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Control and Eradication of Brucella Abortus Infection in a Dairy Herd

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*Control and Eradication of
Brucella abortus Infection
In a Dairy Herd*

by J. H. RIETZ and G. A. BOWLING

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Control and Eradication of *Brucella abortus* Infection in a Dairy Herd

By J. H. RIETZ and G. A. BOWLING *

OWNERS OF HERDS of cows in which infection with *Brucella abortus* is found frequently ask: "What can be done to control and eradicate infections abortion?" They have been advised to proceed as follows: (1) Test the entire herd and either sell for slaughter all reactors, or separate them from the non-reactors, establishing a completely separate and isolated herd of the reactors. (2) Test the remaining non-reactors at frequent intervals, until the danger of further spread of the disease from exposure to the reactors and infected premises has passed. (3) Remove all reactors that are found after each test, selling them for slaughter or placing them in the isolation or quarantine herd. (4) Make monthly tests of the herd until at least three or four consecutive free tests have been made.

The owner usually objects to the immediate-slaughter plan because of the financial loss incurred by sacrificing otherwise valuable breeding and dairy animals at meat prices. Blood lines that have been established over long periods of time cannot be replaced if these animals are slaughtered before the proper offspring are available to carry on the breeding work. Owners object also to the complete-isolation plan because of the additional equipment in pastures, housing facilities, and labor necessary to maintain two separate herds.

To overcome partially the objections to the plans enumerated, it was attempted to control and eradicate *Brucella abortus* infection in the dairy herd of the West Virginia Agricultural Experiment Station by a system of frequent testing and herd management that involved part-time isolation of the reactors.

The basis for assuming that the control and eradication of *Brucella Abortus* infection might be accomplished by a system of herd management and testing is the fact that the causative organisms pass from the genital tract of reactors only for relatively short periods of time following parturition or abortion according to Fitch and co-workers (1) and Cotton (2).

* The authors wish to acknowledge the cooperation of Prof. H. O. Henderson, Dr. E. N. Moore, and Messrs. R. A. Ackerman, C. E. Teague, and L. F. Herrmann, who assisted in various ways in the conduct of this project.

HISTORY OF THE HERD

In 1925 and 1926 the United States Department of Agriculture tested the blood of the West Virginia herd, finding 11 and 12 reactors, respectively. The testing of the blood in the laboratory of the Experiment Station was begun in January, 1928, and was repeated at irregular intervals until May, 1930, when regular monthly testing was inaugurated. Table 1 shows the results of the testing before active experimental measures were taken in the attempt to control and eradicate the disease in the herd.

TABLE 1—*History of Brucella abortus infection in the dairy herd before active control measures were started*

Test No.	Date	Number tested	Negative	Positive	Suspects	Remarks
1	1925			11		Tested by U. S. D. A.
2	1926			12		Tested by U. S. D. A.
3	Jan. 1928	51	37	11	3	Tested by W. Va. Exp. Station
4	May, 1928	52	32	14	6	Tested by W. Va. Exp. Station
5	Nov. 1928	52	29	17	6	Tested by W. Va. Exp. Station
6	Apr. 1929	64	43	17	4	Tested by W. Va. Exp. Station
7	Nov. 1929	74	48	19	7	Tested by W. Va. Exp. Station
8	May, 1930	80	54	22	4	Tested by W. Va. Exp. Station

From January, 1928, until May, 1930, the number of reactors in the herd increased from 11 to 22 under the usual herd management, no special effort being made to eliminate the reactors. During this period the number of animals tested also increased from 51 to 80. This would indicate that the percentage increase in reactors and suspects was only 5 percent in two years. The 51 animals tested in 1928 were adult animals, and throughout the entire experiment almost all the reactors have belonged to the adult group. No effort was made during the period from 1925 to November, 1929, to test the entire herd. Even during the period May, 1930, to November, 1933, cows in advanced stages of pregnancy were sometimes omitted from the monthly test to avoid possible injury to the animal. The bulls were tested approximately at three-month intervals.

THE TEST

The tube-agglutination method of testing the blood was used before and during the active period of control and eradication. The blood was drawn from the jugular vein into sterile vials under approved antiseptic conditions. The vials were sloped until the blood had clotted

and adhered to the vial wall. The vials were then placed in the refrigerator until the serum had separated from the clot.

The amounts of serum used for titrating each blood specimen for agglutination were 0.08, 0.04, 0.02, and 0.01 c.c. These respective amounts of serum represent dilutions of 1:25, 1:50, 1:100, and 1:200 in the test-tube test when used with 2 c.c. of antigen (test fluid). The tubes were read at the end of 48 hours with incubation at 37.5° C.

