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Bang's Disease (Infectious Abortion)
Michigan State University Extension Service
B.J. Killham
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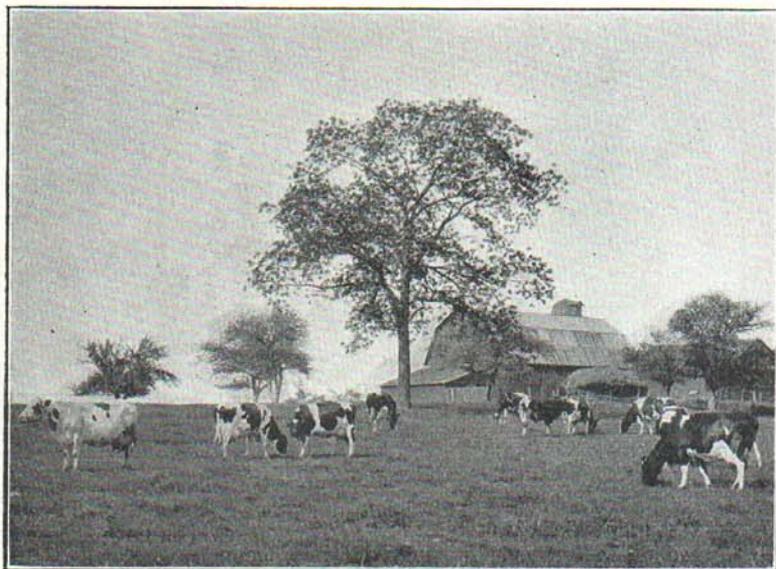
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BANG'S DISEASE

(*Infectious Abortion*)

B. J. KILLHAM

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MICHIGAN STATE COLLEGE
Of Agriculture and Applied Science

EXTENSION DIVISION
R. J. Baldwin, Director

SECTION OF ANIMAL PATHOLOGY

East Lansing, Michigan

BANG'S DISEASE

B. J. KILLHAM

It is the purpose of this bulletin to review some of the established facts relating to the disease and to consider practical control methods and the reasons why such measures should be applied by the cattle owner.

The control of this disease presents one of the largest problems confronting the livestock owner. The disease is spreading rapidly and an ever increasing toll is being exacted. The plea that more complete knowledge should be had before control efforts are launched should be condemned. Other animal diseases of which less is known have been eradicated from the United States or placed under practical control. Sufficient information of a sound nature is available for guidance in control work. This knowledge has been successfully applied in many states.

NATURE OF DISEASE

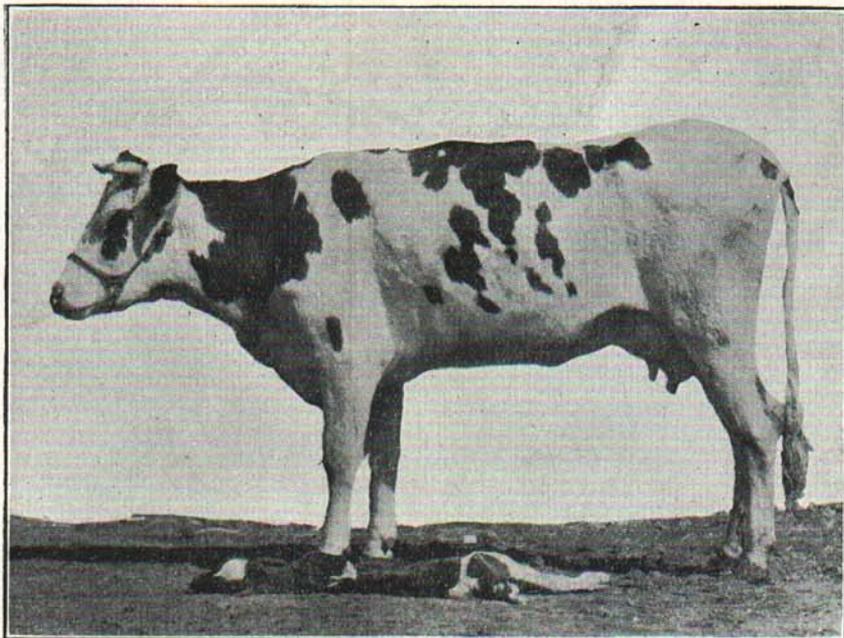
The names or terms usually applied to the abortion disease are misleading. The term Bang's Disease, so-called in honor of the Danish discoverer of the causative germ, is now used but too often the name applied includes the word abortion in a way that leads the uninitiated to believe that the disease is marked by abortions and abortions only. A result of this attitude is the belief that if there are few or no abortions in a herd or if abortions have been numerous and have subsided as to number or have possibly disappeared for a time, the disease is cured or under control. This opinion is incorrect but because of its existence vendors of so-called remedies for the disease have been able to sell their products to cattle owners who actually believe that results are obtained through the use of such materials.

