



Brucellosis

A dairy farmer's guide

Compiled by
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On behalf of Milk SA



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Picture: Eric Miller

Brucellosis is highly contagious and occurs in all nine provinces of South Africa. The main source of infection is cattle. The main route of infection in humans is through the consumption of unpasteurised milk. Although the primary symptom noticed in dairy herds is abortion, brucellosis is NOT a venereal disease. Brucellosis is primarily transmitted through ingestion of the organism (oral route).

How humans become infected

- The most common route of infection is through drinking raw milk from infected animals. Do not let your family, your personnel or any calves consume unpasteurised milk, if you have a herd that has tested positive for *Brucella*. Milk that has been boiled or pasteurised is safe to consume.
- Eating cheese (within three months), yoghurt or ice cream made from raw milk.
- It can be transmitted by eating undercooked or raw meat from infected animals.
- If infected material splashes into the eye or mouth it can infect through the mucous membranes. Take proper protective precautions when slaughtering any animal that has tested positive (wear the correct personal protective equipment [PPE], including shoulder-length disposable plastic gloves, waterproof aprons, gumboots as well as approved surgical masks and goggles.).

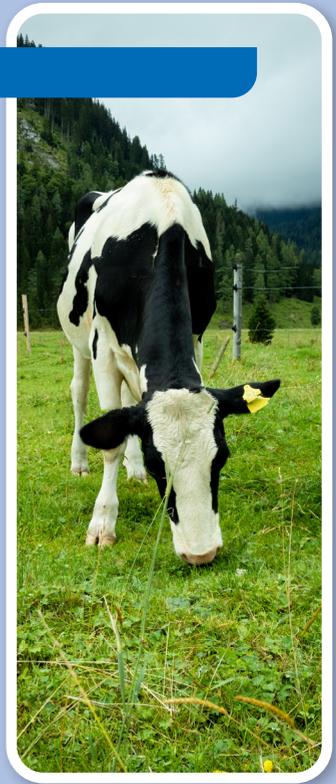


Picture: Manjurul, Getty Images

- If the organism becomes aerosolised, it can be inhaled and infect through the mucous membranes of the lungs. As few as 10 – 100 organisms may infect a person if aerosolised.
- It can cause infection if a person has a cut or sore that comes into contact with infected material such as aborted foetus, afterbirth, infected blood and body fluids. This is a risk especially when assisting an infected cow during calving.
- The S19 and RB51 vaccines are live vaccines that can infect a person if they accidentally stab themselves with the needle when vaccinating animals. Another route of infection would be if the needle comes loose when vaccinating animals and droplets of vaccine end up in the eye or mouth of the operator as a result of blow-back. Wear protective clothing such as masks, goggles and gloves when vaccinating cattle.
- Brucellosis is not normally transmitted from one person to another.

How cows become infected

- The majority of cows are infected by ingesting the organisms. This happens when they lick or eat the abortions or afterbirth of infected animals.
- When a cow calves or aborts, she secretes massive numbers of organisms that contaminate the environment. Do not let cows lick or graze the part of pastures infected with birth fluids and materials.
- Cows licking or smelling the vaginal discharge from an infected animal after she has aborted or calved.
- Calves drinking milk from infected dams will become infected.
- Cows can transmit the organism to the unborn calf in the uterus and the calf will be born infected.
- Flies can transmit the organism if they fed on infected material and then come into contact with the cow's mucous membranes in the eyes or mouth.
- It is possible to transmit infection with artificial insemination if using infected semen. However, sexual transmission by infected bulls is rare.

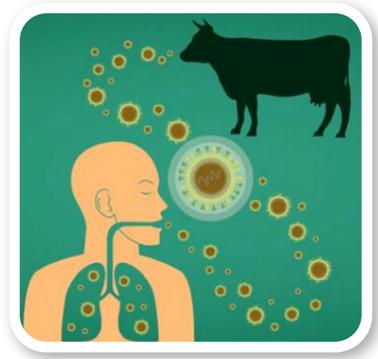


Why all the fuss about Brucellosis?