In Table 2 is shown the interpretation of the various degrees of reactions in the dilutions used in the tests.

A partial agglutination at 1:25 dilution was disregarded, but a complete agglutination at this dilution was regarded as a suspect on the first test. Upon subsequent test if no rise occurred in the titre of agglutination, this partial agglutination was regarded as not significant of infection.

A partial or complete agglutination at 1:50 dilution was regarded as a suspect on the first test. If this partial agglutination persisted in subsequent tests without change of the titre upward, it was regarded as negative.

A partial or complete agglutination at 1:100 or higher was regarded as positive.

TABLE 2—*Interpretation of reactions in dilutions used in tests*

Dilutions				Diagnosis
1:25	1:50	1:100	1:200	
—*	—	—	—	Negative
+	—	—	—	Negative
+	+	—	—	Suspect
+	P‡	—	—	Suspect
+	+	+	+	Positive
+	+	+	—	Positive
+	+	P	—	Positive

‡ P = partial agglutination.

* The symbol "—" indicates agglutination; "—" indicates negative to agglutination.

ADDITIONAL EQUIPMENT

To isolate and control the reactors and suspects properly, it is necessary to provide a maternity ward or barn with sufficient box stalls and stanchions to accommodate the maximum number of reactors and aborters that might calve or abort during any period of eight weeks. The boxstalls were curbed on all sides to prevent drainage from one to another.

The maternity ward was so constructed that cleaning and disinfecting could be accomplished easily. The location of this building was such that the drainage and manure were diverted from the pastures, lots, and barns.

PLAN OF MANAGEMENT

1. All animals in the herd six months of age or older were tested once monthly. This was thought necessary in order that new reactors could be detected promptly and handled in the proper manner to prevent the spread of the infection.

2. Pregnant reactors were observed once daily for indications or symptoms of abortion. This was necessary to prevent, as far as possible, abortions from taking place outside the maternity ward.

3. Reactors or other animals showing symptoms of abortion were transferred promptly to the maternity ward and confined there until the symptoms disappeared or an abortion occurred. If an abortion occurred the animal was retained in the ward for a period of six weeks, then returned to the herd. If the symptoms disappeared without an abortion, the animal was returned to the herd.

4. Reactors were transferred to the maternity ward two weeks before the normal date of parturition and were retained in the ward for a period of six weeks after parturition. If a discharge from the genito-urinary tract still existed at the expiration of the six-weeks period, that animal was retained until the discharge ceased.

Isolating the reactors two weeks before normal parturition time was thought necessary because many cows deliver normal calves a few days short of the usual gestation period.

5. All animals placed in the maternity ward were washed over the legs and lower portions of the body with a disinfecting solution before being returned to the general herd. This measure was taken to prevent, if possible, the mechanical carrying of the infection to the herd.

6. The boxstall or stanchion in the maternity ward in which a reactor suspect or aborter had been confined was cleaned and disinfected after the removal of any such animal, before another animal was placed therein. This was thought necessary to reduce the amount of infection in the maternity barn, thereby reducing somewhat the possibility of fresh infection available to animals added to the quarantine.

7. Reactors were sold for slaughter as their period of profitable production ended and as replacements could be made with heifers coming into production.

8. The manure and drainage from the maternity ward was handled through a special manure pit surrounded by a fenced lot to exclude cattle. This manure was spread upon land in tillage.

9. A pan of disinfecting solution was always kept inside the entrance to the quarantine barn, and all persons entering this barn were requested to dip the soles of their shoes in this solution before leaving the building.

10. Animals that aborted outside the quarantine barn were promptly transferred to this barn and handled as other animals in quarantine. When possible, the place where the abortion occurred outside the quarantine barn was disinfected.

11. Calves from both reactor and non-reactor dams were kept in lots, pens, or pastures entirely separate from other classes of animals during the period of milk feeding. This was done to prevent the

mechanical carrying of infection through the calves' dung as a possible means of spreading infection among susceptible animals.

At least 60 days was allowed to elapse between the end of the period of feeding calves on milk from the positive animals and allowing such calves to associate with susceptible animals.

12. Aborted fetuses and fetal placentas as well as fetal placentas from reactor cows were buried or burned.

RESULTS

In Table 3 is shown the classification of the animals in the herd by months from May, 1930, the beginning of the experiment, to November, 1933 six months after the disposal of the last reactor.