CONDITIONS PRODUCED

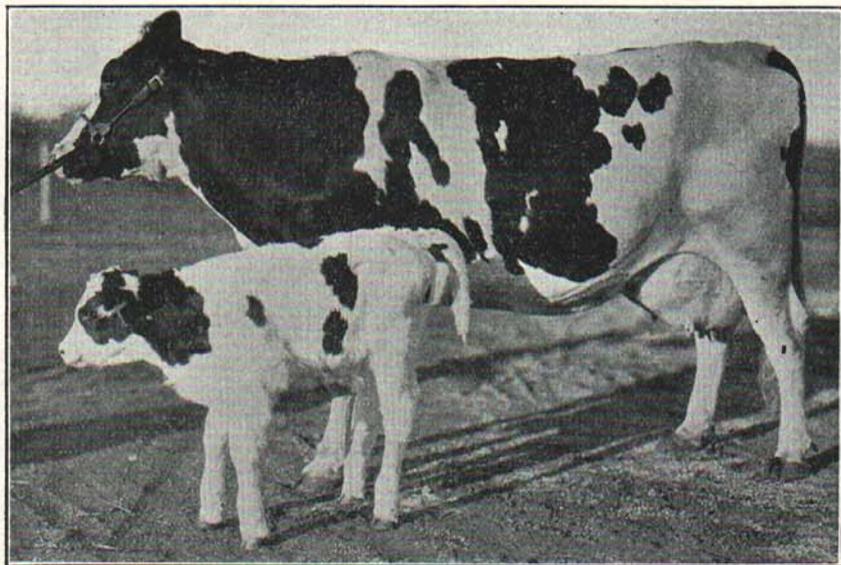
Bang's Disease is characterized by conditions other than abortions and it is possible for cows to be affected with the disease and not abort during any period of pregnancy. The conditions which mark the disease may be outlined as follows:

Abortions	
Retained afterbirths	
Breeding difficulties	
Udder disease	
Pneumonia	} in calves
Scours	

Which Shall It Be



This



Or This

Abortions

It is probably true that a majority of the cows affected with this disease will abort and it is also probable that most aborters will abort but once. There is no rule, however, regarding the number of abortions, the period of pregnancy that may be involved, or the month of pregnancy during which an abortion may take place, and, as indicated, some cows may more or less consistently produce calves despite the presence of this disease.

Retained Afterbirths

Retained afterbirths are always aggravating and frequently the forerunners of serious trouble, particularly if improperly treated. *Brucella abortus*, the germ which causes the abortion disease, may be directly or indirectly responsible for the retention of afterbirths.

Breeding Difficulties

It is becoming more and more apparent that breeding difficulties for which this germ is primarily responsible are the cause of the greatest losses in connection with the abortion disease. These difficulties may range in seriousness from the cases wherein it is necessary to breed the affected cow two or more times to the cases in which the cow is completely and permanently sterile. Undoubtedly, the possibility of loss in this respect has not been sufficiently emphasized. The cow which becomes affected and aborts once and thereafter produces calves more or less consistently is subjecting its owner to a material loss but that loss becomes insignificant when compared to that which occurs when the valuable dairy or breeding cow is entirely disqualified as a breeder or producer because of the disease and becomes a total loss except for the salvage price which the butcher will pay.

The following brief data, obtained from a large herd from which a relatively large number of reactors was removed during a period of several years duration, illustrates the breeding difficulties that may be encountered.

Relation of Abortion Disease to Reproduction

(Large Herd over Period of Years)

Reactors	Per cent	Per cent*
Heifers—Never became pregnant.....	6.0	6.0
Aborted	67.0	
Continued to produce calves	27.0	
	100.0	
 Aborters		
Aborted once	65.0 (28% sterile)	12.2
Aborted twice	23.0 (33% sterile)	5.1
Aborted three times	5.0 (100% sterile)	3.4
Aborted four times	5.0 (50% sterile)	3.4
Aborted five times	2.0 (100% sterile)	1.3
	100.0	

*Aborted more than three times or became permanently sterile

31.4

It will be noted that the first group refers to the reactors or animals which indicated that they were infected through reacting to the blood test and the second group relates to the 67 per cent of the first group which aborted. The percentage figures on the extreme right relate to the whole number of reactors rather than to the aborters only as might be inferred through the position of such figures.

The final summary which shows that 31.4 per cent of the affected cows and heifers were practically disqualified as breeders and producers is rather startling but it is believed that this is not a true indication of what might be expected under average farm conditions. This particular herd had expert veterinary service available for the treatment of sterility and no animal was classed as sterile if it responded to treatment at any time and conceived. Such veterinary service would not be available or its cost would be prohibitive under average farm conditions. Hence, it would not be unreasonable to assume that the percentage of animals which would become permanently sterile under such average conditions would be much higher and instead of 31.4 per cent of disqualified cattle 40 per cent to 50 per cent might be encountered.

Udder Disease

Until recent years, it was not believed that *B. abortus* injured the udder in any way although the organism was frequently isolated from the udder and milk. It has now been demonstrated, however, that the germ does injure the udder. The condition produced primarily would probably not reach proportions that would cause it to be recognized as garget or mastitis by the cattle owner but the injury caused frequently serves as an entrance for other types of organisms which can, and all too frequently do, cause serious udder trouble. Also, any injury to the functional udder tissue no matter how slight may logically be assumed to be responsible for interference with the productive ability of the affected udder.

