

AGRICULTURAL EXTENSION SERVICE

Published and Distributed in Furtherance of Acts of May 8 and June 30, 1914,
Providing for Cooperative Extension Work in Agriculture and Home Economics
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CIRCULAR 385

COLUMBIA, MISSOURI

JULY, 1938

Mastitis; Diagnosis and Control

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All dairy farmers sooner or later are troubled with the problem of mastitis or garget in cows that are in milk. The losses caused by the disease are decreased milk production, discarded milk from diseased quarters, and the shortening or abrupt termination of the productive life of the cow. Mastitis in dairy cows is undoubtedly the most frequently occurring and, from the standpoint of losses, the most important of all dairy cattle diseases.

Tests made on 5,000 dairy herds in New York State indicated that the dairymen of that state were losing fully 10 million dollars a year due to mastitis, three-fourths of this loss resulting from decrease in milk production and the remainder from lowered value of the animals themselves.

Missouri, with three-fourths as many dairy cows as New York, and with milk selling at three-fourths as much per hundred-weight, undoubtedly sustains a loss of $4\frac{1}{2}$ million dollars a year from this disease. Tests of the individual cows in Missouri herds have shown that from 20 to 90 per cent of the animals may be affected with the disease.

Fortunately, however, mastitis can be controlled by methods that have been shown to be very efficient, repeatedly, by research workers who have conducted experiments on the disease. These methods are outlined in this circular. Control is dependent on the dairyman's knowledge of the disease, the use of proper stable hygiene, milking methods, and the detection and proper handling of infected animals in the herd.

CAUSE OF THE DISEASE

Mastitis is an inflammation of the udder tissue caused by germs that enter the teat duct at the end of the teat. The germ that causes the disease in 90 per cent or more of the cases is called *Streptococcus agalactiae*. This germ is infectious and lives for the most part in the udders of cows. The germ can live for a considerable length

of time outside the cow's udder. The Michigan Agricultural Experiment Station found that the germs may stay alive for at least 30 days on the barn floor and for 65 days in water.

Mastitis can be caused by injuries such as bruises, blows, kicks or the sudden chilling of the udder. When the disease is due to any of these causes and if no infectious organisms are in the udder tissue, the inflammation soon subsides and the udder returns to normal. This type of the disease causes very little if any permanent injury to the udder tissue.

SYMPTOMS OF MASTITIS

The symptoms of the disease vary a great deal in infected cows in the same herd. Mastitis may appear in the acute, chronic or sub-clinical form.

Acute Form.—In the acute form of the disease the milk flow may suddenly cease and only a small amount of bloody or yellowish fluid can be obtained from the affected quarter or quarters. The affected quarters may be hot, swollen, and painful. The animal may show general symptoms such as a chill, off feed, loss of appetite, and in rare cases death may follow. In the majority of cases, however, the inflammation subsides and the appearance of the milk returns to normal in ten to fifteen days. The animal is considered cured and is put back into the milking string. Unfortunately, the animal is not completely cured except in very rare cases. The *Streptococcus* organisms that caused the disease have gained a permanent foothold in the udder tissue and are being discharged from the udder into the milk. Such a cow in the milking string is a reservoir of infection from which the organism can be spread to other animals. These so-called recovered cases are affected with the chronic type of the disease.

Chronic Form.—In the chronic form of the disease the symptoms may be so obscure or mild that the attendant or owner is not aware of the fact that the animal has the disease. Animals that are affected with the mild chronic type of the disease may suddenly develop a severe attack or the symptoms may remain mild and only last for a few milkings. In some animals this type of the disease may extend over one, two or more lactation periods before the infected udder reaches the stage where the milk becomes so altered that it is quite obvious that the animal has mastitis. However, the disease-producing organisms are being discharged in the milk more or less regularly during the whole lactating life of such animals.

Mild Form.—In the sub-clinical or mild form of the disease none of the usual symptoms are evident such as abnormal milk and hot, painful or swollen udders. In a herd that contains one or more animals in the more advanced stages of the disease there may be as

high as 40 to 60 per cent of the animals in the herd with the mild form. The organisms in the mild form of the disease slowly destroy the udder tissue which is replaced with connective tissue. Once the secreting udder tissue is destroyed it cannot be replaced. While it is possible for the remaining udder tissue to compensate to some extent by secreting more milk, the milk yield is usually reduced 5 to 20%.

