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The Practical Control of Infectious
Abortion in Cattle

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ACKNOWLEDGMENT

It is not feasible in a paper of this kind to mention all who have done important work on abortion; and it must not be regarded as an invidious distinction if the writer mentions a few who have contributed fundamental facts of practical value. Among foreign investigators, honor should be accorded Franck, Lehnert, and Brauer for their attempts to establish experimentally the infectiousness of this disease, nearly half a century ago, when methods of biological research were comparatively crude. The names of Nocard and Bang whose genius and labors have contributed enduring knowledge of practical value will always deserve mention. The researches of McFadyean and co-workers, at a later date in England, and Zwick, et al in Germany, added new and confirmatory data. Grinsted and Holth greatly advanced the means of practical control in adapting the serological tests to abortion diagnosis. In our own country, Schroeder and Cotton and colleagues of the U. S. Bureau of Animal Industry have established useful facts which can be turned to practical account in the control of this disease. The same can also be said of Giltner and co-workers of the Michigan Agricultural Experiment Station. The work of Williams and collaborators of Cornell University, has also contributed facts of value which rightly used will aid greatly in the control and eradication of infectious abortion, and especially in the prevention of permanent sterility. The forward steps that have been made in a practical way by the veterinary sanitary officers of Pennsylvania under the guidance of Doctor Munce deserve special commendation.

The Practical Control of Infectious Abortion in Cattle

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INTRODUCTION

The purpose of this bulletin is purely a practical one; namely, to give cattle breeders, herdsman, and veterinary practitioners the essential facts which are now known relating to the nature of infectious abortion in cattle, and to show how these facts may be used to prevent and eradicate this disease.

There is yet considerable experimental work to be done before our knowledge of every phase of the abortion problem is complete, but sufficient is known for very effective control of this disease, if such knowledge is applied in an intelligent and diligent manner. Moreover, the facts given herein are quite generally accepted by investigators the world over, as having been definitely established, or as being supported by such a weight of careful experimental research, and reliable clinical observation, as to justify their acceptance and practical application for control of this disease. Many of these facts have been established or verified at this Experiment Station by the writer and his research associates, Durant and Newman; and brief reports of these researches have been given from time to time in the Annual Reports of the Experiment Station. The fuller experimental details, which supply the proofs of the statements presented herein will be given in research bulletins at a more opportune time. Such details are of more interest to research workers, and besides are not necessary in carrying out the main purpose of this bulletin: that of supplying the groups first mentioned the practical information they desire, in a convenient form for ready use in combatting this disease—which in the opinion of many breeders does not hold a second place even to tuberculosis in economic loss.

THE PERTINENT QUESTION

What Facts of Practical Utility Have Been Established that Can be Used in the Prevention and Eradication of this Disease?

In presenting the list which follows, an attempt has been made to select those facts only which are fundamental to a clear knowledge of the nature of the disease, and which will serve as a safe basis for practical measures of controlling the disease.

FACTS ABOUT INFECTIOUS ABORTION IN CATTLE

1. The first important fact is that there actually exists a true infectious disease, specific in nature, which causes the majority of abortions in cattle, and probably also in swine.
2. This infection is transmissible, under certain conditions, directly

from the abortion infected cow to a healthy cow, when kept in close association.

3. The infection is transmitted from the aborting cow to others through the uterine discharges; namely, the aborted fetus, the afterbirth, and the after-flow from the uterus, also by the milk.

4. An infected cow which is sufficiently resistant to the disease to carry a living calf to full term also discharges abortion infection at time of calving, on the coat of the live calf, in the afterbirth, and in the uterine discharges which follow until clean. The milk of such cows is also frequently infected.

5. The abortion infection remains alive outside the body of the infected cow for a considerable time, under favorable conditions. The soiled tail, vulva, and hair of rump of the infected female, as well as the bedding contaminated by the uterine discharges, may transmit the infection to healthy exposed cattle.

6. The period of discharge of abortion infection from the uterus of an infected cow is, as a rule, comparatively short—from three to six or eight weeks.

7. The disease is contracted under natural conditions through the mouth and alimentary tract by eating the materials which contain the abortion infection.

8. The milk of abortion infected cows, although frequently infected, is not liable to transmit infection to **mature** cattle, except from gross carelessness in handling the milk. The probabilities are not great that many sexually mature cows will have an opportunity to ingest sufficient infected milk to cause harm.

9. The danger of transmitting abortion infection from the milk of an infected cow to other cows through the soiling of pasture grasses or other food by the fecal discharges of calves, nursing infected mothers, has not been determined experimentally. (Field observations, however, on a few animals have shown no bad results.)

