.

Breeding age heifers, 4 – 6 weeks prior to breeding

1. Viral respiratory vaccines including BVD 1 and 2, IBR, BRSV, and PI3. Killed vaccines could be used here if there are concerns about MLV close to breeding.
2. Bacterial reproductive vaccines including 5-way *Leptospira* and *Campylobacter (Vibrio) fetus.*
3. Clostridial vaccines also known as 7 – way or 8 – way blackleg vaccines.

Pre-weaning and weaned heifers and bulls (3 – 6 months of age)

1. Viral respiratory vaccines including BVD 1 and 2, IBR, BRSV, and PI3. MLV are best used here to provide a durable foundation of immunity. MLV use in nursing calves should be considered safe for their well-immunized pregnant dams.
2. Clostridial vaccines also known as 7 – way or 8 – way blackleg vaccines.
3. Pinkeye vaccines in relationship to the high risk period of disease such as late spring and early summer.
   Ideal implementation is to immunize calves 3 – 4 weeks prior to weaning then booster immunize at weaning.

Neonatal calves

1. Intranasal respiratory vaccines can be used if disease prevalence is high in the age group. These have the advantage of avoiding maternal antibody interference.