METHODS OF DIAGNOSIS

There are a number of methods available for the diagnosis of mastitis in dairy cattle at the present time. All of the tests are more or less technical and must be conducted with attention to detail if the correct conclusions are to be reached. It is, therefore, recommended that a qualified veterinarian be employed when available to make the herd survey for detecting the disease.

The physical examination of the udder is a very valuable aid for detecting infected animals. This procedure, however, requires considerable skill and judgment, since inexperienced persons are likely to make erroneous conclusions. The strip cup and the bromthymol blue tests can be made by the average dairyman with much less danger of making a mistake. The chlorine test is very delicate and particular care is necessary to keep the glassware clean and to prevent solutions other than those used in making the test from getting into the milk or test solutions.

Detection of Infected Animals

Since the germs that cause mastitis are shed more or less regularly in the milk of infected cows, the infected udders are the principal reservoir of infection. The first requirement, therefore, in controlling the disease in the herd is to detect the animals with infected udders.

In making a survey of a herd to find the infected animals a certain routine should be followed. Specific changes take place in the udder tissue and in the milk secreted in infected udders and these changes are made use of in detecting the animals that are infected.

Any animal in the herd that has been giving lumpy, stringy or clotty milk from one or more quarters for any length of time should be put on the market and sold for beef. These animals are very dangerous in the herd and if it is not possible to put such animals on the market they should be put in strict isolation from the remainder of the herd until they can be put on the market. If put in isolation, the animals should be milked last or preferably by someone that does not do any of the regular milking.

Use of the Strip Cup

The strip cup consists of a pint receptacle fitted with a removable top. The bottom part of the removable top has a fine wire

screen, 100 squares to the inch, across half of the bottom. The other half is covered with tin. These cups are sold by most of the dairy supply companies.

The strip cup, to be of value, should be used regularly every day. At the beginning of each milking the first three or four streams of milk from each teat are slowly milked onto the solid tin half of the removable top and allowed to run down through the sieve. The presence of any clots or flakes on the sieve can then be seen or if the flakes are very fine they can sometimes be noted as the milk flows across the solid tin. The presence of clots or flakes is proof of infection but not all infected cows show clots or flakes in the milk. This test is of value in detecting the more advanced stages.

Treatment of animals showing clots or flakes in the foremilk can be started early, often preventing the case from developing into the severe form of the disease. Such animals should be placed at the end of the milking string to prevent spread of the disease.

Tests That Can be Made on the Milk to Detect Infection

Milk from healthy udders is slightly acid. Milk from infected udders is usually alkaline in reaction. There are various accurate color tests that can be made on milk that will reveal whether or not the milk is acid or alkaline in reaction. The most popular of these tests is the bromthymol blue test.

Bromthymol Blue Test.—This test consists of adding one cc. of bromthymol blue solution of standard strength to five cc. of milk. If the milk is normal or slightly acid it will give the milk a yellowish color. If the milk is slightly alkaline in reaction, denoting infection, it will give the milk a light green, green, or dark green color. The severity of the infection can be judged by the degree of color change in the milk, dark green color denoting an advanced stage of the disease.

The test must be run on the fresh milk from each separate quarter because of the fact that only one quarter may be infected and if the test was run on a mixed sample of milk from all four quarters the abnormal milk would be so diluted that the color change would not show.

Milk from badly infected quarters may at times fail to give a positive test. It is, therefore, advisable to repeat the test at frequent intervals on all cows in the herd. In badly infected herds it would be advisable to run the test once a week, while in herds that are clean or nearly so, tests at thirty-day intervals would be adequate. Slight or medium changes in color of the milk soon after freshening or at drying off time are not significant. The bromthymol blue solution or the prepared papers for making tests can be obtained from any dairy supply company.

Test for Chlorine.—Many research workers regard the chlorine test as one of the most accurate and delicate for detecting infected animals. It is a test to determine the chlorine content of the milk and is based on the fact that normal milk has a chlorine content varying from .08 to .14 per cent. In inflammation of the udder, the chlorides of the blood escape into the milk and the chlorine content of the milk is raised.

The procedure for making the chlorine test devised by Dr. C. E. Hayden of New York State Veterinary College is a rapid test that can be run by a careful dairyman. The reagents and procedure used in this test are as follows:

Reagents.—Silver nitrate solution: Make up 1.3415 grams of c. p. silver nitrate to one liter of distilled water. Potassium chromate solution: A 10 per cent solution.

