EBA Series

FOOTHILL ABORTION UPDATE: PART I: THE TICK

Foothill abortion in cattle, also known as Epizootic Bovine Abortion (EBA), is a condition well known to beef producers who have experienced losses due to this disease problem. It is a major source of economic loss for California cow/calf producers and estimates are that 5-10% of the California beef calf crop may be lost each year (45,000 to 90,000 calves per year). While the infectious agent that causes the abortion has yet to be isolated and identified, the most important vector is well known. That vector is the Pajaroello tick (pa-ha-WAY-lo).

The Pajaroello tick (Ornithodorus coriaceus) is a soft shelled tick, similar in appearance to the common ear tick of cattle. Pajaroello ticks are found in the soil around trees, in dry brush areas, and around rock outcroppings. These are also the areas that cattle and deer prefer as bedding sites. In fact, it is believed that deer may be the primary hosts and source of food for these ticks. The smallest forms of these ticks are the larval forms (the most immature). These larval forms will attach and feed for about 10-14 days. In this way, migrating deer could carry the larvae to other areas. By contrast, the nymph stage of the Pajaroello tick and the adult form of this tick attach and feed for only 10-20 minutes. These stages (adult and nymphs) are the larger stages and could be seen with the naked eye; however, since they feed for such a short period of time, they are never seen on the cattle. Because they spend such a small amount of time on the cattle, spray products effective against other external parasites are not effective in preventing the Pajaroello tick from feeding on cattle. Also, because these ticks tend to feed in bedding areas and may feed mainly on the posterior areas of cattle (hind legs, lower back), the ear tag insecticides do not seem to be a control method of value either. The Pajaroello ticks consume blood from deer, cattle, man, and other warm blooded animals that rest in these bedding areas. The Pajaroello ticks only need a blood meal every 2-3 months during their active season and some of our captive ticks can survive in the laboratory for three years between blood meals.

The activity of these ticks is dependent on temperature and rainfall. Peak feeding activity is during the hottest, driest months of the year and declines during the colder winter month, when soil temperatures are below 45E F. These ticks are not found in wet areas. The peak feeding periods in Northeastern California at elevations above 4,000 feet are usually in June, July, and August. In warmer areas of the state and at elevations from 500-2,500 feet, peak activity occurs from May to October. In general, the heaviest tick activity starts with the browning of the grass and ends with the first frost. Significant variations to this general trend can occur, such as during our recent drought years when tick activity was observed from February to November in some areas. Certainly, last year's heavy rains seemed to decrease or delay tick activity considerably in some areas. These environmental variations and their effects on tick activity are certainly part of the explanation for differences seen in the occurrence of Foothill abortion in cattle from one year to another.

Currently, we do not know how many (what percentage) of the Pajaroello ticks are infected with the agent that causes EBA. In experiments used to recreate the abortion disease, we commonly use 100 to 200 ticks to feed on a single susceptible, pregnant cow or heifer. Because of the aggressive feeding behavior of these ticks, it is thought that only a fraction of the ticks are actually capable of transmitting the EBA agent that causes abortion. Also, at this time we are not able to determine if a cow or heifer has been bitten by Pajaroello ticks and therefore, possibly been exposed to the EBA agent. Cattle exposed to the ticks, and the EBA agent they carry, develop an immunity that prevents abortion with subsequent exposure. This phenomenon is important in preventing EBA abortions. If cattle can be exposed to the feeding of the Pajaroello tick ***before*** becoming pregnant, then they seem to be protected from the risk of abortion. Therefore, in circumstances where a rancher knows of areas where ticks abound, it is common practice to place breeding age heifers in those areas to expose them to the ticks prior to breeding. EBA abortions seem to occur about 90 to 120 days after susceptible cattle that are ***less than six months pregnant*** are exposed to ticks for the first time. Therefore, one of the current control methods is to expose these sexually mature heifers to tick infested areas prior to breeding. In nature, EBA is closely tied to the presence and feeding activity of the Pajaroello tick. If you are concerned that your cattle are at risk of exposure to this tick, your veterinarian, livestock farm advisor, or those of us at the University of California-Davis can give you advice on collecting and identifying this tick. In next month's column the EBA discussion will be continued with the emphasis on the abortion disease as it occurs in the susceptible heifer or cow.

