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DISEASES OF FEEDER CATTLE IN KANSAS¹

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INTRODUCTION

While diseases of feeder cattle in Kansas do not cause as great an economic loss as tuberculosis or blackleg, they are of sufficient economic importance to necessitate a field and laboratory study to determine their causes and best methods of control.

Diseases of feeder cattle comprise a variety of conditions and abnormalities, and it is considered advisable to limit the contents of this publication to those diseases and conditions that have been given the most attention in the field and in the laboratory.

INFECTIOUS DISEASES

"SHIPPING FEVER"

Shipping fever is also termed stockyards' pneumonia, croupous pneumonia, or hemorrhagic septicemia. The intensity and mortality varies from year to year.

Cause: Shipping fever is primarily an exposure disease. Studies at this station have shown that inclement weather, together with methods of shipping, feeding and housing of cattle before and after shipment are responsible for lowering the vitality and resistance of animals and making them susceptible to this disease. It has been observed that the majority of cattle affected are calves.

There are several types of bacteria that are regarded as

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secondary invaders in shipping fever. *Pasteurella bovisseptica* is one of the bacteria commonly found in the tissues of cattle affected with this disease. This organism has also been isolated from the upper respiratory tract, lung tissue, spleen, and occasionally from the blood stream of healthy cattle or those which are affected with other diseases.

Symptoms: Clinical symptoms of shipping fever: Increased nose and eye secretion, painful cough, rough hair coat, arching of the back, rapid loss in condition, lagging behind the herd, complete loss of appetite, and an increase in body temperature from 103.0° F to 107.0° F. Severely affected animals show symptoms of pneumonia. The severity of the disease depends upon the age and resistance of the animals and the exposure to which they have been subjected during shipment and after arrival at their destination. The younger and less thrifty animals are likely to be more severely affected.

Diagnosis: The history of recent shipment together with changes and irregularities of feeding and watering during transportation and the development of respiratory disturbances after reaching the destination are sufficient to make a diagnosis of shipping fever.

Postmortem Changes: The organs of the chest cavity are the seat of most of the important structural and functional changes. Pneumonia, usually of a severe type, is observed in the lower lobes of the lung nearest the heart, less frequently in the upper part of the lungs. The lungs have a distinct marble-like appearance due to fluid infiltration of the tissues between the lobes. The large bronchial tubes show congestion of the lining surfaces. Areas of pleurisy with adhesion of pleura and diaphragm are commonly observed. There may be straw colored fluid in the chest cavity. Small pin point to larger hemorrhages on the serous surfaces are commonly observed. Inflammation of the stomach and intestines is present in practically all cases.

Prevention: The infected animals should be isolated. Good sheltering, easily digestible feed, including forage such as alfalfa hay and plenty of water, are necessary to the recently shipped animals. Those showing a mild form of respiratory disturbance are likely to respond to this method of care and handling. Cattle which develop pneumonia should be treated in accordance with the direction of a veterinarian.

KERATITIS OR "PINKEYE"

Keratitis is an inflammatory disease of the eyes which involves the outer covering of the eyeball and the delicate membrane that lines the eyelids. This disease has a wide

distribution, and has been reported among cattle in almost every part of the county.

This disease spreads rapidly through herds of cattle that are maintained either under pasture or barnlot conditions. It is principally a disease of calves, although it affects older animals to a lesser extent. Little research, however, has been done on this important disease of the eye.

Mortality: The mortality, or death rate, is relatively low, but the disease is an economic factor, since it retards growth and causes a rapid loss in condition. The disease occasionally makes its appearance in dairy cattle. Some of the producing cows go completely off production and a return to normal production depends upon the severity of the infection.

Cause: The cause is undetermined, although it is believed to be due to a germ. Since studies in the laboratory have proved fairly conclusively that the causative factor does not pass through filter-candles of medium and fine density, it indicates that the causative factor is of a bacterial nature. Susceptible calves kept in close contact with diseased calves in screened stalls in the absence of flies and sunlight and caused to eat and drink from the same receptacles occasionally develop this disease.

