SOME OF THE SOIL BORNE DISEASES

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Bacteria of different types are capable of living in the soil for long periods of time. Among these are those causing tuberculosis, swine erysipelas, anthrax, brucellosis and perhaps a dozen others.

There is one genus of bacteria that is responsible for a large number of our common animal diseases and which has several distinct characteristics, this is the genus *Clostridium*. These organisms form spores, that is they cease to multiply but are capable of remaining alive for indefinite periods of time even under very adverse conditions. Also the Clostridia grow only under anaerobic conditions, that is the oxygen concentration must be lower than average. These organisms become established in soil so are maintained in a given area for years. This article is a brief summary and discussion of the more common types of Clostridia infections and points out the more satisfactory methods of controlling the diseases produced by these organisms.

Food and Feed Poisoning

Clostridium botulinum is the organism responsible for one type of food poisoning. These organisms are widespread. They are usually present in garden soil and may contaminate vegetables. Ordinary cooking does not kill the spores, but since they will grow only under conditions of less oxygen than is present in air, no toxin is formed in the preparation of fresh foods. Ensilage, incompletely sterilized canned goods or tightly packed sausage are media in which the botulism organism will grow. At times the botulism organisms grow in grain covered by water. This is the cause of heavy wild duck losses.

The disease produced by the toxins of *Clostridium botulinum* is known as food poisoning, blind staggers, limberneck or botulism. Man, birds and many of the larger domestic animals are all subject to poisoning by botulism toxin. Swine, dogs and cats appear to be quite resistant.

The most common cases of botulism occur in chickens. In many cases these outbreaks are caused by the feeding of spoiled home canned vegetables or meat to poultry.

In one outbreak in turkeys the poults were fed a wet mash. The owner did not move his feeders for long periods of time so that masses of wet mash accumulated around each feeder. The weather was warm so that the tightly packed wet, warm mash made an ideal medium in which the botulism organism could grow. Later the poults started to eat the mash off the ground and heavy death losses resulted.

Sheep, horses and cattle may be poisoned by the botulism toxin but this disease is not common.

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It is not a good practice to feed spoiled food products to animals, but if it is done it is safer to feed suspected food to swine rather than to chickens.

Treatment of botulism in man is made by use of an antitoxin. This type of treatment is not used much in veterinary medicine because of the cost. The most effective type of treatment in animal cases of botulism is the prompt removal of the toxic substance from the alimentary tract. Since most domestic animals don't vomit this must be accomplished by catharsis. Epsom salts or castor oil may be of value if given soon enough in suspected cases of botulism. In any case change the feed.

Tetanus and Its Control

Clostridium tetáni produces tetanus or what is commonly called lockjaw in many animals and man. Dogs, cats and poultry appear to be resistant to tetanus. Tetanus results from a wound infection. The clostridium organism, usually with some other organism enters the wound and the aerobic organisms grow using up the oxygen of the tissue, the clostridium then grows and produces a toxin that causes nerve stimuli that produce very severe convulsions.

Lambs often become infected at the time of birth, in other cases at the time of docking or castration. The same general situations hold for other species of livestock. Cases have come to this laboratory in which the infection had been introduced in shearing wounds on sheep and on inserting ear tags.

Tetanus can be controlled by preventing the organism from entering wounds or by vaccination. Recently born animals do not have time to develop immunity from the use of the vaccine (toxoid) but can be protected by antiserum in serious outbreaks. Preliminary experiments with rabbits have shown that some protection is given the baby rabbits by vaccinating the mother before birth of the young. Older animals are permanently protected by proper vaccination.

Cleanliness in surgery and at the time young animals are born are two very important points in the control of tetanus. A case can be described which will illustrate the value of cleanliness in preventing tetanus. A sheep herdsman kept experiencing losses of baby lambs from tetanus. One night he lost nine lambs, all less than a week old. He then cleaned his lambing barn thoroughly and put in clean, deep straw bedding. He had been using tincture of iodine on the navels of the lambs, but this had not prevented infection. No lambs born after cleaning the barn and using the deep bedding developed tetanus.

In one case of tetanus in a pig, a recovery was made following the use of penicillin and tetanus antitoxin. The pig at the time it was submitted to the laboratory was showing typical symptoms and had to be fed with a stomach tube for the first few days after treatment.

Tetanus is not a disease that can be eradicated, but losses can be cut to a minimum by good sanitary practices and vaccination.

All animals and men were vaccinated in our armed forces and not a single case of tetanus was reported in World War II. In World War I vaccine was not available and there were many cases of tetanus.

Enterotoxemia—A Disease of Sheep and Lambs

Clostridium welchi is the cause of several different types of disease conditions. The most serious disease from an economic standpoint seems to be enterotoxemia of sheep and lambs. In this disease young lambs, feeder lambs and old sheep are involved. The primary requirement seems to be that the sheep are on a diet high in readily available foods. Ewes on very luxuriant pastures may show no evidence of disease while the lambs may die of a disease known as lamb dysentery. Another condition which appears to be due to the same organism is termed "pulpy kidney disease" because of the severe degenerated changes in the kidneys. The disease, enterotoxemia, is primarily a disease of feeder lambs. The symptoms, course of disease and the lesions are rather characteristic. Lambs on full feed are the ones usually involved. They go "off feed", some may stagger or go into convulsions and die in a matter of a few hours. There are usually hemorrhages on the intestines and in the connective tissues of the abdominal cavity. Enterotoxemia should not be confused with listerellosis which usually has a much longer course.