10. Transmission of abortion infection by the bull, in breeding, is also possible, but probably not of such frequent occurrence as from cow to cow, and by swallowing the infected discharges.

Bulls occasionally become infected systemically, and the generative glands and passages may discharge abortion germs, and infect females through copulation, or by the latter licking the soiled sheath of the bull, or the vulva of another cow which has been recently served by an infected bull.

11. The bacillus *abortus* (Bang), a microbe discovered by Professor Bang of Denmark in 1895, in the uterus of an abortion-infected cow, is now quite generally conceded to be the specific cause of the majority of cases of abortion in cattle.

12. In the majority of cases, a **mature** infected cow remains a **permanent carrier** of the Bang abortion infection during life, and is liable to abort at any pregnancy; and is a potential spreader of the disease at each calving, and for a period thereafter.

13. Occasionally the calf of an abortion-infected cow becomes permanently infected with the Bang abortion organism before birth, or from

the milk after its birth, and when subsequently bred may abort; but, as a rule, the calves of abortion-infected mothers overcome the infection before reaching sexual maturity, and the great majority can be reared free from the Bang abortion disease.

14. An "open" cow, free from purulent uterine discharge, even though a permanent carrier of abortion infection, does not seem to discharge virulent infection at the heat periods, and is apparently not a source of danger to other cattle grazing on the same pastures.

15. A pregnant cow, even though a permanent carrier of abortion infection, is not a source of danger to other cows much before the period of calving (or aborting); that is, not before the occurrence of actual premonitory oozing or discharge of infectious fluid from the uterus.

16. Some infected cows develop a considerable degree of immunity or tolerance to the Bang abortion infection, and do not abort more than once or twice; while others in the same herd may abort repeatedly.

17. The artificial inoculation of the "living" abortion germs (or vaccine) in sexually mature cows is liable to cause a permanent infection identical with the naturally acquired disease; and some of the inoculated animals will abort if already pregnant, or if they are subsequently bred.

18. Cows that are infected after they are bred are more liable to abort than those that become infected before breeding; but in either case the infected animal is liable to spread the abortion germs at time of calving even though a living calf is dropped. Moreover such inoculation is not a guarantee against subsequent abortions in the artificially infected animal.

19. The serological tests (blood tests)—"agglutination" and "complement fixation"—when properly applied, are as reliable for the diagnosis of the Bang abortion disease in cattle, as "tuberculin" is for detecting tuberculosis. Besides, there is less disturbance to the herd in making the test, less time is required of the attending veterinarian, and less expense to the owner. And in cases where interstate shipment of breeding animals is to be made, the laboratory report of the abortion test can be returned in ample time.

20. Other micro-organisms occasionally cause cows to abort; as, for instance, the tubercle bacillus may produce lesions in the uterus that result in the death and expulsion of the fetus. But this organism and the pus-producing microbes which occasionally gain access to the uterus, do not seem to have the special invasive properties that are possessed by the Bang abortion bacillus, and which entitle the latter to hold the chief place as a cause of abortion.

In a few outbreaks of abortion in cattle, micro-organisms known as "spirilla" or "vibrios" were found to be the predominant microbes in the uterine discharges; but thus far there does not appear to be any indications that these microbes will prove to be a serious menace to cattle breeding, as an important transmissible cause of abortion, nor that different measures of practical control will be necessary.

21. **Sterility** is at times a sequel of an abortion due to the Bang bacillus infection; but this sterility is probably the result in most instances of neglect to give proper attention to a retained afterbirth. Such neglect per-

mits the invasion of the open uterus with pus-forming microbes, and other wound infections, which may produce a more or less chronic inflammation of the uterus, or of the ovaries and oviducts.

22. Infectious abortion in swine, if not identical with that of cattle, is a closely related infection with clinical evidence of intercommunicability. Moreover, in experimental work, abortion has been produced in cattle by inoculation with the abortion germs of swine; and in swine by inoculation with the abortion germs of cattle. In the experimental work thus far done the abortion organisms from swine seem to be the more virulent. The possibility is thus shown that cattle may contract the disease by natural exposure to abortion-infected swine, from swallowing food materials which have been contaminated by the infected discharges of aborting sows.

PRACTICAL MEASURES OF PREVENTION AND CONTROL

The facts summarized in the foregoing paragraphs supply the basis for measures of control which have been put in practice with success on a number of stock farms in this state, and which it is believed can be adapted to any condition that may arise in the handling of Missouri breeding herds. An outline of these measures is given herewith.