Brucellosis in humans

Brucellosis is a zoonotic bacterial disease of cattle, goats, sheep, dogs and various other species and is transmissible to humans. In dairy cattle the causative organism is *Brucella abortus*. Goats and sheep are mainly infected by *Brucella melitensis*. Both are transmissible to humans. Once a human has become infected, the incubation period to show symptoms is anywhere from one week to two months, but usually two to four weeks. Symptoms are non-specific and similar to flu and include:

- Fever
- Chills
- Headache
- Sweats
- Fatigue
- Loss of Appetite
- Joint and muscle aches
- Occasionally diarrhoea



Picture: Webconsultas.com

In uncomplicated cases, patients may recover within two to three weeks, even without treatment. In some cases, symptoms may disappear for weeks or months and then re-appear. If the disease becomes chronic, people can remain infected for life and experience recurrent bouts of illness. Symptoms depend on which organs the organism affects. In some cases, it can lead to complications that include:

- Arthritis – joint pain and inflammation;
- Spondylitis – Inflammation and arthritis of the spinal bones;
- Sacroiliitis – Arthritis where the spine connects to the pelvis;
- Endocarditis - Inflammation of the inner lining of the heart;
- Epididymo-orchitis – Inflammation and infection of the testicles;
- Encephalitis/Meningitis – Infection and inflammation of the brain and /or spinal cord; and
- In rare instances brucellosis can lead to death.

Brucellosis can be difficult to diagnose and treat. Generally, treatment involves courses of two or three different antibiotics that have to be taken simultaneously for up to six weeks. Even then, treatment is not always effective and may have to be repeated intermittently.



Brucellosis in dairy cattle

Brucellosis is usually contracted per mouth by cows ingesting the organism. The disease is most commonly spread between herds by the movement of infected animals - and between animals - by contact of susceptible animals with discharges at the time of calving or abortion of infected animals, and for up to one month thereafter. Other less common means of spread can occur, as mentioned above. Infected cows and heifers often remain permanent carriers of the bacteria and contamination of the environment takes place with huge numbers of organisms when they calve or abort. Abortion is frequently the only symptom farmers observe. During acute outbreaks of brucellosis in susceptible herds (that have not been exposed to the disease or have not been vaccinated), 30 to 40% of pregnant animals may abort during an abortion storm. Abortions usually occur from five months' pregnancy to full term. Once brucellosis is established in a herd and has become chronic, the incidence of abortion usually decreases, until it is only seen in replacement stock. A female animal usually only aborts once, but she remains a constant source of infection in discharges when coming on heat or calving. Hygromas (fluid accumulation in the knee joint) may occur in some cases.

Production losses occur due to:

- Reduced conception as a result of uterine inflammation.
- Reduced calving rate as a result of abortion.
- Extended inter-calving period as a result of resorption of foetus, abortions and poor fertility.
- Reduced milk production since the organism lodges in the mammary tissue.
- Infected bulls can develop orchitis/epididymitis (inflammation and infection of the testicles and epididymis) and become infertile.
- Calving and abortions from infected cows will contaminate the environment with millions of Brucella bacteria, exposing more animals to the disease.

