

Oregon Agricultural College  
Experiment Station

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Infectious Abortion of Cattle

By  
B. T. SIMMS  
and  
FRED W. MILLER



CORVALLIS, OREGON

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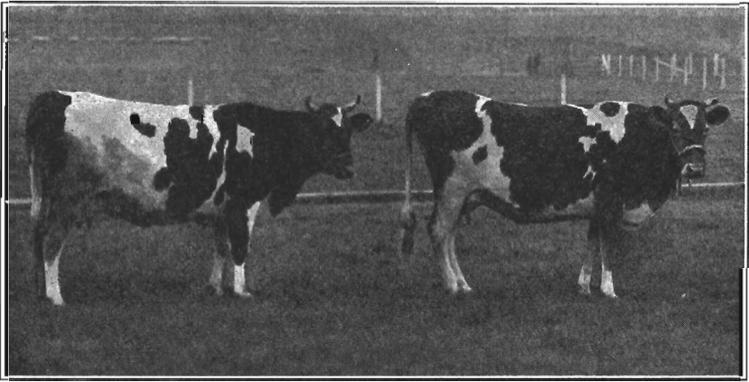
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## SUMMARY

1. Infectious abortion is widespread in Oregon.
2. It causes at least 90 percent of all the abortions in this state.
3. Infectious abortion causes very serious loss to the dairy industry. It is a factor that brings financial disaster to hundreds of dairymen.
4. The germ which causes this disease lives in the fluids of the pregnant uterus and in the udder.
5. The infected cow is the principal source of the contagion. She is most dangerous at the time of calving or aborting.
6. Pregnant cows and heifers are very readily infected through pen or pasture exposure to aborting cows.
7. It has not been possible to spread the disease through the use of bulls which had served infected cows.
8. Heifers fed infected milk as calves will not carry the germs and abort after they are bred.
9. There are no diagnostic symptoms of abortion. Many infected animals give birth to live, vigorous calves. Such cows may be very active spreaders of the disease.
10. The disease can be diagnosed by a blood test.
11. No cure for abortion has been found. It is not even claimed that bacterias and vaccines will rid cows of this disease, but it is claimed they will prevent the act of abortion. They are still in the experimental stage.
12. With our present knowledge two methods of control and eradication are available. One is to test all animals, slaughter or sell all reactors, thoroughly clean and disinfect the premises, and develop a clean herd from the abortion-free animals. The other method is to test the herd, divide it into two parts, and keep the infected animals for breeding purposes. Extreme care must be exercised if this method is to be successful.
13. Owners of abortion-free herds should never introduce into their herds females that have not been blood tested. In buying new stock it is safest to procure young, unbred heifers.
14. A large amount of investigational work remains to be done with this disease. Cattle owners, investigators, and state livestock sanitary officials must cooperate in finally controlling infectious abortion.



Healthy looking cows, but more than sixty abortions followed their introduction into an abortion-free herd.

# Infectious Abortion of Cattle

By B. T. SIMMS and F. W. MILLER

The investigational work reported in this bulletin was done with funds appropriated by the Oregon Legislature, in 1919 and 1921, at the request of the Oregon Dairy Association for investigation of diseases of dairy cattle.

Infectious or contagious abortion is a disease of cattle which is found in nearly all parts of the civilized world where considerable numbers of cattle are kept. It is more serious among dairy than beef animals but is quite prevalent among beef herds. Even under range conditions this disease has sometimes caused heavy losses.

In Oregon infectious abortion exists in practically every county. While not as prevalent here as in some of the older dairy states, it is spreading gradually. Several thousand tests conducted at the Experiment Station indicate that about 15 to 20 percent of all of the dairy cows in the state are infected. It has been found, moreover, that at least 90 percent of the aborting cows of this state are infected with this disease. Occasionally animals abort which are not infected, but they are relatively rare.

## ECONOMIC LOSSES FROM ABORTION

During the past seven years the Veterinary Medicine department of the Oregon Agricultural Experiment Station has been collecting data concerning economic losses from infectious abortion. Some herds have been studied where owners have kept accurate records of all incomes, both before and after the introduction of this disease. In other herds individual records of all cows have been kept. By blood testing this type of herd it has been possible to compare income from both infected and abortion-free animals of approximately the same breeding which have been fed and handled in approximately the same manner. Such studies show that the losses may be the result of four different disturbances, all of which follow infectious abortion. These are abortion, sterility, garget, and decreased milk production.

