



Brucella Abortus Disease (Brucellosis) in Beef Cattle¹

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Background

Brucellosis is an infectious and contagious bacterial disease of animals and humans caused by *Brucella abortus*. The disease primarily affects cattle and the American buffalo. Brucellosis sometimes infects horses, dogs, swine, and humans; however, brucellosis is considered to be a "dead-end disease" in these species, meaning it will not be transmitted to other animals. In the United States, the disease has been a major economic problem for the beef and dairy industries, their consumers and related agricultural industries. Brucellosis once affected more than 10 percent of the cattle population and perhaps as many as 30 percent of the cattle herds in the U.S. Annual production losses to United States dairy producers alone were estimated at \$499 million annually in 1951 (1993 dollars) before an eradication program began. After investing over \$3.5 billion in state, federal, and industry funds since 1951 in joint state-federal cooperative eradication programs the U.S. has reduced the brucellosis-infected herd count from 124,000 in 1957 to 40 as of November 30, 1996. If there were not a brucellosis eradication program, it is estimated that current losses due to reduced

supplies of meat and milk would be in excess of \$800 million annually.

Brucellosis Infection

In Cattle

In cattle, brucellosis is primarily a disease of the female, the cow. Bulls can be infected but they do not readily spread the disease. The brucellosis organism localizes in the testicles of the bull and produces an orchitis (inflammation of the testicles), whereas in the female the organism localizes in the udder, uterus, and lymph nodes adjacent to the uterus. The infected cows exhibit symptoms which may include abortion during the last third of pregnancy, retained afterbirth, and weak calves at birth. Infected cows usually abort only once. Subsequent calves may be born weak or healthy and normal. Some infected cows will not exhibit any clinical symptoms of the disease and give birth to normal calves. The brucellosis organism is shed by the millions in the afterbirth and fluids associated with calving and aborting. The disease is spread when cattle ingest contaminated forages or lick calves or aborted fetuses from infected cattle. Outside the animal, the afterbirth, and aborted calves the brucella bacteria are

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easily killed by sunlight, high temperatures and drying; however, the brucella organisms are difficult to control while they are in the animal; there is no economical cure for a brucellosis infected animal.

In Humans

In humans, *Brucella abortus* causes undulant fever, a disease characterized by intermittent fever, headaches, fatigue, joint and bone pain, psychotic disturbances, and other symptoms. It is contracted through exposure to *Brucella abortus*-contaminated milk and infected organs from infected animals. Livestock and slaughter industry workers, and consumers of unpasteurized milk and other dairy products made from unpasteurized milk are at the greatest risk of contacting undulant fever. Transmission occurs through contact with the tissues of infected animals at slaughter or ingestion of unpasteurized milk derived from infected cattle. (Note: Currently only one dairy herd in the US is known to be infected with brucellosis).

Control and Eradication

The brucellosis control and eradication program has been and continues to be multi-faceted; the program uses surveillance testing at the farm, at the stock markets, and at slaughter facilities; quarantine and herd depopulation with indemnity payments; herd management; and vaccination. Any bovine that is known to be infected with the field strain of *Brucella abortus* is required to be placed under quarantine until slaughtered.

Surveillance Testing

Surveillance testing consists of conducting a serological test or a series of serological tests to detect the presence of *Brucella abortus* antibodies in the animal. Animals that test negative to the initial official screening test are classified as "negative" and are considered NOT to be infected with brucellosis. Animals which are positive on the initial screening test are classified as "positive," and further testing is required to assist in a more definitive diagnosis of brucellosis. Serological screening tests for *Brucella abortus* antibodies include the Buffered Acidified Plate Antigen (BAPA) test, which is used solely in the laboratory, and the "Card Agglutination" test

which is an official test conducted at the livestock markets or in the laboratory to classify animals as either positive or negative. Samples which test positive on the BAPA test are subsequently subjected to the "Card Agglutination" test in the laboratory. Screen testpositive samples could come from either an animal infected with field *Brucella abortus* organisms or from an animal that has persistent antibodies to a brucellosis vaccination.

