COMBINING DIAGNOSTIC TESTING WITH ANIMAL HEALTH PREVENTION PROGRAMS

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ABSTRACT. Reproductive efficiency is the most important output parameter affecting the profitability of the beef cow/calf enterprise. While there are many reasons for suboptimal reproductive performance and calf survival, infectious disease is a major contributor and often plays a pivotal role. Utilizing diagnostic information on a routine basis, as well as in the face of an outbreak will allow practitioners and producers to better plan vaccination and biosecurity programs. The objective of this talk will be to outline how diagnostic information can be utilized to improve overall herd performance.

KEY WORDS: Bovine, Reproduction, Diagnostics, Gestational Losses, Vaccination

INTRODUCTION. Reproductive efficiency is the most important output parameter affecting the profitability of the beef cow/calf enterprise.[1] While there are many reasons for suboptimal reproductive performance and calf survival, infectious disease is a major contributor and often plays a pivotal role. Reproductive disease may manifest itself in a number of ways, depending on the pathogen involved. Early embryonic death, late-term abortion, “weak calf syndrome,” and delayed conception are all common clinical scenarios. However, the end result is that the operation will have fewer kilograms to market from weaned calves. It is critical that the veterinary practitioner be able to understand the relationship of these infectious agents with the risk of exposure, timing of gestational loss, herd diagnostic information, and herd productivity. Only then can comprehensive immunization programs be constructed for the entire operation that will minimize losses associated with reproductive pathogens.

USE OF DIAGNOSTIC TESTING. It is critical that diagnostic information be utilized in the construction of the herd health program. The selection of vaccines to be used in a program and an individual producer's cattle working schedules depends on the presence of a particular pathogen in the herd or geographical area and on the risk of introduction.[2,3] It is important to determine the category or period of reproductive loss since reproductive pathogens have a tendency to occur within specific stages of gestation. Classically these categories have been defined as early gestational, mid gestational, late gestational, and periparturient. Determining when gestational losses occur is the first step in understanding the etiology of these losses and represents the starting point for building the vaccination program.

Utilizing diagnostic tools in cases of abortion can be very helpful and can be very frustrating due to diagnostic limitations and challenges. In cases of abortion an etiologic diagnosis is identified less than 50% of the time.[3-5] However, several diagnostic advances, through conscious efforts by diagnostic laboratories, have been made to improve detection of certain pathogens. Even though an etiologic diagnosis can be challenging, infectious agents causing abortions can be identified. Some pathogens are considered common reproductive agents and some are rarely identified. In addition, certain pathogens can be more prevalent in certain geographical areas.[4]

Diagnostic laboratories have different capabilities in handling an abortion case. As a practitioner, it is prudent to have a close working relationship with your laboratory. Diagnostician consultations are sometimes necessary to develop a systematic approach for abortions. Appropriate tissues and bodily fluids samples are more useful than others and

comprehensive submissions are valuable. These factors may also change over time as diagnostic labs expand the tests offered and improve their capability to perform them.

Even as testing procedures have become more robust, adequate information concerning the history and timing of gestational losses is still the most important component of a diagnostic work up in a problem herd.[3,5] As abortion workups can be expensive and often fail to determine the cause of the gestation loss, it is imperative that the practitioner supply the diagnostician with as much useful information as possible. This will help to minimize the cost of the workup and increase the chance of a successful diagnosis. Even though infectious agents are most commonly associated with reports of gestational loss, there are other causes that may need to be considered.[7] Noninfectious causes, such as environment, toxins, nutrition, and genetics, have to be considered as possible sources of reproductive failures.

Serology is a common tool utilized in the diagnostic workup of gestational losses but these values should always be interpreted with caution.[3,5,6] Single serum samples submitted for titers have little value, especially in vaccinated herds. There is no way to differentiate exposure to an organism from a vaccine response. Paired serum samples have also demonstrated limited value. Many of the bacterial and viral pathogens that cause abortion may infect the fetus or placenta long before the abortive event occurs. This lag time between infection and abortion may prevent the practitioner from detecting the rising or falling titers associated with the initial infection. This leads to the collection of two “convalescent” serum samples that will fail to detect the increase in antibody titer, if it indeed occurred. This is especially true when only affected females are sampled at the time when the abortion is noted. Overall, the time of seroconversion is dependent on the exposure of the agent and the amount of immunity established prior to the

breeding and throughout gestation. Paired sera are much more useful when used as part of a complete diagnostic work-up that includes samples from the placenta, fetus, and fetal fluids.