**Loss of Calf.** Many owners believe the loss of the calf is the most serious result of abortion infection, but these studies have shown that even in well-bred registered herds the calf loss is the least serious of the four. The percentage of infected cows which abort varies greatly in different herds and in the same herd in different years. In some instances it is as high as 80 to 90 percent, while in others it may be as low as 5 percent or even less. It is difficult to form an estimate, but in these studies more than one-fourth of the infected cows have aborted. The value of each calf lost varies from practically nothing for scrub dairy calves to several hundred dollars for calves from high-producing registered dams.

**Sterility** so commonly accompanies abortion that many dairymen consider it as a symptom of the disease. Nearly every abortion-infected herd studied has had more or less sterility. These cases are almost always among the abortion-infected rather than among the abortion-free

cows of the herd. The percentage of sterile cows has varied in different herds. A conservative estimate places the permanently sterile animals at 10 to 15 percent of all abortion-infected cows and the shy breeders at 15 to 20 percent of all infected animals. This means that abortion causes a minimum annual loss in Oregon of 5,000 to 7,000 sterile cows in addition to about 10,000 which are shy breeders. This represents a loss of nearly a million dollars annually.

**Garget** or mastitis has been much more prevalent in abortion-infected than in abortion-free animals. This trouble usually develops after cows have been infected for more than a year rather than at the beginning of an outbreak. It is not unusual to find a herd in which the percentage of abortion is decreasing while the diseases of the udder are increasing. One herd of 71 cows was blood tested and divided into two groups, there being 44 infected animals and 27 abortion-free animals. In a three-year period there were 31 cases of garget among the 44 infected cows while there were only 2 cases among the 27 abortion-free cows.

**Decreased milk production** is practically always noted in abortion-infected herds. Dairymen interviewed have usually reported a decrease of nearly one-half in milk production following outbreaks of abortion. Where accurate individual records of all cows have been available, this loss has varied from almost nothing to 100 percent in various cases, with an average of about 25 percent in the infected cows. These studies have included all cows infected, many of which have given birth to normal calves.

Estimating that 20 percent of Oregon cows are infected and that these average a loss of milk flow of approximately one-fourth, this indicates an annual loss in milk production of nearly one million dollars. The results of abortion disease alone are thus costing the livestock industry of Oregon more than two million dollars every year. This disease is bringing financial ruin to hundreds of dairymen each year.

## CAUSE

The germ causing this disease is known as *Bacillus abortus*. It can be seen only with the aid of a microscope. All experiments indicate that this germ does not grow naturally outside the animal's body. It can be grown in laboratories, however, thus making it possible to study the germ under experimental conditions. It will live for several weeks to several months in yards, barns, etc. Exposure to dry air and sunlight hastens the death of the germ.

At the Oregon Experiment Station the abortion germ has been found in only two organs of the cow, namely the udder and the uterus. It has been found in the stomach, spleen, and other organs of aborted calves or living calves coming from abortion-infected dams. This infection will persist for months or even years in the udder, but in the uterus it disappears one to three months after calving.

The most serious source of these germs is the fluid in an infected pregnant uterus. This liquid is literally teeming with bacteria. They escape in large numbers with the calf whether there is an abortion or a live calf is born. The infection, moreover, continues to escape for several days to two or three months following aborting or calving.

Cows with infected udders give off these germs in their milk. An infected udder may pass germs from only one quarter, and it may pass germs in the milk only a part of the time. The amount of infection coming from the udder is relatively small when compared to that in the discharges from the uterus at the time of aborting or calving.

Calves born from infected cows may pass the germs in their dung for a few days. It is also possible that calves fed abortion-infected milk will continue to void these bacteria in the dung as long as such milk is consumed.

Some investigators have found a few bulls which were infected. Such animals may have abortion germs in their testicles and may pass them out in the semen. Abortion-infected bulls are very scarce in Oregon. The Experiment Station has not found any bull which throws off the infection in this manner.

## METHODS OF SPREAD

An extended study of the methods of spread of abortion has been made. Various dairymen and investigators have claimed that the trouble is spread by the bull at service, through infection of calves by infected dams before birth, through feeding infected milk to calves, through pen or pasture exposure of unbred heifers to aborting cows, and through pen or pasture exposure of pregnant heifers or cows to aborting animals. All of these have been tested at the Oregon Experiment Station.