How *Brucella* spreads from one farm to another

- The most common way for *Brucella* to spread from one farm to another is by the movement of infected animals from one farm to another.
- The most important mode of transmission is when an infected animal calves normally or has an abortion, as this process releases millions of bacteria into the environment that can easily infect other animals.
- Cattle normally become infected by eating contaminated fodder, drinking contaminated water, or licking the afterbirth or vaginal mucous secretion of an infected cow that has aborted or calved.
- Keep cows that have tested positive separate from the other cattle and slaughter them as soon as possible. When a cow calves or aborts, she secretes large numbers of organisms that infect the environment. Clean and disinfect these areas if possible and keep other animals away from these areas.
- Since *Brucella* needs cool moist areas to survive, lush vegetation in wet and muddy calving camps play an important role in the transmission of *Brucella*.
- Heifers that were born from infected cows often test negative before they have calved and only test positive after their first calf is born. Newly bought-in heifers pose a high risk and should ideally be kept separate from the rest of the herd until they have calved and have tested negative for brucellosis.
- Predators and scavengers, such as roaming dogs, jackals, seagulls and crows may carry infected material (aborted foetus and afterbirths) between farms. Ensure that all aborted material is disposed of properly by burning or burying. Do not leave any material lying around.
- Flies that feed on infected material may spread the bacteria mechanically after feeding on infected material and then sitting on the mucous membranes of animals.

Keep your herd clean and Vaccinate!

- The only person who can protect your cattle herd against brucellosis is YOU!
- When you are buying cattle, insist on proof of vaccination records and recent negative herd tests of the farm of origin.
- For biosecurity reasons, it is always advisable to isolate any cattle bought into the herd. Keep them isolated until test results return before introducing them to your herd.
- All heifers between four and eight months of age must be vaccinated once with an effective vaccine for brucellosis (currently the only approved vaccines available are Strain 19 and RB51). Strain 19 may only be used in heifers between four and eight months of age and may not be repeated. Follow-up vaccinations with RB51 in female animals may be done, but only with the

written permission of the responsible state veterinarian.

- No bulls may be vaccinated, regardless of their age, since the vaccine will cause sterility in male animals.
- If all cattle have been removed from a farm for one month and all facilities have been disinfected, no further infection will usually occur.



Picture: SA Veterinary Association

It is a herd disease!

- Animals that become infected may take up to three years to react to tests, but will remain a danger to cattle and people on the farm.
- If one animal in your herd tests positive for brucellosis, the whole herd is considered infected and can be placed under quarantine. This is due to the chronic (long-term) nature of the disease and slow onset of symptoms caused by *Brucella*.
- Animals that tested negative at first, will often test positive on another round of tests.
- There is no cure, and all cases must be reported to State Veterinary Services, as this is a controlled disease.
- It affects your pocket! Be careful – don't ruin your farm and your future.

What happens if your herd tests positive for brucellosis?

Your responsibilities

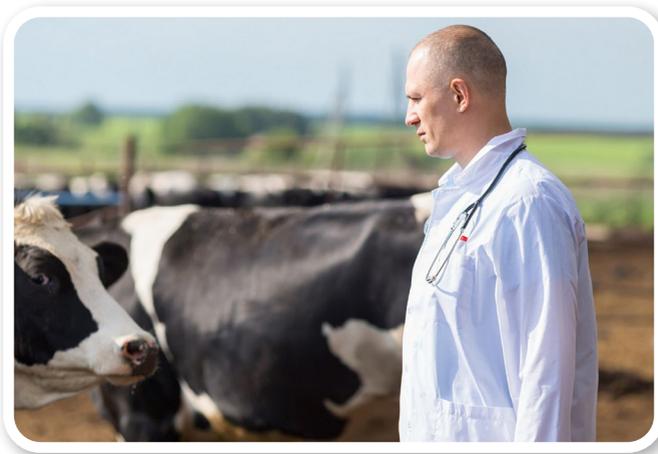
- It is important to understand that brucellosis is a herd disease. If one animal tests positive, then the WHOLE HERD is classified as positive and quarantined.
- Even if the other animals within the herd test negative, they must be treated as suspect since they can carry the organism for quite some time before their test results become positive.
- Animals that test negative on the first test can often test positive on the next round of tests.
- *Section 11 of the Animal Diseases Act, No. 35 of 1984* determines that livestock owners must take reasonable steps to prevent their animals from becoming infected and to prevent the spread of disease.
 - An owner is not allowed to knowingly buy infected animals and bring them into his herd.
 - An owner who becomes aware of the presence of a controlled disease (such as brucellosis) in his livestock, must inform the following groups of people:
 - ♦ All his neighbours;
 - ♦ All prospective buyers; and
 - ♦ All buyers who had bought animals from him within the preceding 30 days.
 - ♦ ***This is the case even if the disease has not yet been confirmed, but is suspected.***