Calf Diseases

Calves dropped by cows affected with the abortion disease after having been carried through a gestation period approximately normal as to length may exhibit symptoms of pneumonia or scours shortly after birth. These conditions may be directly due to *B. abortus*.

Complex Disease

In brief, this is a disease marked not only by abortions but responsible also for at least three other major conditions in mature cattle, if we may consider the breeding difficulties as a single condition, and possibly two important conditions in the calf. It is not the intention to convey the impression that all of the conditions mentioned are always due to Bang's Disease. Any of these conditions may be produced by other means, even the abortions, but in far too many instances the *B. abortus* is the direct or indirect cause. Cows affected with the disease may or may not abort and abortions may occasionally be due to other causes, but too great emphasis can not be placed on the probable fact that 90 per cent or more of the cattle abortions occurring in Michigan are due to this disease. If progress in control efforts is to be made, the issue will have to be faced

squarely on this basis and action governed accordingly. There is far too much inclination to attribute abortions to other causes and to spend time and effort in endeavoring to develop an excuse or in building up an alibi for the aborting animal rather than to confront the situation frankly with the realization that in the vast majority of cases the trouble is due to this very prevalent disease.

WHY SHOULD DISEASE BE CONTROLLED

The reasons for controlling Bang's Disease are numerous and should be considered from two aspects. First, that of human health and second, that of the cost of the disease as that subject relates to the person who owns cattle.

Effect on Human Health

The health of the human race is a very important asset, and obviously anything which may adversely affect human health should be given careful consideration. It has been established that undulant fever is produced by *B. abortus*, the same germ that causes Bang's disease in cattle. There may be a question, however, regarding the way by which the germ enters the human body. That infection is established through milk or milk products which contain the germ appears to be definitely proved, although the danger in this respect does not appear to be great. The theory has been advanced that the average person has considerable ability to combat *B. abortus* when encountered in milk or milk products, and possibly the mixing of milk from infected cows with other milk results in such a dilution of the germ's concentration that the danger of infection is greatly reduced. A great mass of data show that persons contacting infected animals, alive or dead, frequently contract undulant fever. The disease is more common among farmers, veterinarians, and meat handlers. The closely related germ, *B. suis*, which is the type usually found in the hog, appears to be more virulent for the human being than *B. abortus*. Future investigations may reveal additional reasons for anxiety in this respect, but at present there is enough evidence to warrant action by officials interested in conserving human health, and such action, if taken, may have an important effect on the control of Bang's disease in cattle.

Cost of Disease

Any cattle owner who has had Bang's Disease in his herd will undoubtedly admit that the disease is costly, but, obviously, the farmer is not in a position to determine the exact financial damage wrought by this condition.

Graham of the Illinois Experiment Station after a study of the milk records of an infected herd over a period of four years, decided that the aborting cow because of lowered milk production was losing \$54.00 a year.

Davis of the Nebraska Station concluded that the annual loss per aborting cow in the Station herd was \$107.00, but he included in his estimate loss of calves and breeding deficiency as well as loss of milk.

White and associates of the Storrs Connecticut Station have reported for a study of the problem extending over a period of 11 years. They estimate the annual loss for each reacting cow as \$44.01 of which \$28.41 was due to

lowered milk production and the remainder, or \$15.60, was due to the loss of calves and the depreciation of the affected animals. These figures having been compiled as the result of more than a decade of work appear to be worthy of serious consideration. It will be noted that the first two investigators which were mentioned reported for the aborting cow. The Connecticut investigators, however, report for the reacting cow, the cow which indicated that it was infected with the disease through reacting to the blood test for the disease. This information presents a very fair basis for estimating losses caused by cows affected with the disease without giving specific attention to the aborting cows.

Ingham and Meade, reporting from the Maryland Experiment Station, showed a loss of 21.7 per cent in milk and 23.1 per cent in butterfat because of Bang's disease. These same investigators also reported on the production records of 42 cows that were observed both following normal calvings and abortions. The decrease in production following abortions amounted to 34.18 per cent for milk and 31.84 per cent for butterfat.

Obviously the prevalence of Bang's disease has a direct bearing on the cost of the disease to Michigan farmers as a whole. A federal report, covering the testing of 10,332 herds containing 124,828 cattle and located in all parts of Michigan, shows that 34.2 per cent of the herds and 12.3 per cent of the cattle were infected. The incidence of the disease is very low in some of the northern counties; hence, the disease is present to the extent of 15 per cent and more in many of the larger cattle counties.