**Bulls Have Not Spread Abortion.** Approximately fifteen bulls have been used in a study of the possibility of the spread of the disease through the bull at service. These have been bred to cows which had aborted and then to abortion-free cows or heifers. In some instances bulls were bred during the morning to a cow which had aborted and during the afternoon to sound heifers. All told, more than 100 calves had been sired by these bulls. In no instance has there been any evidence obtained that the bull has spread the disease.

**Abortion Is Not Inherited.** The possibility of calves from infected dams becoming infected before birth has been studied by observing both heifers and bulls born from infected cows. Such calves have not inherited the infection. If they are fed milk from their dams they will frequently give positive blood tests during the first few months of their lives, but if this milk is discontinued before the sixth or seventh month the blood test changes to negative. If such heifers are not exposed later in life they remain negative to blood tests and give birth to normal calves.

**Heifer Calves Are Not Infected By Drinking Infected Milk.** More than 90 heifers have been used in studying the possibility of spreading abortion through feeding infected milk. These heifers have been fed raw milk from an abortion-infected herd. This milk has been tested at intervals for abortion germs by injecting guinea pigs. Such tests have shown that the infection has been present. All these heifers have remained negative to blood tests and have given birth to normal calves, if they were not exposed after the milk feeding period had passed.

**Unbred Heifers Are Not Easily Infected.** Pen and pasture exposure of unbred heifers has been studied by using animals between the ages of 7 and 18 months. They have been penned and pastured with aborting

cows. Monthly blood tests have been made on these to determine whether they became infected. Only a small percentage have changed from negative to positive blood tests. It has been noted, though, that as the heifers grow older and the udder tissue increases in amount they may become slightly more susceptible. In cases of infection in this manner the bacteria very probably become localized in the udder.

**Pregnant Cows and Heifers Are Easily Infected.** Many experiments with pregnant heifers and cows have been conducted. The first one of these consisted in using eight pregnant heifers. They were penned with three cows which aborted while with them. Five of these heifers aborted. Further experiments showed that it is very easy to infect pregnant animals through penning or pasturing them with abortion-infected cows.

**Infection Enters the Body Through the Mouth.** In an effort to determine how the bacteria enter the body of the susceptible animals, pregnant cows have been given abortion germs in water through their digestive tract. Cows used in this experiment have been negative to blood tests before the experimental work began. They have changed to positive blood tests and have either aborted or given birth to weak premature calves. The germs have been found in the stomachs of calves aborted by these cows. These experiments have shown that it is easy to infect pregnant cows by giving the germs through the digestive system. Such experiments, moreover, have been successful even as late as the seventh month of pregnancy.

**Cleaning Stalls Without Disinfecting Them Is Not Satisfactory.** In still another test two cows were allowed to abort in a stall. This stall was cleaned out down to the concrete floor but was not disinfected. After a week had passed a negative cow was placed in the stall. This cow changed to positive in less than one month and aborted.

## SYMPTOMS

There are no absolutely positive symptoms of abortion. The most generally recognized symptom is the act of abortion. It is true, though, that many infected animals give birth to apparently normal calves. Such cows may be very dangerous as spreaders of the disease, though they themselves carry their calves full time. In animals which do lose their calves the loss may occur any time during pregnancy. At this Experiment Station cows have been observed to abort as early as the seventh week and as late as the middle of the ninth month of pregnancy. Many dairymen say cows do not abort before the fifth month. Up to this period, however, calves are so small that they are not seen when aborted.

Retained after-birth or failure to clean is another very common symptom in infected cows. This follows both abortion and delivery of live calves, but this trouble is sometimes quite prevalent in herds not infected with abortion.

Studies at this Station have shown that sterility, enlarged joints, garget, and lessened milk production are very frequent in infected cows. Since these troubles are occasionally seen where abortion is not present it is not possible to make a positive diagnosis by observing them. As stated above there are no symptoms by which a high percentage of abortion-infected cows can be detected.

## METHODS OF DIAGNOSIS

Two laboratory blood tests for diagnosing this disease have been found by investigators to be satisfactory. These are the agglutination test and the complement fixation test. Of these the agglutination is the simpler and in the hands of most investigators has been just as satisfactory. This is the test used at the Oregon Experiment Station. After running several thousand of these blood tests it seems to be as accurate as any of the tests for disease. It will not foretell an abortion, but it will detect the abortion-infected cows. Animals infected experimentally usually react in two to six weeks after they are given the organism.