Identifying positive animals

- A negative result immediately after abortion may be a false negative as the immune system may not yet have developed antibodies, so a repeat serological test after at least a two-week period will give a more informed result.
- Most infected animals become serologically 'positive' soon after infection, but some may not sero-convert until after the first abortion or calving post-infection.
- Latent infection refers to heifer calves that are infected with brucellosis but do not react to serological tests. They are extremely dangerous in transmitting infection as - although they are carriers of the disease - they do not show that they are infected on serological tests.
- Testing individual animals is meaningless without the herd's status being known. Due to the long incubation period of brucellosis, an animal could be carrying the organism and still test negative. It is advisable to quarantine any new animals for at least 30 days and retest them before allowing them into the herd.
- If animals older than eight months old are vaccinated with the S19 vaccine, they may produce antibodies that are picked up by the serological tests and hence show false positive results on the screening tests. Therefore, female animals should only be vaccinated with S19 vaccine when they are between four and eight months old.

Testing

- Blood samples must be collected by a veterinarian or a registered, authorised technician in vacuum tubes that are properly marked with the animal's identification number.
- The samples for testing may only be sent to a SANAS (South African National Accreditation System) accredited laboratory approved by DALRRD .
- Whole herds are screened for brucellosis by using the Milk Ring Test (in dairy herds) or drawing blood for the Rose Bengal Test on serum. All animals in the herd must be tested, including bulls.
- If any of the tests show a positive result, those animals that tested positive will be re-tested using a complement fixation test to confirm the diagnosis.



Picture: Animalwised

State Veterinarian's role

The test results will be sent to the state veterinarian as well as the veterinarian that collected the blood samples. If there are any positive cases, the state veterinarian will place the whole farm under quarantine. Infected animals must be isolated and kept separate from the herd. The animals that tested positive will be branded with a C on the right-hand side of the neck. Such animals may only be slaughtered with the written permission of the state veterinarian and at an approved abattoir. Animals may only be moved to the abattoir under cover of a Red Cross permit and may only be moved to the specific abattoir indicated on the permit. Under no circumstances may such animals be sold to any other person or at any other place.

An owner must minimise contact with animals in isolation and only allow persons responsible for the care of the animals and officials responsible for implementing the control measures, to have access to them. Milk from cows that are infected or suspected to be infected with brucellosis, may not be used for any purpose unless it has been boiled, pasteurised or sterilised. The owner also has a duty to disinfect the area where the infected animals had been kept with an effective disinfectant and this includes the vehicles on which such animals were transported. Any equipment that has been potentially infected must also be disinfected in the prescribed manner. Where any control measures have been performed on the animals, the owner must keep the proof thereof. This includes proof of vaccinations. Where the control measures have been carried out by an official or private veterinarian, the owner should request a certificate which contains the details of such measures. If an owner had performed some of the measures personally, proof can be provided by way of an affidavit accompanied by empty containers and proof of purchase where relevant.

There is no treatment for brucellosis in cattle. The only way to eliminate the disease is by testing and slaughtering all positive animals. Calves (heifers and bull-calves) born from cows that are positive, also need to be slaughtered since they can carry the organism and will not test positive until they reach breeding age.

A herd is only deemed brucellosis free after two negative tests of the whole herd at least three months apart. Keep in mind that the organism can survive in the environment, under ideal conditions, for up to 12 months. It is therefore prudent to wait for a herd to test negative for up to 12 months before considering that the disease has been eliminated from a particular farm.

Eradication can only be achieved by test-and-slaughter combined with effective prevention measures and control of animal movements.