OTHER REASONS FOR CONSIDERING CONTROL

In addition to the reasons for controlling the abortion disease which relate to human health and economy, there are other important factors which will probably ultimately compel the cattle owner to give serious consideration to control efforts regardless of personal desires or inclination. These factors relate to markets for cattle and cattle products, shows and exhibitions, breeding operations and the movement of cattle, and may be enumerated as follows:

- Milk Ordinances and Regulations
- Regulations—Other States
- Sales
- Fairs and Exhibitions
- Breeding Operations
- Movement of Cattle
- Slaughter

Milk Ordinances and Regulations

It will have to be conceded that the agitation relative to the possibility of persons contracting undulant fever through consuming milk or milk products has resulted in the enforcement of a large number of city and village ordinances or health department regulations restricting the sale of milk coming from cows affected with Bang's Diseases or requiring that such milk be pasteurized. Such restrictions will react upon the cattle owner supplying milk to a city or village with such ordinances. Thus, a barrier

more or less formidable is placed between the producer and his market, probably his best market and possibly his only market.

There may be disagreement as to the seriousness of the danger involved in the possibility of undulant fever being a milk-borne disease, but it is more than probable, that restrictions are going to multiply and will present problems for the farmer who sends milk or milk products to certain cities and villages.

Regulations Other States

On first thought, it might not appear that regulations relating to the abortion disease drafted by other states would in any way affect the Michigan farmer but a little analysis should result in the conclusion that the effect of such regulations will be far-reaching.

Before the tuberculosis eradication campaign was well under way, Michigan was shipping about 3,000 dairy cows to other States each year. Later, when the results of the work were apparent and a confidence in Michigan cattle had been established, such exports exceeded 15,000 per annum. This increase resulted in better prices and an ever ready market for dairy cattle. The farmer who is in the dairy cattle business on a sound basis will not only be interested in the sale of milk and milk products but will occasionally have surplus cattle to offer. The best market for such cattle has been in other states.

The confidence in the freedom of Michigan cattle from tuberculosis is still well-established in other states, but the regulatory authorities are now viewing prospective imported cattle from the standpoint of Bang's disease as well as tuberculosis. Most of the states now have regulations prohibiting the entrance of dairy or breeding cattle affected with this disease. This regulatory idea is growing rapidly and it is reasonable to assume that the remainder of the states will have similar restrictions in the not distant future.

If the Michigan farmer is interested in preserving the market which has been established, it would appear that he will have to give more consideration to the disease which may be responsible for decreasing the demand for surplus cattle.

Sales

Most farmers realize that there is always danger of buying diseased cattle at sales, especially public sales. The possibility of obtaining cattle affected with Bang's disease in this way is great and the fact is beginning to be appreciated. Pure bred cattle organizations are giving this matter serious consideration and blood test requirements for state sales are enforced. It is not unreasonable to assume that other organizations will give the situation serious thought and, if so, it can be expected that the blood test requirement will reach other types of sales and eventually the ordinary farm sale of cattle will become involved. A state law or regulation requiring a clean blood test for all cattle offered at public sales appears imminent.

Fairs and Exhibitions

Because of the movement and handling of cattle incident to exhibiting, and of the conditions prevailing on most fair or show grounds, there is ample opportunity for the spread of Bang's disease if diseased cattle are exhibited. A State Department of Agriculture regulation now requires

that all female cattle over one year of age must pass a negative blood test for Bang's disease before being offered for exhibition at any fair or livestock show in the state. This regulation has, and will, continue to affect cattle exhibitors even though they may not personally favor Bang's disease control.

Breeding Operations

Many good breeders are awakening to the fact that breeding operations may be responsible for the spread of Bang's disease. The owner of the good bull in particular is becoming aroused, and his interest is justified. If a bull is being used by the owner of a herd that is infected with the disease and an abortion occurs, one of the most natural desires would be to breed the aborting cow as soon as possible in order to procure a calf to replace the one just lost at the earliest possible date. An aborter may show indications of estrum within a short time, possibly a few days after aborting. At this time, the affected animal would undoubtedly be discharging material containing the germ that causes the disease and consequently may infect the bull or other cattle on the premises where the bull is kept.

Some owners of bulls are now requiring that cows presented for service be demonstrated to be free from Bang's disease. This attitude should not be considered as entirely selfish. It is fair and sound and the farmer who does not own a bull will have to face the situation sooner or later.

Movement of Cattle

The best opportunity for the spread of this disease from herd to herd comes through the movement of cattle. Certain definite restrictions have been placed for cattle known to be affected. In Michigan, cattle demonstrated to be infected with Bang's disease can legally be moved from the premises of the owner or keeper only for immediate slaughter or to go into known infected herds. The regulations should work no hardship to the farmer for it is not probable that he would want to make any other disposition of an animal he knew to be affected, but the barriers placed will affect the dealer and should be considered by any cattle owner who has animals which are or may be infected.

Slaughter

The possibility of having to slaughter an animal because of Bang's disease may or may not be a serious matter, but it is not probable that the sale to the butcher will often mean a profit on an individual animal. Frequently, slaughter will present the only way, and it usually is the ultimate way, out of the abortion difficulty. The necessity for selling a valuable dairy or breeding animal for a meat price will often result in a material financial loss. Such loss, of course, will mean an ultimate gain if a proper program is pursued, but many of the individual animal losses could be avoided by earlier action.