1. If an abortion occurs in the herd, isolate the animal promptly. Do not take the risk that the abortion was due to an accidental injury or shock, or to some non-specific infection.

2. Destroy the aborted fetus and afterbirth; burn, or bury them deeply, adding quicklime before covering with earth.

3. Disinfect the stall and litter where the abortion occurred. Use Compound Cresol, (U. S. P.), or other good disinfectant. If the abortion occurred in the open-field, or cattle-yard, cover the spot with freshly slaked lime, or sprinkle thoroughly with a disinfectant which has a disagreeable odor, to prevent healthy cattle from licking up infected material.

4. Give attention to the quarantined cow. If the afterbirth has been retained, give proper treatment to prevent complications leading to chronic metritis, or other conditions that may result in temporary or permanent sterility. Day by day disinfect thoroughly the uterine discharges and contaminated bedding. Do not permit these to come in contact with healthy mature cattle and swine; and especially in contact with healthy pregnant females.

5. Keep the aborting cow in quarantine until uterine discharges have ceased. The period of quarantine should not be less than three weeks and preferably from six to eight weeks. Before releasing from quarantine, spray the rump and tail with a disinfectant which has a sufficiently disagreeable odor to prevent healthy cows from licking the soiled parts.

6. While the cow is in quarantine, draw a blood sample from the jugular vein and send the sample to the "Veterinary Department, State Experiment Station, Columbia, Mo.," where the diagnostic tests for abortion disease are made, free of charge, for the cattle and swine breeders of the state. Tubes, needles and directions for drawing the blood sample are sent on request.

(a) If the first sample, drawn soon after the cow aborted, proves to be **negative** to the test, draw another sample in ten or fifteen days and have a retest made. (It occasionally happens that the blood serum of a cow that has recently aborted does not contain sufficient reacting "antibodies"—in a free state—to give the specific reaction.) If convenient, also send a sample of colostrum, or first milk. This fluid contains the reacting antibodies even when they are apparently absent from the blood of an infected cow or sow. As a rule, however, the blood reacts strongly both at the time of parturition and at later periods. If therefore a negative reaction is reported on samples, drawn on the fifteenth to thirtieth day, the probabilities are that the cow is not infected with the Bang abortion disease.

(b) If the blood sample shows a **positive** reaction to the abortion test, proceed to test all the sexually mature breeding cows in the herd, and the mature bulls as well. There may be other infected animals in the herd that are not suspected, but which are "carriers" and distributors of abortion infection at an apparently normal calving; or, in the case of an infected bull, with a diseased genital tract, a more continuous discharge of infection may be occurring.

7. After the test of the herd has been made: (a) Mark or identify in some plain manner all the reacting individuals, (b) If convenient, separate all the reactors from the non-reactors, in different pastures and barns, to facilitate proper handling and observation, as well as to lessen the risk of spreading infection to the healthy animals. (c) Make a careful appraisal of the worth of the reactors as breeding animals, or as milk and butter producers. (d) Sell to the butcher all reactors that are not of special merit; such as old cows that have about reached the end of their usefulness, animals of defective conformation, poor milkers, unthrifty hard keepers, uncertain breeders, cows with bad udders, cows affected with persistent leucorrhoea, metritis, or other genital ailment that has not yielded to expert treatment.

The greater the number of reactors of the classes mentioned that are sent promptly to the butcher, the better it will be for the owner of the herd, and for the industry. It will lessen the number of potential distributors of abortion infection to be kept under surveillance, and hasten the day when the herd will be free from the disease. The ultimate elimination of all reactors is the end to be striven for.

8. Do not sacrifice abortion-infected animals of exceptional merit. They can be handled without great danger of spreading the disease. Some of them will abort more than once, and in widely separated pregnancies, and practically all will remain potential distributors of the infection; but many of them will become quite regular breeders, and their progeny, with but few exceptions, can be reared free from abortion disease. A careful watch, however, must be kept on all abortion-infected pregnant cows, and if one should show signs of premature calving, she should be removed promptly from the herd into the quarantine quarters, and handled as described in a preceding paragraph, until safe to return to the herd.

At calving time every abortion reactor retained in the herd should be regarded as a dangerous distributor of the infection, although the calving

may appear to be in every way normal, and the calf fully developed and vigorous. Virulent infection has been demonstrated in the afterbirth of abortion reactors in such cases. (The same is true of abortion-infected sows which farrow living litters of pigs.)

To avoid danger from this source, separate the "abortion reactor" from the herd, several days before she is due to calve. Place the cow in a calving stable so constructed that it can be kept in proper sanitary condition. Isolated paddocks may be used if the drainage can be controlled.