The number of animals in the herd remained at practically the same level throughout the experiment. During the entire period covered by this experiment, 163 individual animals were tested one or more times. Of this number 130 animals were completely and consistently negative and 22 of them were completely and consistently positive.*

In June, 1930, three animals, numbers E-35, E-36, and E-37 became reactors. This was one month after the beginning of the experiment. These three animals were yearling heifers that may have become infected before the beginning of this experiment.

In August, 1930, animal 192 became a reactor; this was three months after the beginning of the experiment and may possibly have resulted from exposure before the beginning of the experiment, but probably should be considered a break.

In December, 1930, animal 312 became a reactor. This animal was added to the herd in April, 1930. This was seven months after the experiment was begun and must be classed as a cross-infection or break.

In June, 1931, animal 252 became a reactor. In April this animal gained access to the lot in which the quarantine ward manure pit was located and was seen eating of the bedding from the quarantine ward. This probably accounts for the break.

In December, 1931, animal 310, an open heifer, became a reactor. The circumstance cannot be explained on the basis of available information.

Six animals that at one time were classified as positive, ceased to react and were reclassified as negative. In Table 4 are shown the degrees of reactions of this group and the classification of the animals. The animals in this group were isolated as provided for reactors and suspects, until they were considered negative.

Five animals were classified as suspects at the time the control measures were begun. Two of these animals were sold as suspects and three of them were later reclassified as negative. The test records of these five animals are shown in Table 5. Animal 81 of this group was

* The test charts of the consistently negative and consistently positive animals have been omitted from this report.

TABLE 3—*Classification of animals in the dairy herd and disposition of reactors and suspects*

Test No.	Date	No. of animals tested	No. of animals negative	No. of animals positive	No. of animals suspects	No. new positives	Changes pos. to suspect	Changes suspect to negative	Positives sold
1	5-30	80	54	22	4	0	0	0	0
2	6-30	79	55	20	4	3	0	0	5
3	7-30	79	55	20	4	0	0	0	0
4	8-30	81	56	21	4	1	0	0	0
5	9-30	78	53	21	4	0	0	0	0
6	11-30	74	54	17	7	0	3	0	0
7	12-30	77	56	18	5	1	0	4	0
8	1-31	77	56	17	5	0	0	0	1
9	2-31	79	57	17	4	0	0	0	0
10	3-31	77	57	15	5	0	1	0	1
11	4-31	78	58	15	5	0	0	0	0
12	5-31	78	59	14	5	0	0	0	1
13	6-31	82	62	15	5	1	0	0	0
14	7-31	81	64	15	2	0	0	3	0
15	8-31	84	67	14	3	0	1	0	0
16	9-31	89	72	14	3	0	0	0	0
17	10-31	89	74	12	3	0	0	0	2
18	11-31	84	71	10	2	0	1	0	1
19	12-31	86	73	10	2	1	0	0	1
20	1-32	85	72	10	2	0	0	0	0
21	2-32	83	71	8	3	0	1	0	1
22	3-32	82	71	8	3	0	0	0	0
23	4-32	82	73	6	3	0	0	0	2
24	5-32	80	73	4	3	0	0	0	2
25	6-32	79	72	4	3	0	0	0	0
26	7-32	79	74	3	1	0	0	2	1
27	8-32	79	74	3	1	0	0	0	0
28	9-32	78	73	3	1	0	0	0	0
29	10-32	78	73	3	1	0	0	0	0
30	11-32	75	71	3	0	0	0	0	1
31	12-32	74	71	3	0	0	0	0	0
32	1-33	74	71	3	0	0	0	0	0
33	2-33	80	77	3	0	0	0	0	0
34	3-33	73	71	2	0	0	0	0	1
35	4-33	76	75	1	0	0	0	0	1
36	5-33	78	77	1	0	0	0	0	1
37	6-33	83	83	0	0	0	0	0	0
38	7-33	80	80	0	0	0	0	0	0
39	8-33	80	80	0	0	0	0	0	0
40	9-33	84	84	0	0	0	0	0	0
41	10-33	86	86	0	0	0	0	0	0
42	11-33	86	86	0	0	0	0	0	0