CONTROL

Fundamentally there are but two ways of proceeding in an effort to control a condition such as Bang's disease, which is a germ disease of cattle capable of being spread from animal to animal. These may be indicated as:

1. Immunization.
2. Control of Spreader.

Immunization

An animal becomes immunized against a certain disease when it is placed in a condition which enables it to resist successfully that disease when met. This condition is brought about through the formation of combating, resisting, or neutralizing substances in the animal's body as the result of successful conflict with the germ that causes the disease, provided the disease involved is one for which an immunity is produced. Such substances enable the animal to overcome the attack of the disease and to offer resistance if the germ is again encountered. Immunity may be produced by an attack of the disease in a natural manner or in some instances may be brought about artificially by the use of real or so-called vaccines. Substances used for inducing artificial immunity contain the germ of the disease or its products.

Artificial immunization or vaccination has been very successful in connection with some diseases for which certain types of products have been used; for example, hog cholera and black leg, but vaccination has not met with unqualified success when used against some germ diseases possibly because of the nature of the diseases or the kind of products used. Because of the success met with in vaccination in some instances, efforts have been made to produce vaccines for many types of germ diseases. Unfortunately, many of these efforts have been complete or partial failures.

It is probable that no phase of the abortion disease problem has been subjected to more thought and study than that of vaccination. It is natural to desire and to seek an easy way out of a difficult problem and the simple procedure of applying a vaccine would present an agreeable answer to the abortion disease question, but it does not appear that the vaccines developed to date and now available for general use offer the desired solution. The possibilities in this direction are still under investigation but vaccination should be considered an experimental procedure until future research substantially demonstrates otherwise.

Control of Spreader

Without the possibility of control of the disease through vaccination, there remains but one basic control factor for consideration. This is the control of the spreader of the disease. This factor is the one that has been successfully employed in the other major animal disease control or eradication campaigns in this country. It was used in fighting contagious pleuro-pneumonia, southern cattle fever, foot and mouth disease, tuberculosis, and now it is advocated and is being successfully used in combating Bang's disease.

The Spreader

The two organs in the body of the cow in which the germ does the greatest damage and from which it can be passed to outside are the udder and the pregnant uterus. The germs may and do lodge in other parts of the body, particularly in the lymph glands, but unless the place where the germ is located is so situated as to permit the organism to escape to the outside the affected animal is not a spreader of the disease. Therefore, from a practical standpoint, the spread of the disease may be considered to come from the udder and the pregnant uterus.

When *B. abortus* enters the body of the cow it is probable that in approximately 50 per cent of the cases it will lodge in the udder. From there, it can logically be assumed that it may escape in the milk. The contaminated milk might be consumed by calves, but under normal conditions there is not much danger of the infection being conveyed through the milk to the mature cattle of a herd, and the calf fortunately has the ability to resist and overcome the disease during the early months of its life. Consequently, attention should be concentrated upon the pregnant uterus for the real spread of the abortion disease from the cow. The non-pregnant uterus apparently does not furnish a favorable lodging place for *B. abortus* and the germ is not ordinarily eliminated from the uterus for any great length of time after termination of pregnancy by abortion or calving. Any discharge from the pregnant uterus or vagina which occurs prior to abortion or calving should be considered as containing the germ and therefore infective. The discharge which follows the delivery of the calf should likewise be considered dangerous. In this connection, it should be remembered that the infected cow which calves in an apparently normal manner may spread as much infection through its discharges at that time as an aborter. The discharge may occur during a period beginning several days before calving or aborting and continue for three or four weeks thereafter, rarely longer. The discharge will usually stop within a week or two after the termination of pregnancy.

The bull may become infected with the disease and the germ may lodge in the breeding organs and possibly, in rare instances, be eliminated in the breeding discharges, but it has not been shown that the bull is an important factor in the spread of Bang's disease. The use of infected bulls upon a cow not infected is not recommended, however, because of the remote possibility of transfer of the disease. There is very little evidence to indicate that an infected bull may directly infect a cow he serves but there is the possibility that his discharges may contain the germ of the disease and such discharges might reach the mouth of a susceptible animal, particularly if the feed or water becomes contaminated.

How Disease Is Acquired

Carefully checked experiments have shown that under normal conditions most of the infection is acquired through the mouth of the animal that becomes affected. In other words, the disease is acquired because the germ gets in to the feed or water or is deposited in places where it can be licked up or picked up by susceptible animals. Hence, control work should consist of efforts to prevent the material which enters the cow's mouth from becoming contaminated with the germ. This can be best accomplished by strict control of the spreader to avoid any chance of its spreading the disease at the time it is in a position and condition to do so.

Entrance of Disease Into Herds

The principal ways by which Bang's disease is introduced into a herd are:

1. Purchase of mature infected animals.
2. Permitting animals of the herd to associate with infected animals of another herd or herds.
3. Breeding operations by which infected cows are brought to the farm.

If an infected cow is added to a herd, that cow is almost sure to spread the disease in the herd when it calves or aborts unless proper precautions are taken.