Picture: unsplash

How to diagnose bovine brucellosis

Due to the non-specific symptoms of brucellosis, it can be diagnosed with laboratory testing only.



Foetal specimens

If abortions occur the specimens of choice for bacterial culture from the aborted foetus are:

- The aborted foetus
- Lung
- Liver
- Foetal abomasal fluid
- Spleen
- The afterbirth or parts thereof which must include the cotyledons

These samples must be submitted to the laboratory on ice, as soon as possible after abortion has occurred. Specimens must be collected aseptically and submitted in separate jars / containers and must reach the lab within 24 hours.

Smears can also be made of the following:

- Abomasal fluid
- Lungs
- Cotyledons of the placenta
- Lochia from the aborting cow

Sampling

- When handling or sampling aborted fetuses and the afterbirth, wear the correct personal protective equipment (PPE) including shoulder-length disposable plastic gloves, waterproof aprons, gumboots as well as approved surgical masks and goggles.
- Infection occurs by ingesting or inhaling the organisms, through contact of infected material with open sores or by fluid splashing into the conjunctiva of the eyes.
- Ensure that all aborted material is disposed of properly by burning or burying. Do not leave any material lying around since scavengers (jackals, dogs, crows, seagulls etc.) may carry or drag it and contaminate your farm or neighbouring farms.
- Since most infections occurs via the mouth, do not let cows lick or graze the part of pastures infected with birth fluids and materials.

Brucella abortus Characteristics

Brucellosis in dairy cattle is caused by *Brucella abortus* and is the species of Brucella most commonly isolated in South Africa. It belongs to the family *Brucellaceae* along with ten other recognised Brucella species. Although usually associated with cattle, it may also infect sheep, goats, horses, dogs, wild ruminants and humans. Four species infect humans: *B. abortus*, *B. canis*, *B. melitensis*, and *B. suis*. *B. abortus* is less virulent than *B. melitensis* and is primarily a disease of cattle. *B. canis* affects dogs. *B. melitensis* is the most virulent and invasive species. It usually infects goats and occasionally sheep. *B. suis* is of intermediate virulence and mainly infects pigs. The predominant infection in humans is caused by *Brucella abortus* (from cattle) and far fewer cases of *Brucella melitensis* (from goats and sheep).

Brucella abortus are very small gram-negative, rod-shaped bacteria that live intracellularly (inside cells). Since they occur intracellularly they are protected from the immune system and as a result, they frequently persist for the host's lifetime. During the initial phase of infection, bacteria are carried to the regional lymph nodes where they continue to multiply. A phase follows where the bacteria are carried via the bloodstream to the spleen, liver, supra-mammary lymph nodes, bone marrow and joints. In the pregnant animal, *Brucella abortus* is attracted to the placenta as its growth is stimulated by erythritol, a carbohydrate that is present in large quantities in the cotyledons and foetal fluids. Bacteria are shed in placenta and foetal fluids as well as urine, milk and semen. Cows and heifers infected with brucellosis often look healthy, which is misleading. If these animals remain in the herd, they continue to silently spread the infection which will cause severe economic and production losses. The most important mode of transmission is when an infected animal calves normally or has an abortion, as this process releases millions of bacteria into the environment that can easily infect other animals. Although *Brucella abortus* does not multiply outside the host, it can survive in the environment for long periods under suitable conditions. In cool moist conditions, it can remain viable in faeces for up to a year and in dust or soil for up to 125 days. Despite its stability in the environment, Brucellae are sensitive to many disinfectants and high temperatures. Exposure to sunlight kills it within hours.