To determine if a screen-test positive animal is either infected with the disease or if it still has antibodies that were caused by vaccination, its blood samples are subjected to official supplemental serological testing. The Rivanol, the Complement Fixation (CF) and the Particle Concentration Fluorescent Immuno Assay (PCFIA) tests are official supplemental serological tests used in the laboratory. The results of the official supplemental testing are subsequently interpreted by a trained brucellosis epidemiologist who makes the final determination on the screen-positive animal; it is either designated as "suspect" and will require further testing, or it is classified as a "reactor" and must be sent to slaughter under permit.

Suspects, if they have not been slaughtered, are required to be re-tested in 30 to 60 days. Quarantining the suspect animal or the herd from which the suspect originated will be determined by the trained epidemiologist.

Reactors, those animals at highest risk of being infected with field strain brucellosis, are required to be appropriately tagged and branded within 15 days of the owner receiving official notification of the reactor status. The herd from which the reactor originated is placed under immediate quarantine. All reactors are "B" branded on the left tail-head; the reactor animal(s) must be slaughtered at an approved slaughter facility within 15 days of tagging or branding.

Quarantine

When a herd has been officially quarantined because of brucellosis, any movement of non-neutered cattle into and out of the herd is restricted (neutered animals are steers and spayed heifers). Movement of non-neutered cattle out of

quarantined herds is allowed to approved destinations only and only with a written permit (USDA Form VS-127) obtained from state or federal animal health personnel or a veterinarian accredited by USDA. Brands are required on all non-neutered quarantined animals prior to movement; Reactors are "B" branded on the left tail-head and all exposed or known suspect cattle are "S" branded on the left tail-head. Approved destinations include quarantined pastures, quarantined feedlots and approved slaughter facilities.

Release from Quarantine

Herds that are classified as "Quarantined Reactor Herds" and are subsequently found NOT to be infected with field strain *Brucella abortus* are released from quarantine without any further restrictions.

Quarantined infected herds can be released following a minimum of two negative whole-herd tests. One additional negative whole-herd test is required following quarantine release for the herd to remain released from quarantine. A whole-herd test must include all animals in the herd over 6 months of age *except* steers, spayed heifers, brucellosis-vaccinated heifers less than 24 months of age, and bull calves less than 18 months of age.

The first negative whole-herd test must be conducted no less than 30 days following removal of the last reactor cattle from the herd and the second negative whole-herd test must be conducted no less than 180 days following the removal of the last reactor animal from the herd. For the herd to remain released from quarantine, a post-quarantine whole-herd test must be conducted no less than 6 months following release of the herd from quarantine. Failure to conduct the post-quarantine whole-herd test can result in the herd being placed back under quarantine until the required testing is completed.

Herd Depopulation

Quarantined herds that are determined to be infected with field strain *Brucella abortus* will remain under quarantine. A quarantined herd may be considered for depopulation if the owner agrees and the herd is approved for depopulation by state and

federal authorities. If an infected herd is selected to be depopulated, all non-neutered cattle will be slaughtered and the owner will receive an indemnity for each animal included in the depopulation. Neutered cattle (steers and spayed heifers) may be allowed to remain on the premises for additional growth before marketing; however, spayed heifers will be required to be appropriately branded with an official "spay" brand.

Herd Management

Cattle herds in states or areas that are not free of brucellosis are at risk of contracting the disease. Factors that increase a herd's risk of being infected with brucellosis in endemic areas are listed as follows:

Replacement cattle. Purchasing replacement cattle is a common method of herd-to-herd transmission of brucellosis. The more replacement animals a herd owner purchases, the higher the risk of contracting brucellosis.

Source of additions. The source of purchased herd additions also affects an owner's risk of purchasing brucellosis-infected cattle.