Once the disease caused by *Clostridium welchi* has become established on a farm the organism seems to become more pathogenic. Mild losses at first may be followed by severe losses toward the end of the feeding period. Experiments conducted at the Colorado Experiment Station showed that when sulfur was included in the ration the losses due to enterotoxemia were reduced. In North Dakota losses from enterotoxemia are greater among lambs harvesting corn than among those actually in feed lots. Under our system of turning the lambs into corn fields it is of course impossible to use sulfur as a prophylactic against enterotoxemia.

Experimental work reported from Oregon and New York shows that the losses from enterotoxemia can be greatly reduced by the use of a vaccine. Reports from some sheepmen in North Dakota indicate that the vaccine may be of considerable value in decreasing losses of feeder lambs.

It appears, however, that the duration of immunity following vaccination is rather short and that sheep on a prolonged feeding regime may have to be vaccinated twice.

Clostridium welchi also causes a severe type of gangrenous mastitis in cows. It produces gas gangrene in man and animals.

Blackleg and Malignant Edema

Clostridium chavoei and *Clostridium septicum* are the causes of blackleg and malignant edema. Blackleg caused by *Clostridium chavoei*, is a disease of cattle, sheep and goats. Malignant edema, caused by *Clostridium septicum* and other species, apparently produces disease in all species of animals.

Ordinarily blackleg is distinguished from malignant edema by the presence of gas in the tissues. An animal suffering from blackleg shows swelling on some parts of the body and if pressure is placed on the swelling a crepitating noise can be heard. In malignant edema there is little or no gas in the tissues.

Since the organisms causing both blackleg and malignant edema are frequently found in the same area it is advisable to use a so-called bivalent vaccine, in other words vaccinate for both diseases at the same time.

In both of these diseases death follows quickly after symptoms are shown. Antiserum and sulfa drugs as well as penicillin have been used with some success. However, in most cases the animals, particularly on the range, are found dead.

Some investigations have suggested that at least in certain areas it may be necessary to use a more complex type of vaccine, however most death losses appear to be due to either blackleg or malignant edema. Blackleg can be practically controlled by the use of the bacterin which should be given while the calves are quite young. Some stockmen regularly vaccinate their animals as calves and again as yearlings. Most bacterins or anacultures used for immunization against malignant edema are prepared and dispensed with the blackleg bacterin. Some stockmen report losses about six months after vaccination of cattle given the malignant edema vaccine. Laboratory diagnoses have in nearly all cases been malignant edema. The general opinion is that the immunity produced in the animal by malignant edema bacterins is of much shorter duration than is the immunity produced by similar blackleg bacterins.

Where losses from blackleg or malignant edema are encountered in vaccinated animals it is recommended that all animals be vaccinated at six month intervals.

There are several other diseases produced by members of the Clostridium group. *Clostridium hemolyticum*, for example, causes a disease of cattle and sheep called red water disease. This disease is characterized by a rather heavy death loss, while the most striking symptom is a red colored urine. This disease has not been definitely diagnosed in North Dakota.

Prevention of Clostridium-Caused Diseases

In the general considerations of this group of diseases we can say that botulism can be eliminated by use of feedstuffs that have

been cured under aerobic conditions. Feeds which have been wet or tightly packed may be dangerous hence they should be tested by chicken feeding before being fed to other animals. Chickens are highly susceptible to botulism poisoning. **If a feed makes a chicken sick do not feed it to cattle, sheep or horses.** Swine are resistant to botulism.

Tetanus can be eliminated as a serious disease by thorough cleaning of pens in which young are born, by prompt treating of wounds and by immunization of older animals. Penicillin and most of the sulfa drugs are effective against the tetanus organism but may be of no value after symptoms develop. Deep puncture wounds should be opened as a precaution against tetanus.

Those diseases produced by *Clostridium welchi* may be sporadic in which case treatment with sulfa drugs is indicated. Those epidemic outbreaks of disease, especially in sheep are best prevented by use of the vaccine.

The blackleg-malignant edema diseases can be prevented by protective immunization. It may be necessary, however, to treat at six month intervals.

In some cases it may be necessary to get autogenous bacterins. These are bacterins prepared from organisms isolated in a particular outbreak. There appear to be some cases of malignant edema that are caused by variant strains not included in the commercial bacterins. In any case where the bivalent bacterin has failed to protect animals for at least six months, it is suggested that an autogenous bacterin for that herd be prepared for immunizing purposes. The Veterinary Science Department of the North Dakota Agricultural College will assist any owner in getting such a bacterin.

Carcass Disposal

The method of carcass disposal is important in any disease control program. The most satisfactory method of carcass disposal is to have the carcass removed by a licensed rendering plant. The second best method of carcass disposal is burning. Complete incineration is necessary. The carcass should be placed on stones or lumber and thoroughly soaked by pouring oil on the carcass. Hay or straw should then be piled on the carcass and again oil should be applied and the entire mass burned. In this way the carcass is disposed of and the soil sterilized.

Animals dying from a disease which is caused by a spore-forming organism, contain millions of spores. These spores continue to live in the soil. They can be brought to the surface by earthworms or by flood waters and start an outbreak of disease many years after the death of the animal.