Background

Brucellosis was first diagnosed in humans in Malta during the Crimean war in the 1850s. Hence the names of the disease Malta Fever, Crimean Fever, Gibraltar Fever and Mediterranean Fever. The bacterium was only isolated by a British pathologist / microbiologist, David Bruce in 1887. 10 Years later, in 1897 a Danish veterinarian named Bernhard Bang, isolated a bacterium that caused spontaneous abortion in cattle. At the time no-one suspected the causal relationship between the two diseases. In the 1910s an American bacteriologist called Alice Evans began to suspect that the same organism caused both diseases. During the 1920s, this hypothesis was vindicated. The organism was subsequently named *Brucella* in honour of Bruce. The name “brucellosis” gradually replaced the other names of the disease.

Testimonies

Case Study - Farmer 1

We farm in an area in the Western Cape that had not had any brucellosis cases for several years. Over the years most farmers had stopped vaccinating for brucellosis since there were no positive herds in the area and everybody was careful to only buy animals from brucellosis-free herds, if they bought any animals at all. We all thought our biosecurity measures were good enough. As a result, we had stopped vaccinating against brucellosis to save costs.

We only picked up that we had brucellosis during our routine bi-annual testing for TB and CA in 2014. 10 Cows tested positive. We did not have any abortions yet to indicate that something was wrong. Cases started to increase and by 2015 we once had 130 cows testing positive in one go. The state veterinarian investigated to determine the source of the infection. Our neighbouring farm had brought beef cattle from the Free State to rear for slaughter. His herd was tested and 80 out of a herd of 140 head tested positive. He had bought the cattle in good faith and did not know that they had brucellosis. Since our calves were in a camp bordering his farm, we assume that we got infected through the fence by nose-to-nose contact of our calves and his weaners.

Since this was an area that had been brucellosis free for several years, nobody wanted the disease to become endemic again. As a result, we had sterling support from our state veterinarian, herd veterinarian and the local farming community. A meeting was held with all the stakeholders and

local farmers and a biosecurity protocol was agreed on. The milk lorry would collect from our farm as the last stop on the route every day, so that they did not visit any farms immediately after our milk was collected. The same applied to the truck that collected any animals for slaughter. Everybody monitored any animal movements in the area. Any vehicle carrying cattle would be pulled over and questioned as to the origin and destination of the cattle. Nobody could bring any animals into or out of the area without being certified free of brucellosis. All the farmers vaccinated their animals for brucellosis.

Since the outbreak, our whole herd was tested every month. All positive animals were immediately isolated and sent for slaughter as soon as possible. If a cow tested positive, we slaughtered her offspring (the replacement heifers) as well. If a cow had tested negative for two tests and then tested positive, we regarded that as a new infection and then did not slaughter her offspring if they were born before the first negative test. If a lactating cow tested positive and she was not pregnant yet, we would keep her to finish her lactation. They were kept isolated, milked last and slaughtered once their lactation finished. All steam-up cows were tested every two weeks and slaughtered immediately if positive.

The milk parlour was disinfected with formalin daily. Afterbirths were collected twice daily and the areas where the cows calved were sprayed with disinfectant. Calves were raised on milk formula. No fresh milk was given to calves. Since S19 vaccine was in short supply, we would vaccinate the calves with a $\frac{1}{4}$ dose of RB51 at four months and $\frac{1}{2}$ a dose of RB51 at nine months and then a full dose every year after that.

Initially we tested the herd every month. Once the whole herd tested clear we would test them three months later. If there were any positive results, we would start testing every month until we got a clear test again. It is now (in 2023) six months since we last tested positive. If we stay clean for 12 months our herd will be declared brucellosis free at last. It is more than eight years ago that we tested positive and only now are we almost in the clear.

The financial implications were that we could not sell any heifers. A total of 820 positive animals have been slaughtered to date. We only got R3 000 to R4 000 for the meat per animal that we slaughtered, but had to buy replacement animals for R11 000 each. Fortunately, we had another farm nearby where we had a clean herd that we could milk and that could supply us with clean vaccinated replacement heifers.

Make sure that you vaccinate your animals, no matter how good your biosecurity measures are. If we had vaccinated our herd regularly before the outbreak, we might have been able to eradicate it a lot sooner and lost far fewer animals. It has been a really tough eight years!