- Buying replacement cattle from special auction sales, herd dispersal sales and/or consignment sales does not appear to significantly increase a herd's risk of contracting brucellosis.
- Purchasing cattle from private treaty sales and livestock dealers/order buyers increases the risk of buying brucellosis infected cattle. Cattle moving through these marketing channels often bypass change of ownership testing prior to the sale. In addition, some owners may be selling their cattle by these methods in order to avoid their cattle being tested and the potential that their herd may be placed under quarantine.
- Herds consisting of replacements bought from regular auction sales have a higher risk of contracting brucellosis. Some cattle moving through these sales can test negative but be in the incubation stage of the disease. During the incubation stage of the disease, the animal is infected but as yet has not developed clinical

signs of brucellosis nor has it had sufficient time to produce antibodies against the organism; hence the test is negative. More likely, however, brucellosis-infected cattle that are marketed through these sales are untested (but infected) brucellosis-vaccinated heifers that are considered "too young to test." In this way, infected heifers may move to other farms without a test, spreading brucellosis in the process.

Distance between herds. The distance between your herd and a brucellosis-infected herd affects the risk of contacting brucellosis. Herds located less than half a mile away from brucellosis-infected herds are more than four times as likely to become infected than other herds. Herds one half mile to one mile away are still at risk of brucellosis spreading through the cattle community. However, the spread of the disease into a herd is much less likely to occur when the herd is located over one mile from the brucellosis-infected herd. **Stray cattle.** Herds reporting stray cattle are more than twice as likely to have brucellosis than herds not reporting stray cattle intrusion into the herd.

Contact with animals. In areas where brucellosis exists, herds that have contact with foxes, stray dogs, and coyotes are at higher risk of contacting brucellosis. Domestic and wild canids can spread brucellosis by dragging dead/aborted calves and afterbirth (placenta) between neighboring herds. Coyotes have been shown to shed the brucellosis organism in their feces for several weeks following ingestion of infected material.

Multiple herds. Ownership of multiple herds potentially increases the risk of a herd being infected with brucellosis. The more herds a rancher owns, the higher their probability of being exposed to brucellosis becomes.

Culling practices. Culling practices are important factors when considering a herd's risk of having brucellosis. Owners of small cattle herds continue to cull less than 10 percent of their herd each year. In general, it requires 3-5 years (or longer) to detect an infected cow through livestock marketing or slaughter testing if the owners cull less than 10 percent of their cow herd each year. If the industry

solely relies upon market and slaughter testing to detect brucellosis-infected herds, many small brucellosis-infected herds will remain undetected just because of the culling practices used on the herd.

Vaccination of Female Cattle against Brucellosis

Strain-19 Vaccine

Until recently, "Strain-19 vaccine" was the only brucellosis vaccine used in the brucellosis control programs for cattle in the United States. Strain-19 vaccine was and still is an effective tool in brucellosis control. However, as with any tool, using Strain-19 vaccine has its advantages and disadvantages. Strain-19 is a live vaccine that stimulates the immune system of the vaccinated animal to resist a brucellosis disease challenge, produce antibodies against the disease organisms, and kill off the vaccine organisms. Normally, a vaccinated animal will retain the resistance to disease for an extended period of time (years) but the detectable antibodies will disappear in a few months.

Unfortunately, the serological tests used to detect brucellosis-infected cattle cannot differentiate between antibodies produced against the Strain-19 Vaccine and antibodies produced against the brucellosis disease organism; hence, if a vaccinated animal is tested too soon following vaccination or if the vaccinated animal retains the antibodies stimulated against the vaccine for an extended period, the vaccinated animal would test positive. In addition, some animals vaccinated with Strain-19 vaccine (such as those whose uteruses and/or mammary glands have begun to develop) will become permanently infected with the vaccine organism, constantly producing antibodies against it and thus continuing to test positive. If an animal is vaccinated with Strain-19 Vaccine after the animal's the animal is prone to become permanently infected with the live vaccine organism; hence the animal will continue to be stimulated to produce antibodies against the vaccine.