When the cow has calved, dispose of the afterbirth and contaminated bedding in the manner already described. The vaginal tract and uterus should receive such treatment by the attending veterinarian as the circumstances may require. Disinfect the tail, and soiled hindquarters, as often as seems necessary, while the cow is in quarantine. Spray the infected stable litter daily with a disinfectant before cleaning the stall, so that infection may not be carried on the feet of the attendant to the stalls of susceptible cattle, and to prevent cattle from eating the contaminated bedding.

Disinfect the coat of the calf before transfer to quarters where the young animal may come in contact with mature susceptible cattle.

Keep the cow isolated from mature non-infected cattle until free from infectious discharges—three weeks, to six or eight weeks. And when released from quarantine, sponge or spray the tail, vulva and hindquarters with an ill smelling disinfectant to prevent other cattle from licking the parts mentioned.

The use of the spray on the hindquarters is especially applicable in the handling of beef-bred cows which are reactors, and which have recently aborted or calved. The period of detention in quarantine may be lessened, if after release from quarantine the infected cows are sprayed frequently until the danger period is past.

In the case of milk cows the use of an ill smelling disinfectant applied as a spray is objectionable, on account of its contact with the teats and udder and the danger of tainting the milk; but the application can be made more carefully by the use of a sponge, and the objections mentioned can thus be overcome. The milk should not be used as human food, if a purulent uterine discharge exists, and such milk should be boiled if fed to calves or swine.

9. The handling of the calves from abortion reactors is not a matter of much concern, prior to sexual maturity, so far as the permanent infection of these calves is concerned. No special changes in management are required, since the young animal in a great majority of cases effectually overcomes the abortion infection before reaching sexual maturity.

The young heifer on reaching breeding age should, however, be carefully protected from "open cases" or carriers of abortion infection; namely, cows that have recently aborted, and abortion reactors that have recently calved. Heifers (and gilts) when sexually mature are susceptible to permanent infection before breeding, as well as after becoming pregnant, although the susceptibility is probably greater during the pregnant state.

Proper protection therefore should be given to all sexually mature animals, both before and after breeding.

10. While the bull, as a rule, is not the most important factor in the spread of abortion infection, it is preferable not to use an abortion reactor; and no reacting bull should be allowed to run free with the herd.

If from necessity, or other valid reason, a reacting bull is used, a special breeding pen should be provided, to be used for this purpose only. The sheath of the bull should be flushed out a half hour or more before service, and a canvas bag muzzle should be placed over the mouth of the cow while in contact with the bull. Moreover, after service the coat of the cow, and especially the rump, tail and vulva, should be sprayed or sponged with a coal-tar disinfectant. The cow should then be isolated a few days and sprayed again with the disinfectant before she is returned to the herd.

To lessen the dangers of infecting a clean bull, when bred to an infected cow, flush out the vagina of the cow before service, and the sheath of the bull after service.

Avoid the use of strong disinfectants in flushing out the vagina or the sheath, since a disinfecting solution strong enough to destroy the bacteria will irritate the tender mucous membranes. A copious washing with a warm salt solution is preferable—a tablespoonful of table salt to each gallon of warm water makes a very suitable cleansing wash for the purpose mentioned.

11. In the management of a herd of cattle (or swine), a rigid rule should be adopted and adhered to by every breeder—requiring the temporary isolation of all sexually mature breeding animals that are purchased, and the application of the serological abortion test before admission to the home herd. This also applies to nurse cows that may be needed in show herds, and to cows (and sows) sent in from other herds to be bred. Clean herds of purebred cattle (and of swine) have become infected and have suffered severe loss from these sources of infection.

12. A systematic testing and retesting of an abortion-infected herd should be carried out until the herd is free from the disease. All the young heifers should be tested after reaching breeding age, and especially after they have been bred a few weeks. The entire herd should be tested two or three times yearly, or oftener as circumstances may require. The drawing of the blood samples is such a simple matter, and the disturbance to the animal so slight, that these tests should not be neglected in valuable purebred herds. The services of the laboratory of the veterinary department of the College of Agriculture are available for these tests, without cost to the cattle and swine breeders.

13. The "Health Certificate" for the admission of breeding cattle from other states into this state, which at present requires the "tuberculin test," should also require the the "abortion test" for all sexually mature breeding cows and bulls.