Case Study – Farmer 2

Our neighbour's farm got brucellosis. So, we started vaccinating for it. About a year later we tested positive on the Milk Ring Test. We bled the herd and had positive test results for brucellosis. That was where our problems began.

We started testing the whole herd every month and slaughtering all positive animals and their offspring. After a few rounds of tests, we only slaughtered the replacement heifers of positive cows if they were younger than three months old at the time that the cow tested positive. All steam-up cows are tested weekly from four weeks before their due date and twice after calving. Afterbirths are collected daily and placed in double black bags before being disposed of. A red flag is placed in the ground where the afterbirth was found and then the area is sprayed with disinfectant. Steam-up camps are "disinfected" with lime twice a year. Heifers are vaccinated with RB51 at four months old; again one month before AI; and again when due to calf; and then annually.

Despite vaccination, some cows will still get infected and test positive. The disease almost ruined us. Fortunately we had another farm with a dairy to keep us afloat. Even so, we lost our brucellosis premium on the milk. The Co-op was very supportive since our outstanding account ran to over a million rand at one stage. They stuck with us regardless. We started using sexed semen to produce more heifers to be able to grow our herd back to normal. Any heifers that needed to be inseminated a second time were given beef semen.

The community worked together extremely well. All unfamiliar movements of animals are stopped and their origin and destination queried. Our milk is collected last on the collection route so that the milk lorry does not visit any farms after visiting our farm. The same applies to the abattoir lorry that collects the positive animals for slaughter. All animals from the farm may only be transported to an accredited abattoir and only under permit from the state veterinarian. Fortunately our State Veterinary Services were very supportive with testing, issuing permits and giving general advice.

It has been more than seven years since we first tested positive and the end is only now in sight. Sometimes we will test negative for three months and then suddenly there will be a few positive cases, despite all our cows being vaccinated. If one animal tests positive, then the herd is classed as positive. This is a disease that will bring you to your knees!

Private Veterinarian – Western Cape

I am not that familiar with handling a brucellosis outbreak, since the state veterinarians usually deal with an outbreak. However, I am of the opinion that it might be easier to eradicate brucellosis from dairy farms that calf seasonally. Purely from a management point of view it is a lot easier. When you constantly have cows calving on the farm throughout the year, there is a constant exposure to animals excreting large numbers of the organisms and infecting other animals. With a short calving period, it is easier to identify most of the positive animals and eradicate them. Disinfecting contaminated areas is easier. It is also easier to test and manage the heifer group separately. Regardless of your production system, in the end it comes down to a very strict vaccination, testing and slaughter regime, combined with disinfecting contaminated areas. If a dairy farm becomes infected it has a major emotional and financial impact on the farmer. It is unlikely that you will be able to eradicate the disease on a farm in less than three years.



Picture: Afrimik

Dr Danie Odendaal – Director: Veterinary Network

We managed to eradicate brucellosis from a very large commercial and stud beef herd within two and a half years from when it was first diagnosed. This involved very strict testing of all animals and slaughtering of all the positive cases without fail. After the first round of tests, all the replacement heifers and bull calves (offspring) from cows that tested positive were slaughtered as well - regardless of their test status. If a cow tested negative for two rounds of testing and subsequently tested positive, she was considered a new infection. In those cases, her offspring were not slaughtered. Fortunately, the farmer agreed not to bury his head in the sand and to slaughter all positive animals without fail, even the stud animals. This can ruin a farmer. However, after having done this, the farm is clear and the farmer is growing his herd and his farming business again. This is a large and extensive farming enterprise with opportunities for infected animals to cross the fences and re-infect the herd. Therefore, all heifers are vaccinated with S19 before being eight months old and then once a year with RB51 for the next three years. Combined with strict biosecurity, this has so far managed to prevent re-infection of the herd.

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