Procedure.—Measure 5 cc. of the silver nitrate solution into a small bottle or tube. Add 2 drops of the potassium chromate solution. A red color develops at once. Add 1 cc. of milk to this combination. The red color will be maintained if the chlorine content of the milk is under .14 per cent, or near that of normal milk. If, on the other hand, the chlorine content of the milk is .14 per cent or more, a yellow color will develop within one minute. If the chlorine content is high the yellow color develops very rapidly.

Interpreting the Test.—Even in healthy cows the chlorine content of the milk tends to rise just after freshening and also in approaching the drying off period. Slight increases in the chlorine content of the milk during these periods, therefore, should not be regarded as conclusive proof of infection if all four quarters test the same and there is no other evidence of infection. A sharp rise in the chlorine content of the milk from one of the four quarters, the other three remaining normal, is evidence of recent infection and the animal should be handled carefully. If the same container is to be used for successive determinations of the chlorine test, it is important that it be washed out after each test, using either distilled water or clean rain water.

This test is a quantitative test and reveals only the fact that the chlorine content of the milk is above 0.14 per cent. The test should be run only on the milk from each separate quarter.

Where chlorine solutions are being used in the barn for a disinfectant, care must be taken not to allow any of the chlorine solutions to get into the milk or test fluids because it will make the test inaccurate. The silver nitrate solution should be kept in a brown colored bottle with a glass stopper so as to prevent the light affecting the solution and to prevent evaporation.

What are the Changes Produced in the Udder Tissue?

In the acute type of the disease a large amount of udder tissue may be destroyed and result in the formation of abscesses. If the infection results in destroying the greater part of the quarter, all of it may slough out including the teat. In the more favorable cases the destroyed udder tissue is repaired by the formation of

scar or connective tissue. Because of the fact that scar or connective tissue replaces the udder tissue that has been destroyed, it can be used to diagnose the animals that are affected with mastitis. This is done by palpating the udder and finding the well-defined lumps of connective tissue that have been formed in it.

Physical Examination of the Udder

The physical examination of the udder is conducted directly after milking. The normal healthy udder of a cow is symmetrical, the two front quarters and two rear quarters being equal with each other in size, shape and weight.

The quarters are palpated by taking each quarter in the palms of the hands and applying pressure on one side of the quarter with the fingers and with the thumbs on the opposite side. Then by applying pressure between the thumb and fingers the inner structure of the glandular tissue can be felt.

The normal udder has a soft velvety or spongy feeling and the characteristic lobulated structure may be felt. The lobules in a normal udder are small and regular in shape and the consistency of the udder tissue is the same throughout.

The diseased quarters have well defined areas that are hard and do not have the characteristic feeling of the normal udder. In these areas the normal glandular tissue has been replaced with connective tissue. The areas usually are irregular in shape and are hard. When these changes are found it signifies infection.

HERD MANAGEMENT IN THE CONTROL OF MASTITIS

After determining which animals in the herd have infected udders, the herd should be arranged with the clean animals at the head of the milking string, followed by animals with slight infections and then by animals having well-marked cases of the disease. The animals should be milked in order starting with the clean animals and ending with the badly infected animals. In large herds the animals should be grouped, clean, slightly infected and marked cases, and a milker put in charge of each group.

According to many investigators most infections occur during milking. It is, therefore, important to take every precaution possible to prevent infection taking place during milking. The hands of the milker should be washed in clean soapy water and dried before milking each cow. If a milking machine is used, the teat cups of the milking machine should be dipped in a chlorine solution after milking each cow. The udders and teats, before milking, should be wiped with a clean towel that is kept in a chlorine solution. The ideal method is to have a towel for each cow that is milked. The towels are placed in an enamelware receptacle containing the chlorine solution. Before milking each cow, a towel is

taken from the chlorine solution and the udder washed; the towel is then put in a discard receptacle. After milking, all of the towels are washed and put back into a chlorine solution until the next milking. The ends of the teats, after each milking, should be dipped in a chlorine solution. Chlorine solutions to be effective must have 200 to 300 parts of chlorine to 1,000,000 parts water.