FOOTHILL ABORTION UPDATE: PART II: THE CAUSE

Foothill abortion in cattle, also known as Epizootic Bovine Abortion (EBA), has been experimentally reproduced in a consistent manner by allowing Pajaroello (pa-ha-WAY-lo) ticks to feed on susceptible, pregnant cattle. Last month's article detailed much of what we know about this tick, that is the vector of this abortion disease. At the present time, we think the Pajaroello ticks transmit some type of infectious microorganism and that the ticks are not the direct cause of the subsequent abortion disease. It is also likely that not all of the Pajaroello ticks carry and transmit the agent. Most of the experimental work at the University of California-Davis suggests that feeding 100-200 ticks on a single susceptible pregnant cow or heifer is necessary to cause abortion. An important unanswered question has been, "How many infected ticks are necessary to transmit enough of the responsible microorganism to cause abortion?"

Ticks are notorious for transmitting disease agents. A common example of this phenomenon in cattle is ***Anaplasma marginale***, the cause of anaplasmosis. The anaplasma organism can be transmitted by hard shell ticks such as *Dermacentor andersoni*. In humans and other mammals the agent of Lyme Disease is also transmitted by ticks. For this and other reasons, it has long been suspected that the cause of EBA is some sort of microorganism that is transmitted by the Pajaroello tick. The types of microorganisms suspected includes viruses, bacteria, and/or rickettsiae. There are many

examples in nature where ticks transmit these types of microorganisms to susceptible hosts.

Recently, it has been found that EBA can be experimentally reproduced **without** using Pajaroello ticks fed on susceptible pregnant cows or heifers. Work at the University of California-Davis' School of Veterinary Medicine and at the University of Nevada-Reno has shown that using tissue from a fetus that was aborted due to EBA could be used to cause abortion in another susceptible cow. Therefore, ticks were not necessary to reproduce EBA. This was an important step in showing that there is a microorganism involved in foothill abortion (EBA). The tissue from EBA fetuses that has proven to be the most consistent in reproducing EBA experimentally is the **thymus**. The thymus is located in the neck of cattle and is commonly called the sweetbreads. The thymus is one of the tissues most damaged in an EBA fetus; therefore, it is not surprising that the causative organism of EBA might be present in this tissue. The thymus has been used to successfully reproduce EBA in a series of experiments. Now the search can focus on finding the microorganism that causes EBA in the thymus and perhaps other organs related to the thymus.

The disease in cattle behaves very much as an infectious disease. Susceptible pregnant cows and/or heifers that are from 2 to 6 months pregnant are thought to be infected with the causative agent through the bite(s) of the Pajaroello tick(s). Because the fetus at this age of gestation (2-6 months) has not yet developed a functional immune system and the cow/heifer has not "seen" the agent before, it is thought that the agent gains access to the fetus, across the placenta, and initiates a chronic infection in the fetus. This chronic infection in the fetus results in death of the fetus and abortion about 90 to 120 days later. This results in abortion at about 6 to 9 months of gestation (third trimester abortions). If a fetus is infected at 7, 8, or 9 months of gestation, it is more likely to have developed a functional immune system and can either survive the infection or be born weak. Cows or heifers do not show signs of infection other than the loss of the fetus.

The appearance of an EBA fetus tends to be quite characteristic. The fetus has a fluid filled abdomen and a "pot-bellied" appearance. There are often tiny, red hemorrhages around the eyes, nose, and mouth. The lymph nodes are enlarged, especially easy to see is the prescapular lymph node under the skin and just in front of the shoulder blade. The EBA fetuses usually have a fresh appearance. Your veterinarian can perform a post mortem examination and send samples to the California Veterinary Diagnostic Laboratory System to confirm the diagnosis. Occasionally, weak calves will be born due to infection with the EBA agent. With both abortions and weak calves, you should seek to have your veterinarian make sure of the diagnosis as a number of other conditions can result in the same problems.

If cows or heifers are exposed to the ticks and the EBA agent they carry, the cattle tend to develop immunity and are not susceptible to abortion for a considerable period of time. This occurs in the natural setting when a cow or heifer aborts or when they are exposed before becoming pregnant. This phenomenon is important in preventing EBA abortions. Next month we will discuss the methods currently known to prevent or

minimize losses due to foothill abortion. Meanwhile, the search to identify and isolate the microorganism that apparently causes EBA goes on and that search has narrowed on the thymus and other tissues of the EBA fetus.