In some localities, it is a common practice to allow cattle from two or more herds to mingle during the pasture season. This practice offers a splendid opportunity for the spread of the disease if there are animals in the consolidated group which are infected and in a condition to spread the disease.

The possibilities relating to breeding operations have been discussed.

How to Protect Herd

From the aspect of disease control, the safest way to build up a clean herd is through the development of the young animals of the herd. If it is necessary to purchase cattle to add to such a herd, preference should be given to animals under one year of age, and it is always advisable to have newly acquired cattle subjected to test unless they are from an abortion disease-free herd. Some cattle may not react to the blood test until from one to four months after exposure to infection, therefore if possible, cattle should be bought subject to a retest in from 60 to 120 days. Occasionally, a pregnant infected cow may not react to the test until after the termination of pregnancy. For this reason, the blood test should not be wholly depended upon in the purchase of pregnant cattle. Such animals should be isolated until after calving and then tested.

If Abortions Occur

Abortions may rarely be due to accidents and occasionally may be caused by other germs, but it is probable as indicated previously that more than 90 per cent of the abortions occurring in cattle in Michigan are due to Bang's disease, and, when an abortion takes place, it should be viewed on that basis and proper precautions taken.

If an abortion occurs, the aborting cow should be **immediately** removed from the herd, the aborted calf and afterbirth burned or deeply buried, the contaminated bedding and manure burned or removed beyond the reach of other cattle, and the place where the abortion occurred thoroughly cleaned and disinfected. In the event of a pasture abortion, the spot soiled by discharges should be covered with lime or a disinfectant to repel curious, smelling, licking cattle.

It may be convenient but it is not advisable to have a blood sample taken immediately after an abortion. An infected cow may not show a reaction at that time. It is better to delay the test until a week or preferably two weeks have elapsed following the abortion and then it probably would be a wiser procedure to procure blood samples from all of the cattle over six months of age for test. The expense and effort for a complete test should not be much greater than for one animal and if only one is tested and it

reacts it will be necessary to arrange for the test of the remainder of the herd if the knowledge obtained is to be utilized to the advantage of the herd.

BANG'S DISEASE CONTROL PROJECT

The educational project authorized by the Michigan State College is based upon the employment of three logical related measures, namely:

1. Blood Testing.
2. Practical Segregation.
3. Sanitation.

Blood Testing

The blood tests for the abortion disease are accurate and can be depended upon to point out the infected animals if intelligently used. It should not be expected that the application of a single test is going to solve any given problem. Cattle may have been exposed shortly before a test and not be in a condition to react at the time of the test, but might react to a subsequent test in 60 to 120 days; the test may be applied to pregnant cows which are the exceptions that will not react while in that condition; or blood samples may be obtained from infected cows that have recently calved or aborted. If due allowance is made for the exceptional animals and if the tests are properly timed, a reliable record of the condition of each animal can be obtained in a relatively short time.

The application of the blood test is the first logical step in any clean-up effort. To proceed wisely, knowledge of the particular cattle infected must be had. No general plan can be suggested for control of the infection in a herd, but with the information gained through the blood test and with the knowledge regarding the age, productive abilities, and breeding records of the reactors and the size and value of the herd and facilities and conditions on the farm, a definite plan can be outlined.

It is believed that a qualified veterinarian is the person who is best fitted to collect the blood samples, and his training and experience enable him to advise cattle owners properly regarding the various problems which may arise. The blood testing is simply an initial and incidental procedure. The real difficulties will develop in connection with problems of segregation and sanitation and the conditions which accompany or follow Bang's disease. If herds are grouped for bleeding the cost of such work should be nominal.

Segregation

Segregation may be classed as complete or partial. Complete segregation may be accomplished by slaughtering the diseased cattle, by placing the affected cattle on one farm and the non-infected cattle on another, or by definitely separating the two classes of cattle on one farm.

Partial segregation provides for the separation of the infected animal from the herd when it is most dangerous as a spreader, which is at the time of calving or aborting.

If a test shows that one or two animals in an average size herd are affected and those animals are not particularly valuable, the best procedure would be to send such cattle to the butcher and start on a comparatively

clean basis, with the idea of having another test in 60 to 120 days for the purpose of locating any additional infection that might develop. Should the test reveal a higher percentage of infection, including cattle of greater value, some other plan of complete segregation might be advisable, or attention should be concentrated upon the diseased animals and arrangements made to isolate them at the time of calving or aborting. The decision regarding procedures will have to be made by the cattle owner, and it should be influenced by the presence or absence of a federal or state project calling for free blood tests and payment of indemnity for slaughtered reactors.

Slaughter offers the quickest way of getting rid of the disease, but it may not be the best way unless indemnities are available, and even in such an event the possible results should be carefully considered before action is taken.

Complete segregation will usually result in a quick clean-up, and the plan should be followed when feasible. It is realized, however, that the average Michigan farmer does not have the facilities for complete segregation and will have to proceed in some other way if progress in control or eradication is to be made.