TABLE 4—*Reactions of positive animals that became negative*

Test No.	Date	Animal 168	Animal 218	Animal 252	Animal E-36	Animal E-37	Animal 280
1	5-30	++++	++++	-----	++--	+	++++
2	6-30	++++	++++	-----	+++ P	++++	++++
3	7-30	++++	++++	-----	++++	++++	++++
4	8-30	++++	++++	-----	++++	++++	+++--
5	9-30	+++--	++ P--	-----	++++	++++	+++--
6	11-30	++--	+++--	-----	-----*	-----*	-----*
7	12-30	++ P--	+++ P	-----	+----	+----	+----
8	1-31	++ P--	++ P--	-----	P----	-----	-----
9	2-31	++--	+++--	-----	P----	-----	-----
10	3-31	++--	++ P--	-----	-----	-----	-----
11	4-31	++++	++ P--	-----	-----	-----	-----
12	5-31	++++	++--	-----	-----	+----	-----
13	6-31	+++ P	++++--	+++++	-----	+----	-----
14	7-31	++ P--	++--	+++++	+----†	+ P----†	-----†
15	8-31	+++--*	+-----	+++ P	+----	-----	-----
16	9-31	++--	++ P--	+++ P	+----	+----	-----
17	10-31	++--	++--	++--	+----	+----	-----
18	11-31	++--	+++--	+ P----*	+----	+----	-----
19	12-31	++--	+++--	+ P----	+----	+----	-----
20	1-32	++--	++ P--	+ P----	+----	+----	-----
21	2-32	+ P----	+++--*	+----	+----	+----	-----
22	3-32	++--	++--	+----	+----	+----	-----
23	4-32	++--	+----	P----	+----	+----	-----
24	5-32	-----	+ P----	P----†	+----	+----	-----
25	6-32	++--	+----	P----	+----	++--	-----
26	7-32	+++--†	++--	-----	+----	+----	-----
27	8-32	++--	+----†	-----	+----	+----	-----
28	9-32	+----	+----	-----	+----	+----	-----
29	10-32	+----	+ P----	-----	+----	+----	-----
30	11-32	+----	+----	-----	-----	-----	-----
31	12-32	+ P----	+ P----	+----	-----	-----	-----
32	1-33	+----	+ P----	+----	-----	-----	-----
33	2-33	++--	+ P----	+----	+----	-----	-----
34	3-33	++--	+----	+----	+----	sold	-----
35	4-33	+ P----	+----	-----	sold		-----
36	5-33	+----	+----	-----			-----
37	6-33	+----	+----	-----			-----
38	7-33	+----	+----	-----			-----
39	8-33	P----	+----	-----			-----
40	9-33	+----	+----	-----			-----
41	10-33	+----	+----	-----			-----
42	11-33	P----	-----	-----			-----

* Considered suspect.
† Considered negative.

P = Partial agglutination.

TABLE 5—*Degree of reaction of the suspect group*

Test No.	Date	Animal 40	Animal 81	Animal 116	Animal 147	Animal 256
1	5-30	+ + - -	+ - - -	+ - - -	+ + - -	P - - -
2	6-30	+ P - -	+ P - -	+ P - -	+ P - -	+ P - -
3	7-30	+ + P -	+ + P -	+ P - -	+ - - -	+ P - -
4	8-30	+ P - -	+ + P -	+ P - -	+ P - -	+ P - -
5	9-30	+ P - -	+ P - -	+ - - -	+ - - -	P - - -
6	11-30	P - - -	+ P - -	+ - - -	P - - -	P - - -
7	12-30	+ P - -	+ P - -	+ P - -	P - - -	+ - - -
8	1-31	+ P - -	+ + P -	+ - - -	+ P - -	- - - -
9	2-31	+ - - -	+ P - -	+ - - -	+ P - -*	P - - -*
10	3-31	+ - - -	+ P - -	+ - - -	+ P - -	- - - -
11	4-31	+ - - -	+ - - -	+ - - -	+ - - -	- - - -
12	5-31	+ - - -	+ - - -	P - - -	+ - - -	- - - -
13	6-31	+ P - -	+ P - -	+ + - -	+ + - -	+ - - -
14	7-31	+ P - -	+ + - -	+ P - -	+ P - -	+ P - -
15	8-31	+ P - -	+ + - -	+ + - -	+ P - -	P - - -
16	9-31	+ P - -	+ + - -	+ + - -	+ + - -	+ - - -
17	10-31	+ P - -	+ P - -	P - - -	- - - -	+ - - -
18	11-31	+ P - -	+ + - -	sold	+ + - -	+ P - -
19	12-31	+ P - -	+ + - -		+ + - -	+ - - -
20	1-32	+ P - -*	+ + - -		+ + - -	+ P - -
21	2-32	+ P - -	+ P - -		+ P - -	+ - - -
22	3-32	+ P - -	+ P - -		+ P - -	P - - -
23	4-32	+ P - -	+ P - -		+ P - -	+ - - -
24	5-32	+ P - -	+ P - -		+ P - -	+ - - -
25	6-32	+ P - -	+ + - -		+ P - -	+ - - -
26	7-32	+ + - -	+ + - -		+ + - -	+ - - -
27	8-32	+ + - -	+ P - -		+ + - -	+ - - -
28	9-32	+ - - -	+ P - -		+ + - -	P - - -
29	10-32	+ - - -	+ - - -		+ + - -	+ - - -
30	11-32	+ - - -	+ P - -		+ + - -	+ - - -
31	12-32	+ - - -	sold		+ P - -	+ - - -
32	1-33	+ - - -			+ - - -	+ P - -
33	2-33	+ P - -			+ + - -	- - - -
34	3-33	+ P - -			+ + - -	- - - -
35	4-33	+ P - -			+ P - -	- - - -
36	5-33	+ P - -			+ + - -	- - - -
37	6-33	+ P - -			+ + - -	- - - -
38	7-33	+ - - -			+ - - -	- - - -
39	8-33	+ P - -			+ P - -	- - - -
40	9-33	+ P - -			+ + - -	- - - -
41	10-33	+ - - -			+ + - -	- - - -
42	11-33	- - - -			+ P - -	- - - -