Serologic profiling is one option to optimize the use of serologic testing. The basis of serologic profiling is analyzing titers from affected/aborted and nonaffected dams over the same time period.[5] It is unclear how many samples are needed, but some suggest that the same number of affected and nonaffected animals, preferably at same stage of gestation and age, is adequate.[6] In herds with chronic gestational losses serum may be collected and frozen from a statistically relevant number of cows for future testing as needed. These frozen samples may be collected as the females are processed prior to breeding and/or at the time of pregnancy examination. Then, as fetal loss is detected, banked serum samples can be submitted along with acute and convalescent samples to provide a clearer serologic picture of the affected animals and their normal cohorts. This should give a more complete picture of when seroconversion occurred and what pathogens were involved.

DIAGNOSTICS AND VACCINATION PROGRAMS. While vaccines represent an important tool in protecting reproductive performance, they tend to be somewhat underutilized in beef herds.[8] When designing protocols to immunize the beef breeding herd against reproductive pathogens, there are several other important factors to consider. The potential at-risk level of the herd should be considered not only from the entry of potential pathogens, but also from the standpoint of the current disease level in the resident herd, different management groups on the ranch, breeding animal movement, and the potential side effects of the immunizing agents.[2,3] While complete protection against every pathogen in every individual is not realistic, the goal would be to minimize the number of susceptible animals in the population. This should prevent

epidemic outbreaks of reproductive disease as well as the establishment of chronic endemic losses in the cow herd.

While veterinarians and producers often think of individual vaccination protocols for different management groups on the ranch, it is our belief that vaccination programs should be viewed as a continuum. For example, if producers are developing their own replacement heifers, the suckling calf vaccination program should be viewed beyond the summer grazing season and fall weaning events. This vaccination program should be constructed to take into account the probability that these young heifer calves will join the replacement pool, become pregnant, and eventually become a productive member of the mature herd. The suckling calf protocol should be designed to prepare the calf for post-weaning disease challenges and increase the calf's response to subsequent reproductive vaccination. Research has clearly shown that calves vaccinated at an early age will mount a cell-mediated immune response that will enhance the calf's ability to respond to subsequent vaccination or disease challenge.[9,10] This approach will maximize protection against reproductive pathogens and minimize the potential for any negative vaccine side effects associated with the pre-breeding vaccination of seronegative females. These side effects may include multifocal areas of ovarian necrosis, hemorrhage and inflammatory cell infiltrate in the ovary, as well as the development of cysts in the corpus luteum. These lesions are transitory in nature, but can result in decreased reproductive performance in the short term.

Other factors to consider in vaccine selection include fetal protection and duration of immunity. Recent advances in vaccine technology and diagnostic testing have allowed vaccine manufacturers to document the ability of their products to prevent disease organisms from spreading to the placenta and fetus following maternal infection. Challenge studies using virulent BVDV, infectious bovine rhinotracheitis (IBR), and *Leptospira borgpetersenii* (serovar *hardjo*)

have shown that fetal protection against pregnancy wastage, BVDV persistent infection (PI), and leptospiral renal colonization and urine shedding is possible following vaccination.[11-15] Studies have also shown that this protection can last for 1 year or longer following vaccination of animals of various ages.[11,13,16] The concepts of fetal protection and duration of immunity are especially important for beef operations as they are more likely to come in contact with adjacent herds and may only be handled for vaccination once per year.

Before constructing any vaccination program for a cow/ calf operation, the potential risk for exposure of the herd to a particular pathogen through herd additions or herd contact with clinical or inapparent carriers of a pathogen should be evaluated. The epidemiological terms "open," "closed," and "modified open" have been used to describe the potential risk level of a given herd.[2,3] When assessing the need for vaccination, factors such as risk-level management, the magnitude and etiology of previous reproductive losses, herd working patterns and animal management, and the producer's long-term goals should all be considered. Once this information is collected and evaluated, recommendations concerning the use of specific vaccine antigens, the type of vaccine needed, and the frequency of vaccination can be constructed to fit within the confines of the total ranch management plan.

SUMMARY. The process of designing immunization programs for beef cattle operations must take into consideration factors such as traffic patterns on and off the ranch, normal handling times, the pregnancy status of the animals to be vaccinated, historical disease patterns, and the relative risk of disease introduction. The goal of the immunization program should be to increase the level of collective herd immunity by minimizing the number of animals that are susceptible to reproductive disease. This will prevent not only epizootic outbreaks of pregnancy wastage, but should also control chronic endemic disease. Our ability to better understand the relationship

between reproductive pathogens and the bovine reproductive tract has enabled vaccine manufacturers to provide products that ensure fetal protection and a long duration of immunity, while minimizing negative vaccine side effects. The end result is that the practitioner can provide the client with cost-effective vaccine options to help insure optimum reproductive performance.

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