Where complete segregation or slaughter is out of the question, some method of separating the infected animals at the time of calving or aborting should be devised. This separation should start before any preliminary discharges appear and continue until the discharges following the termination of pregnancy have ceased. Usually, a couple of weeks will suffice but the period occasionally may be extended to three or four weeks. A box stall, horse stall, pen, shed, or even a small outdoor enclosure during the warmer weather could be utilized in confining the animals. Isolated cows, of course, should be milked, fed, and cared for only after attending to the rest of the herd, and care should be exercised to prevent any thing contaminated by the discharges of the isolated cows reaching the parts of the premises used by the main herd. Manure and bedding should be placed where not accessible to other cattle, preferably spread thinly upon an open field where other cattle do not graze. Unless there is objection to the procedure because of the danger of tainting the milk, it is a good practice, before returning the isolated cow to the herd, to have it sponged or sprayed with a strong smelling disinfectant to repel cattle which may be prone to lick or smell and to destroy possibly some of the infection harbored on the body.

It will be readily appreciated that the aborter will present the biggest problem in any plan of partial segregation. The calving date can be anticipated but the abortion is not governed by rules and may occur at any time. It is true, however, that unless the abortion occurs very early in the period of gestation it is usually preceded by certain preliminary symptoms such as drying up of milk, making bag, relaxation in the pelvic region, uneasiness, switching of the tail, or swelling of the vulva. Many practical farmers who have had much experience advise that they can foretell the coming of an abortion, and, if this is true, the cows involved can be promptly isolated before the great spread of germs starts.

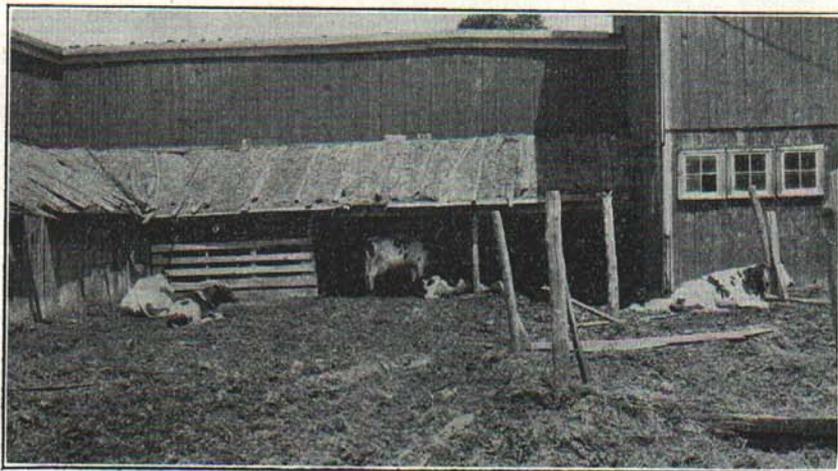
The efficiency of any method of partial isolation will depend upon the extent to which the knowledge of the disease is employed and the degree of adherence to the rules of sanitation.

The Ultimate Aim

The aim in any plan of segregation is the ultimate elimination of all diseased animals from the herd. This should be kept in view at all times.

Many of the infected cows may early develop conditions which will cause their sale to the butcher, but others may produce calves more or less consistently, and there will be a temptation to retain such animals. The infected animal is always a potential disease spreader and should be eliminated as soon as permissible under existing conditions.

The object should be to replace infected animals with cattle free from Bang's Disease. The sheet anchor here is the young animal. Even though the mature cattle may all be infected, clean calves can be raised. It has been shown that calves dropped by infected cows almost always can be raised as clean animals if removed from the source of infection presented by association with diseased cattle or drinking infected milk and protected against the disease, particularly as they approach the breeding age.



Conditions of this kind make the eradication of Bang's disease very difficult

Sanitation

There is too much inclination to view sanitation from the standpoint of disinfectants, real or so-called. Such agents have their place but are incapable of destroying disease germs unless they come in actual contact with such germs. Opportunity for such actual contact is frequently not given yet it is often confidently believed that the spraying or spreading of a disinfectant has accomplished the task of destroying all harmful germs in the vicinity.

Broadly speaking, the term sanitation may be applied to any means or measures used to preserve or protect health. The term is often interpreted as meaning a super-cleanliness. This view, although limited, is good, but if disease germs are to be successfully fought a few other factors must be considered.

Nature has provided certain agencies which are very efficient in destroying most harmful germs and these can usually be used to advantage. Fire is the most efficient of germ destroyers but unfortunately cannot be used frequently. However, sunlight, fresh air, dryness, and cleanliness can be used cheaply, easily, and regularly and will accomplish results. In contrast

to the foregoing enemies of the disease producing germ, darkness, foul air, moisture, and filth should be considered as the germ's allies or friends. Fundamental sanitation would include the replacing of the agencies which favor the germ by those factors which slow it up or bring about its destruction. An investigation showed that the Bang's disease germ, *B. abortus*, in thinly spread manure exposed to the sunlight was killed in one or two days but the germ in moist manure located in a dark place lived for 75 days or longer. These findings exemplify the effects of the contrasting agencies which are mentioned.