This test is conducted in the following manner. Blood is collected from the jugular vein of the cow to be tested and set aside in a cool place until it clots. As the clot grows older it contracts and squeezes out a clear liquid called serum. In the laboratory the abortion germs are grown and then suspended in a weak salt solution. Enough germs are placed in this solution to make it slightly cloudy. Measured amounts of this suspension are then placed in test tubes, three tubes usually being prepared for each animal that is to be tested. Then serum is added in such quantities that the first tube will contain 1 part of serum to 50 parts of bacterial suspension; the second tube, 1 part of serum to 100 parts suspension; and the third tube, 1 part to 200. The tubes are stored in a dark place and examined at the end of the third day. If a cow is infected her serum will cause the bacteria to agglutinate or clump together. These clumped germs will settle to the bottom, leaving a clear solution. If a cow is not infected her serum will have no influence and the bacterial suspension will remain cloudy.

In some cases a diagnosis can be made by finding the abortion germs either in the milk or in the uterine discharges. This is usually done by injecting guinea pigs and producing the disease in them. This method is too slow and too expensive ever to come into general use.

## DURATION AND OUTCOME

Infectious abortion is essentially a chronic disease. Some cows under observation at this Experiment Station now have been infected for more than six years. While infection usually disappears from the uterus a few weeks after calving or aborting it remains more or less permanent in the udder. It is probably true that some animals do make complete recovery, but studies at this Station indicate that this is relatively rare in dairy cows. It is a mistaken idea that cows will abort only once or twice and then become immune. Many cows abort the third time. Two cows under study now have aborted five times each. Dairymen have learned from experience that aborting cows are many times shy breeders. It has become a general practice, therefore, to sell any cow that aborts a second time. This is one reason that cows that have aborted three or more times are not very plentiful.

The course and severity of the disease vary greatly in different herds. In some outbreaks half to two-thirds of the pregnant animals may abort one year and only 5 to 10 percent abort the next time. Some herds have been studied in which abortions were very numerous one year, while the following season all cows carried their calves full time only to have

quite a number of abortions in the next pregnancy. Other herds under observation have had heavy losses annually for six or seven years in succession with no material decrease.

Data collected indicate possibly some relation between the method of handling a herd and the course of an outbreak. In those herds that are bred so that all the cows freshen during one season, outbreaks are many times very severe, but frequently the percentage of abortions occurring in the following year is quite low. On the other hand herds that are bred so that some cows freshen each month frequently have a less severe initial outbreak but a higher percentage of abortions in the following year. More data on this are being collected.

## TREATMENT

No method of curing abortion infection is known. Many remedies have been recommended but none of them have stood the test of time. The claim that various forms of lime salts will cure the trouble has not been proved. It is a significant fact that abortion is very common in those sections of the country where the soils contain large amounts of lime and where the foods generally used are those relatively high in this substance. Administration of drugs seems to have no influence in the course of abortion. An occasional cow probably makes a complete recovery, but such animals are rare in the herds studied by this Station. The only safe procedure is to consider that once infected means always infected unless there is definite proof to the contrary.

Abortion bacterins and vaccines have been widely advertised and used during the past few years. The bacterin is a suspension of dead abortion bacteria in a weak salt solution, while the vaccine is a suspension of live abortion germs in a salt solution. It is interesting to note that the various investigators that have recommended these substances differ very widely in size of doses, number of doses necessary to produce immunity, etc. Abortion varies so much in different herds that it is very difficult to interpret results following these injections. Some investigators have reported excellent results, while others have failed to find any virtue in either the bacterin or the vaccine. As a matter of fact these are not yet beyond the experimental stage. The Oregon Station has begun a rather limited study of the vaccines, but it will take several years to obtain definite proof that this is either valuable or worthless.

It should be borne in mind that neither the bacterin nor the vaccine is supposed to rid cattle of abortion infection. They are used with the hope that they will increase the resistance and enable the injected animals to carry their calves to maturity.

Furthermore, the use of the vaccine may result in establishing infection in clean animals. It should therefore be used very cautiously and only in unbred animals which will very probably be exposed to the infection during pregnancy. Cattle owners should not be deceived by offers to guarantee results. These substances are sold at very substantial profit, and manufacturers can afford to reimburse a goodly percentage of their customers and still make a profit on the production cost.