FOOTHILL ABORTION UPDATE: PART III: PREVENTION

The last two columns have discussed the tick that transmits Foothill Abortion (EBA) and the evidence that there is a microorganism (virus, bacteria, or rickettsia) that causes the death of the fetus and the subsequent abortion. While the search for the agent goes on, there are a number of steps that can be taken to help minimize losses. The only known way that cattle develop immunity to the disease is by exposure to the agent through the bite of the Pajaroello tick. Also, cattle do not seem to develop an immune response to the agent until they are sexually mature, which for English breeds is 10 to 12 months of age and for Zebu breeds is about 12 to 14 months of age. The length of time cows and heifers are immune after exposure is not known. It is probable that the cows' immune response is boosted from time to time by re-exposure to feeding ticks. So that once the cattle become immune, the periodic re-exposure aids in maintaining immunity. Some observations indicate that cattle may need to be re-exposed on an annual or every other year basis to provide the best protection.

At least three groups of cattle seem to have immunity to EBA and can be classified as follows:

1. Open heifers, that are sexually mature (10 months of age or older, depending on breed, feed, and individual maturity), and mature open cows which have been bitten by EBA carrier ticks **prior** to the breeding season.

2. Cows which have either aborted due to EBA or given birth to weak EBA calves.

3. Cattle bitten by EBA infected ticks after 6 months of pregnancy. In this case it seems that the fetus can respond to the EBA agent and is born normal and healthy.

Pregnant cows and heifers without pre-exposure to EBA are most susceptible and abortion storms can cause losses of 50%, or more, of the expected calf crop. Susceptible cattle are common in the following circumstances:

1. Pregnant heifers in a tick infested area. In areas with low tick exposure, some females may not be bitten until they are four or five years of age.

2. Pregnant females brought into a high risk area from a tick free area or from outside the state.

3. EBA "immune" cows from tick infested areas may lose their protection if removed from tick re-exposure for two or more years.

Possible circumstances for EBA abortion outbreaks include the following:

1. A warm period of weather (instead of the usual cold or wet period) during the second trimester of pregnancy, causing pregnant animals to be exposed to the ticks.

2. Brush burned over areas (within the last few years) may have opened up tick areas in pastures and ranges where cattle have not usually been grazing, exposing them to increased tick activity.

3. Drought conditions may force cattle to graze higher, more remote pastures where the tick density may be greater.

4. When increasing herd size, the grazing pressure may open up new areas that may have more ticks. Also, when repopulating cow herds or adding pregnant cows or heifers from other areas it is important to consider the risk of EBA to these animals.

Based on our understanding of EBA, there are a number of management strategies that can help control, or minimize, the losses due to EBA. One of the important items is to learn which pasture and/or range areas have the greatest number of ticks and therefore, the greatest risk of exposure to EBA. Your University of California Livestock Advisor and/or your veterinarian can be very helpful in this respect. Those pastures that most likely have Pajaroello ticks are those where dry bedding areas are frequented by both deer and cattle. These areas include oak, pine or juniper tree areas and high brush or rock outcroppings where cattle and deer prefer to bed. Wet areas or irrigated pastures are usually free of the Pajaroello ticks. Bedding areas can be examined for the presence of these ticks by using dry ice (carbon dioxide) traps to attract the ticks so they can be identified. The ticks are attracted to the carbon dioxide from the dry ice as they would be attracted to a large mammal. These areas can easily be identified with a little help. Once these areas are identified, they can be included in the management plan.

1. Expose heifers that have reached puberty to active tick areas **before** breeding. Heifers born in the spring can be bred as fall calving replacements and heifers born in the fall can be bred for spring calving replacements. This will allow for pre-breeding exposure.

2. Breed susceptible heifers as yearlings and turn them into tick areas **after** six months of pregnancy.

3. Alter the breeding season to prevent tick exposure of pregnant cattle **before** they are six months in gestation. Examples of this would be to place pregnant cattle on irrigated pastures until after they are pregnant at least six months. Another example would be to change from spring calving to fall calving.

4. Run stocker cattle or bulls in EBA areas.

5. Keep cows or heifers that have had EBA abortions. They should be immune for the next season or two at least.

6. Buy replacements from areas known to have high tick exposure or EBA.

7. Manage tick infested pastures to more efficiently expose cows or heifers or to prevent exposure. Place pregnant females on irrigated pastures or open valleys where tick exposure is minimal.

Unfortunately, periods of drought and heavy rainfall years can both modify the tick activity patterns greatly. While these management methods are far from perfect, knowledge of tick exposure and subsequent risk of EBA should help to minimize losses. Until a more predictable means of prevention is developed, we will have to use the above concepts to try and control this costly condition.

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