If a real job of eliminating abortion disease germs is to be performed any thing or condition which will favor or protect the germ should be removed or corrected. A good mechanical cleaning is important. Germs protected by sticks, cobs, straw, manure or other litter must be exposed to destroying agents. Forks, shovels, brooms, and brushes should be utilized as far as possible and then, if permanent surfaces are to be cleaned, hot solutions of lye or sal soda can be used to remove the remaining germ protection. After that, disinfectants may be used but it is probable, if the procedure indicated is followed, that such agents may not be needed. Common dirt is often the reason for the survival of the germ and if the dirt is removed the germ goes with it or is exposed to natural destroying agents. In the clean-up, particular attention should be paid to places away from the light. Outside, the task is not so difficult for there sunlight plays an all important part in germ destruction.

CONCLUSIONS

Sufficient sound information is available to warrant concerted efforts to control Bang's disease.

The terms applied to Bang's disease often mislead in unduly emphasizing the abortions.

This disease produces not only abortions but may be directly or indirectly responsible for retained afterbirths, breeding difficulties, and udder disease in cows and pneumonia and scours in calves. The production of sterility appears to be an exceedingly important effect of the disease.

Probably more than 90 per cent of the abortions occurring in Michigan cattle are due to Bang's disease. The aborting cow should be considered as guilty of infection until demonstrations prove otherwise. Efforts to find excuses or develop alibis for abortions may lead to disaster.

Substantial reasons for controlling the disease are apparent from the aspects of human health and economy.

It is probable that the danger of contracting undulant fever through consuming milk or milk products from infected cows may have been overstressed in some respects. This danger exists but the possibility of contracting the disease through contact and association with the affected animals looms large.

Conservative data indicate that the cow infected with Bang's disease is losing the owner from \$40 to \$50 a year because of loss of calves lowered milk production, and depreciation.

The disease causes a probable annual loss to Michigan dairy farmers of more than \$5,000,000.

There are other reasons why the cattle owner may ultimately be forced to

consider the control of Bang's disease, regardless of personal inclinations. These reasons relate to markets, exhibitions, breeding operations, and the movement of cattle, and may be due to regulations in other states, sale and fair requirements, the demands of owners of valuable breeding cattle, and restrictions governing the movement of cattle within the state.

Basically there are but two ways of controlling a disease of this kind, namely, immunization and control of the spreader.

Immunization would mean vaccination. Vaccines are still in the experimental stage.

Controlling the disease spreader has been the underlying motive in the successful animal disease control campaigns in the United States and it is being employed effectively, in fighting Bang's disease.

In most instances, the mature infected cow remains a permanent carrier of the infection and may abort during any pregnancy and should be considered a possible spreader of the disease at the time of each calving.

The udder and the pregnant uterus are the two organs in the body of the cow in which the germ does the most damage and it is from these organs that the germ can readily be eliminated and thus cause the affected animal to be a spreader of the disease.

The infection is usually acquired through the mouth of the animal and the infection occurs when the germ has in some way reached the feed or water or has been deposited where it could be picked up by a susceptible animal. It appears that there is only a remote possibility that the bull may be directly involved in transmitting the disease.

Bang's disease is most frequently introduced into clean herds through the purchase of mature infected animals, permitting cattle to associate with infected cattle, and breeding operations wherein infected cows are brought to the farm.

Clean herds can be protected by adding only cattle from abortion-disease-free-herds or animals which pass satisfactory blood tests. Unless purchased cattle are from known clean herds, preference should be given to animals under one year of age. Usually, calves up to at least eight or nine months of age have an ability to resist and to overcome the infection and although a calf may be dropped by an infected dam it may be raised as, and continue to be, an abortion disease free animal.

The vast majority of abortions are due to Bang's disease and when an abortion takes place it should be viewed on that basis and proper precautions taken to prevent the spread of the disease.

The Bang's Disease Control Projects under way in Michigan embrace the use of blood testing, practical segregation or slaughter and sanitation.

It is believed that the qualified veterinarian is the proper person to collect the blood samples. His training and experience enable him to do this work properly and he possesses knowledge of disease and control principles and sanitation which will be invaluable to the cattle owner when the problems outlined by the results of the blood test are presented.

There is no medicine or combination of materials known to be a cure for Bang's Disease. It is largely because of the restricted view of the disease, abortions only, that many manufacturers and vendors of so-called cures and remedies are selling their wares. Naturally, help is sought when abortions in the herd are most numerous. Without the application of any purported remedy, this condition is usually followed by a marked reduction in the number of abortions because a natural degree of resistance has been developed. If a so-called remedy were applied, it would be given

credit for the results. In any event, the disease would not be cured but continue to be firmly established in the herd. A reduction in the number of abortions is too often considered progress in the control.

Two outstanding factors which can be utilized to advantage in control efforts characterize Bang's disease. First, from a practical standpoint the spread of the disease occurs in a limited way and for relatively short periods of time; and, second, the calf possesses an ability to resist and overcome the infection.