## METHODS OF CONTROL AND ERADICATION

Since no method of curing infectious abortion has been found, it is all the more necessary that methods of control and eradication be worked out. At the Oregon Experiment Station all investigational work with this disease has been planned and carried out with this end in view.

**Non-Infected Herds.** In considering control all herds may be divided into two groups, those not infected and those infected. Every dairyman whose herd is free from the disease should take every precaution to keep this most serious trouble out of his herd. He should be just as careful concerning this disease as he is concerning tuberculosis. No new animals should be brought into the herd without a blood test being made before they are allowed to mingle with the herd; then there should be a second test after 60 days. Stray cows and heifers should be kept out of pastures, barn lots, etc., in which the abortion-free animals are kept. A rather common method of spread consists in pasturing pregnant heifers and dry cows of an entire neighborhood in a single pasture. Under such conditions a single infected cow may spread the disease to a large number of herds.

**Infected Herds.** The infected herd presents a far more difficult problem. At the Oregon Experiment Station two methods of handling such herds are being studied. One consists in blood testing all cattle, selling off all reactors, thoroughly cleaning and disinfecting the barn, and then retesting every 30 to 60 days until the herd has passed at least three tests. This method has been tried out sufficiently to show that it will give results under some conditions. Not enough data have been accumulated, as yet, to be sure that this will be successful in every section and under all systems of herd management. This is the method recommended for all herds showing less than 8 to 10 percent reactors and in most herds into which the disease has been introduced very recently. Such a procedure may seem very drastic, but figures collected show that abortion-infected cows are usually money losers. The sooner they go for beef, therefore, the better off the owner will probably be. After a herd is once free, of course every precaution must be taken to keep it clean.

The second method is a far more difficult one. It consists in blood testing the entire herd, separating the infected animals from those not infected, and keeping the infected cows separate until a sufficient number of non-reacting heifers have been raised to fill the herd. This involves the maintenance of a rather rigid quarantine. Garget, sterility, and lessened milk production frequently appear to such an extent among the infected animals that they are money losers, but in high-priced pure-bred herds such a method of control of abortion and reestablishment of abortion-free herds may be warranted. This method of control is still in the experimental stage. It has given satisfactory results in some herds, but only in those owned by men who would keep the infected cows absolutely separate from the sound ones. The expenses of following this plan are so great that it can be used economically only in herds of good cattle.

No economical method of eradicating abortion from badly infected herds of common cattle has been found. Perhaps vaccination may increase the resistance of these animals to some extent, but as stated else-

where the vaccines are still in the experimental stage. With the present knowledge of the disease it seems advisable to sell any grade herd in which the disease has become so severe that the animals are losing money for the owner.

## QUARANTINE AND STATE REGULATIONS

Many owners have urged that the State Livestock Sanitary Board through the office of State Veterinarian should take control of infectious abortion and handle it similarly to present methods of handling tuberculosis. They have believed that infected herds should be quarantined, that blood tests should be required of all animals offered for sale at public auction, and of all animals exhibited at state fairs, and that no cattle should be brought into the state for breeding purposes unless they have been tested and found free from contagious abortion.

The time does not seem to be ripe for such drastic action as yet. A great deal is still unknown concerning this disease. The percentage of infected cattle is very high, and cattle owners are not as yet awake to the seriousness of contagious abortion. Before quarantines can be established and state control can be undertaken, a large amount of investigational work must be done. The livestock owners, too, must be thoroughly informed as to the economic losses caused by this disease. At the present time at least, each owner must be very largely his own sanitary and quarantine officer.

## THE FUTURE

Contagious abortion is becoming more widespread and more serious as time goes on. Its ravages must be checked or it will bring financial ruin to increasing numbers of cattle owners. In order that this may be accomplished all forces concerned must band together for the fight. The investigators must push forward finding new truths, making new discoveries, and working out new methods of applying them. Individual dairymen and beef producers and all dairy and beef associations must support the Experiment Station in doing this work. The progressive dairymen and beef producers must educate the less progressive to the dangers of the trouble. As soon as investigations and educational work have made such action possible, state livestock sanitary officials must take proper steps toward control and eradication. Perhaps abortion-free, accredited herds can be established. Then abortion-free areas and finally abortion-free counties may ultimately be realized. Such results can only come through continuous and increased cooperation of investigator, livestock owner, and livestock sanitary official. It will be a long fight and a hard one, but the victory will be well worth all the effort.

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