Construction and Care of the Stable

The proper construction of stalls and cleaning of the stable is very important in controlling the spread of mastitis. Animals should have stalls that fit them. Stalls that are too short are dangerous because when the animal lies down part of the udder hangs over the rear of the platform into the gutter causing constant irritation to the udder tissue. Stalls should be provided with partitions to prevent animals in adjacent stalls from treading on the teats. Injuries to the end of the teats nearly always result in a case of mastitis developing. During cold weather adequate bedding should be kept on the stall floors to protect the udder from chilling. The barn floor should be washed once a week with a lye solution containing one pound of lye to five gallons of water. The milk from infected quarters should never be milked onto the barn floor. Cows that are heavy producers and leak milk from the teats when the udders are full should be milked three times a day to prevent possible contamination of barn floors. Muddy, wet and manure-littered barn lots should be cleaned up and kept dry so as to prevent infection taking place outside the stable.

Placing Fresh Cows in the Milking String

Animals that have freshened should not be added to the milking string until it is determined into which group the animals should be placed. It is not possible to run the various chemical tests on the milk until the sixth or eighth day after freshening. First-calf heifers are sometimes found to have one or more quarters infected. Infection of the udders of heifers probably takes place during calthood due to the habit of calves sucking one another. The organisms that are in the milk contaminate the mouths of the calves and when they suck the teats of other calves the organisms are transmitted into the udder. This habit should be prevented and as a further precaution only milk from cows that are clean should be fed to the calves. Where pasteurized milk is available for the calves, mixed milk from all cows can be fed.

TREATMENT

It has been explained that cows giving milk of normal appearance and with udders showing no symptoms of inflammation harbor the infection in the diseased quarters and that they are reservoirs of infection from which the disease may be spread to other

animals in the herd. There may be a large percentage of the animals that may have their udders infected in which the disease has not developed to the stage where the milk is abnormal or the udders are visibly inflamed. Because of these facts many different treatments have been given credit for curing mastitis, when, as a matter of fact, no cure has been effected.

Vaccination has been used quite extensively in treating mastitis. Controlled experiments on the use of vaccine have shown that it has no apparent curative effect and that it will not prevent infection of the udder.

The injection of antiseptic solutions into the udder through the teat canal has also been used quite extensively. This method of treatment not only failed to cure the disease, but is likely to make the condition worse. So far as known, drugs given by the way of the mouth have given no curative effect on the udder.

Acute flare-ups of the disease can be relieved if the condition is recognized early and proper measures of alleviating the condition are started at once. When there are symptoms of pain, heat or swelling in the udder or if the strip cup shows some flakes, the following measures put into operation at once will prevent the disease in many cases from developing to the stage where all the milk from the quarter is abnormal and has to be discarded.

First, take the grain feed away from the animal.

Second, give a large dose of Epsom salts.

Third, start to milk the udder once every hour and keep up the hourly milking day and night until the inflammation is relieved and the milk is normal in appearance. If there is no noticeable change for the better after continuing the hourly milking for 24 to 36 hours, the case usually is hopeless.

In the early stages of the flare-up, when there is evidence of heat in the udder, the application of cold or ice packs during the first 24 hours may be beneficial. After 24 hours the application of heat to the udder is of more benefit. In the chronic cases with no evidence of heat or pain in the udder, the application of heat from the first is probably advisable. Gentle massage of the exterior of the udder and the application of a stimulating ointment or liniment helps to stimulate resorption of the products of inflammation in the udder tissue.

It is not necessary to dispose of infected animals in a herd unless the animals have reached the stage where one or more quarters are continuously giving abnormal milk. It is important, however, to keep the infected animals grouped and to practice proper sanitary methods of milking and barn management to prevent spread of the disease if mastitis is to be held at a minimum in a herd.

When purchased additions are being made to a herd, the milk and udders should be subjected to the various tests and only animals added that are free from the disease.

Digitization Information Page

Local identifier C385-1938

Source information

Format Book
Content type Text
Source ID Gift copy not added to collection
Notes

Capture information

Date captured November 2019
Scanner manufacturer Fujitsu
Scanner model fi-7460
Scanning system software ScandAll Pro v. 2.1.5 Premium
Optical resolution 600 dpi
Color settings 8 bit grayscale
File types tiff

Derivatives - Access copy

Compression Tiff: LZW compression
Editing software Adobe Photoshop CC
Resolution 600 dpi
Color grayscale
File types pdf created from tiffs
Notes Images cropped, straightened, and brightened
Canvas size: 6 x 9