* Considered negative.

a reactor before May 1930. This accounts for the long period of time this animal was classed as a suspect.

In Table 6 are shown the reasons for the elimination of the reactors and suspects from the herd. Two animals were eliminated to terminate the experiment; all other animals eliminated showed sufficient cause for their elimination, even if they had not been reactors.

TABLE 6—Disposition of reactors and suspects

No. of animals	Classification	Reasons for elimination or reclassification
8	Reactor	Poor producers
6	Reactor	Failed to conceive
2	Reactor	Two blind quarters each
1	Reactor	Tumor on the eyeball
1	Reactor	Died at time of parturition
1	Reactor	Neck broken (accidental)
1	Reactor	Unbred heifer—sold
6	Reactor	In the herd as non-reactors and classified as negative
2	Reactor	Eliminated to terminate experiment
1	Suspect	Old
1	Suspect	Failed to conceive
3	Suspect	In the herd as non-reactors and classified as negative

TABLE 7—Calving record of the dairy herd

Classification	Year			
	1930	1931	1932	1933*
Negative cows dropping living calves, full-time gestation	25	25	40	23
Negative cows dropping dead calves, full-time gestation	2	1	1	0
Negative cows aborting	2	2	1	1
Suspect cows dropping living calves, full-time gestation	1	5	3	0
Suspect cows dropping dead calves, full-time gestation	0	0	0	0
Suspect cows aborting	0	0	0	0
Positive cows dropping living calves, full-time gestation	12	2	3	0
Positive cows dropping dead calves, full-time gestation	1	1	0	0
Positive cows aborting	5	3	0	0

* January, 1933, to June 30, 1933.

The calving record of the herd from January 1, 1930, to June 30, 1933, is shown in Table 7. Six abortions as well as four dead calves of full-time gestation occurred in the negative group, and eight abortions and two dead calves of full-time gestation occurred in the positive group. The negative group averaged 66.3 animals tested per month, while the positive group averaged 10.4 animals tested per month.

During the period covered by this work, 37 isolations were made in the quarantine barn on account of parturitions and abortions. Of this number 31 were reactors and suspects and 6 were negatives.

BULLS

The bulls were first tested in November, 1928, and from that time forward a total of eleven bulls were tested in the herd. One bull reacted on the first test and remained a consistent reactor until September, 1931, when he was sold for slaughter. This animal was used only for breeding reactor cows.

DISCUSSION

The success of the plan described in this report and executed in the dairy herd of the West Virginia Agricultural Experiment Station depends upon the ability of the management to carry out many details. Herd owners should have their equipment examined and checked by a competent person before attempting to control and eradicate abortion disease by this method.

SUMMARY

There were 22 reactors in the West Virginia Agricultural Experiment Station dairy herd on May 1, 1930, the beginning of the experiment.

During the time covered by this experiment seven additional reactors appeared in the herd. Three of these appeared the month following the beginning of the experiment. One animal gained access to the quarantined manure pit. The remaining three breaks cannot satisfactorily be accounted for.

Twenty-two reactors were sold for slaughter, six became non-reactors and were in the herd at the termination of the experiment, and one was reclassified as a suspect and sold for slaughter while so classified.

One reactor only was retained in the quarantine longer than six weeks following parturition. This animal was retained eight weeks on account of a vaginal discharge.

All reactors had been eliminated from the herd by May, 1933, and the herd was considered clean at that time.

Replacements were made from heifers produced in the herd, excepting where purchase was made for new blood lines.

Brucella abortus infection was eliminated from the dairy herd of the West Virginia Agricultural Experiment Station by the prescribed system of frequent testing and herd management.

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