Calves born to Strain-19-vaccinated cows will acquire anti-brucellosis antibodies from the cow through the colostrum (first-milk) immediately after birth. These acquired antibodies will normally be

circulating in the calves' blood system for 4-6 months, and can neutralize or kill the live vaccine organisms if the calf is vaccinated during the time it still possess the antibodies. Hence, it is required that no heifer calf be vaccinated before 4 months of age. Because some calves mature early and become permanently infected with the live vaccine organism and because older calves can produce excessive antibodies when vaccinated, heifer calves should be vaccinated before they are 10 months of age. The routine vaccination of cattle/herds against brucellosis is restricted to heifers between the ages of 4-10 months of age.

RB-51

In 1996, the USDA officially recognized and began using a new brucellosis vaccine for vaccinating cattle against the disease. Like Strain-19, the new vaccine, "RB-51," is a live vaccine derived from the cattle brucellosis bacteria, *Brucella abortus*. Unlike Strain-19; however, RB-51 vaccine does not stimulate antibodies that are detected by the standard brucellosis serological tests. Thus the problem of having some brucellosis-vaccinated cattle testing positive has been alleviated. As with Strain-19, the new RB-51 vaccine is to be administered only by state and federal brucellosis program personnel and USDA accredited veterinarians. The vaccination age of heifers is between 4-10 months of age and proper permanent identification is required of all vaccinated cattle. Permanent identification consists of applying an official USDA brucellosis eartag and official ear tattoo to each vaccinated animal.

Who Should Vaccinate?

Cattle owners have inquired about the feasibility of continuing to brucellosis vaccinate heifers. The answer is not a simple one; it has to be the decision of the herd owner. But the herd owners must realize that brucellosis has not been eradicated from the U.S. and if their herd is located in an area of brucellosis infection, then *vaccinate*. If their herd is at risk of contacting brucellosis (described above) then *vaccinate*. If they are selling replacement heifers and their clients will only purchase vaccinated heifers, then *vaccinate*.

Routine Herd Testing

If a herd has had at least two consecutive negative whole herd blood test between 10 and 14 months apart, the herd is eligible for "certification." Certification is not automatic; it requires, in addition to the negative tests, that the herd owner APPLY for the "Brucellosis Certified Free" status at their respective State Veterinarian's Office. Once certified, a herd must have an annual negative whole-herd test between 10 and 14 months after the certification anniversary date to be eligible for re-certification. Herd owners also frequently ask if they should continue to test their herds annually to retain a "Brucellosis Certified Free Herd" status. Basically, it is an economic decision depending upon the type of operation and the location of the herd(s). If the cattle operation is selling breeding stock or replacement heifers throughout the year, a certified herd keeps them ready to sell at any time without any additional brucellosis test requirements. In addition, the certified status provides the buyers with some degree of confidence that they are not "buying" brucellosis. If the herd is located in an area where brucellosis- infected herds exist, an annual test will allow the owner to detect infection faster than waiting for a market/slaughter test to find it. Whole-herd testing every 10 to 14 months provides an excellent monitoring tool to insure that brucellosis has not been introduced into a brucellosis-free herd. In reality, the owner should consider having a "Brucellosis Certified Free" status a bonus from using an important disease-monitoring tool.

Brucellosis in the U.S.

As of December 1, 1996, there are 37 brucellosis- free states and 14 Class A states in the U.S. The brucellosis Class Free classification is based on a state carrying out all requirements of the state-federal cooperative eradication program and finding no cases of brucellosis in cattle or bison during a 12-month period. To be eligible for Class A status, a state must have a herd infection rate of less than 2.5 herds per 1000 for a 12-month period (0.25%). Several of the current Class A states have not detected a brucellosis- infected herd during the last year and are on the 12-month count-down to Class Free. However, experience indicates that if a

state has no infected herds for six years, it has eradicated the disease and no more brucellosis remains in the cattle population waiting to cause a problem; many states fall within this category. All-in-all, the brucellosis eradication program has made major advances in controlling this disease; however, if you maintain cattle in areas that are still at risk, please consult your private veterinary practitioner to discuss whole-herd testing of your cattle and whether brucellosis vaccination of heifers should be continued as a part of your herd health program.