There is scarcely any state from which Missouri dairymen and cattle breeders purchase purebred cattle that is not already provided with the necessary laboratories and veterinary personnel to carry out the "abortion test" on all their outgoing cattle. And the extra cost of furnishing this

additional protection to the cattle industry of this and other states would amount to but little. The losses to cattle breeders in this state, resulting from the introduction of infectious abortion from other states, has already reached a considerable amount, and measures should be adopted to prevent further loss from this source.

14. All sexually mature breeding cattle offered for public sale should be free from the Bang abortion infection, as well as from tuberculous infection. An official certificate to that effect should be furnished each purchaser.

15. As vaccination with the "live culture" vaccine for immunizing cattle (and swine) against infectious abortion increases the number of permanent "carriers" and potential spreaders of abortion disease, its general and unofficial use should be prohibited.

The use of such "live cultures" should at least be surrounded by the strictest measures of governmental control, and not be allowed the loose tolerance, and even assumption of official endorsement, that is now permitted by a defective federal system of licensing and controlling biological products. For unfortunately, under the present regulations, it seems to be impossible or impracticable to prevent commercial concerns from putting on sale and exploiting in a large way vaccine whose value has not been determined, and which subsequent investigations prove to be worthless and potentially dangerous, as shown by public statements of officers of the Federal Bureau. The defects in the regulations should be corrected and the regulations should then be strictly enforced.

Active immunization (even the imperfect immunization that may be acquired by natural infection, or by artificial inoculation with the "live germs") might indeed in some situations be desirable were it not for perpetuating the infection in permanent carriers and spreading the disease to other herds by traffic in the vaccinated breeding cattle.

Cattle can be "immunized" against Texas fever but unfortunately such cattle are thereafter permanent carriers of Texas fever infection, and under certain conditions are dangerous to susceptible cattle. For this reason the Southern stockmen have chosen, as a permanent solution of the problem, the large-scale plan of controlling and ultimately eradicating the disease by quarantining the infected cattle when carrying "open infection"—namely, the Texas fever ticks—and by destroying these intermediate infection bearers over large areas by systematic dipping or spraying of the host under official supervision.

The South is destined to be a great market for many years for purebred breeding cattle from the North; and the cattlemen of that section will be unwise indeed if, after the labor and expense they have borne for so many years in getting rid of Texas fever, they do not take adequate precautions against the further introduction and spread of the Bang abortion disease. And cattle breeders of the North will be equally unwise if they do not pursue a policy that will prevent the increase of abortion reactors in their herds, and ultimately eradicate the disease wherever the infection exists.

Cattle can also be "immunized" against tuberculosis, in the same sense that they may become tolerant to the presence in their tissues of the living tubercle bacilli; and may not suffer seriously from the toxic products of these microbes, and may even grow fat. But no sensible breeder of the present day would allow his herd of purebred cattle to be injected with the Behring Bovo-vaccine, or other highly praised vaccine, containing the living germs of tuberculosis. On the contrary, he prefers even the drastic method of slaughter and eradication to that of attempted immunization,

since he knows that an apparently healthy (or immune) tuberculous animal is liable to become an "open case" of tuberculosis, and an active distributor of tubercle bacilli. He is therefore giving every possible aid toward eradicating this disease.

The parallels here drawn between the Bang abortion infection, and Texas fever, and tuberculosis, are not fanciful sketches, but the presentation of a practical lesson to which live stock raisers and live stock sanitary officers should give due heed.

16. In conclusion, the fact should be emphasized that effective measures for the control of abortion disease in individual herds are now available, and that these measures are practical. It only remains to apply them, in a proper manner, and more extensively.

It is evident, however, that success cannot be attained unless the special though simple details of herd and stable management, which have been mentioned, are carried out in an intelligent and diligent manner. The larger burden of this work must of necessity fall upon the owners and upon the herdsmen who are in immediate charge; but a special obligation rests upon the veterinary practitioners, and the live stock sanitary officers, in the course of their professional or official duties, to give to the men in immediate charge of the herd proper and practical instruction in what to do, how to do it, and when to do it.

Moreover, the veterinary practitioners, and especially those practitioners who have been honored by the state with appointments as special sanitary officers should look upon this disease as one belonging to the category of glanders, tuberculosis, Texas fever and other eradicable diseases, and should pursue a policy with respect to it that will lead to its extinction. It is true that there are ready financial profits to the veterinarian from attempts to immunize herds against this disease, by injecting them with the living cultures of the abortion germs, but that road is not the true way to render the most efficient service to a client, and to the cattle industry of the state. The better way is to cooperate in the fullest manner with the cattle raisers and dairymen, and their herdsmen, in carrying out the practical suggestions outlined in the foregoing pages. Richer rewards will come to all.