It has been proved experimentally that calves previously affected with the chronic type of infection are capable of transmitting the disease seven or eight months after apparent recovery.

Symptoms: A grayish white spot appears on the outer covering of the eyeball just below the center of the eye, and gradually spreads until the whole eyeball is cloudy. If both eyes are affected, which is usually the case, the animal is blind and has difficulty in locating feed. The delicate membrane that lines the eyelids is inflamed, and a watery secretion from the eyes runs down over the face. An ulcer may form on the eyeball and it occasionally breaks. This produces a chronic type of the disease from which the animal recovers very slowly if at all.

Isolate all affected animals and if possible protect them from flies, sunlight, and dust. Prompt isolation and treatment may prevent the infection from spreading to the remainder of the herd. Wash affected eyes once or twice daily with three per cent boric acid solution, and one per cent silver nitrate solution or a five per cent solution of argyrol. Calomel may be beneficial when blown into the eyes to clear up white spots in old standing cases in the absence of acute inflammation. A two per cent solution of zinc sulfate used as an eye wash once or twice daily has proved beneficial.

COCCIDIOSIS OR "RED DYSENTERY OF CATTLE"

Coccidiosis in cattle was first observed in the United States by Theobald Smith in 1889. It is probably more prevalent in this country than is generally considered. In some sections of the United States it is almost a limiting factor in cattle raising.

Cause: Coccidiosis in cattle is an infectious disease caused by small parasites of the genus *Eimeria*. *Eimeria zurnii* is one of the three known species, and there are probably some more that have not been discovered. This organism has a choice for mucous linings of the intestines, where it produces the active type of the disease, while going through one cycle of its development. In Kansas the disease is more prevalent during the winter months, but it has also been observed during fall and early spring.

Transmission: The disease is spread to healthy cattle when the latter come in contact with feed and water known to contain the causative parasite.

Susceptibility: Coccidiosis is principally a disease of young cattle, although it has been occasionally observed among adult animals.

Symptoms: The first symptoms are loss of appetite, a slight rise in temperature, a lessening of muscular activity of the paunch, and the passage of blood-tinged manure. As the disease progresses the above mentioned conditions together with loss in weight becomes more pronounced. The duration of the disease is from one to two weeks. In favorable cases recovery may take place more rapidly. The mortality varies from five to ten per cent of the animals affected.

Diagnosis: Diagnosis is determined from the history of the disease, the presence of blood-tinged manure, and the finding with the aid of a microscope of the parasite in the dung or from scrapings taken from the infected lining membrane of the rectum.

Coccidia are not so resistant to heat, cold, and ordinary disinfectants as formerly thought. Sanitary measures such as isolation of infected cattle and providing them with clean feed and water should be observed. Sulfanilamide has been recommended as detrimental to coccidia; however, the effectiveness of this drug has not been definitely established. Laxatives, disinfectants, tonics and rectal injection of medicines may be used in accordance with the recommendation of a veterinarian.

Prevention: Since coccidiosis is transmitted from diseased to healthy cattle, sanitary measures are necessary to prohibit its spread. Separate and isolate the animals known to be in-

fect. Remove and burn contaminated feed and bedding. Clean and disinfect feed troughs and feed racks that have become contaminated. Elevate the feed troughs above the ground to check the ease of contamination.

Unfortunately, calves recovered from the disease are occasionally carriers and serve as a continuous source of infection in the herd without showing symptoms of the disease. Microscopic examinations of dung from recovered cases may show the presence of the causative parasite. Such animals, when detected, should be sold for slaughter or otherwise removed from the herd.

The coccidia or causative parasites have a low resistance to heat, cold and disinfectants. This is an encouraging factor in combating the disease.

GENERAL DISEASES

"CORNSTALK DISEASE"

"Cornstalk disease" is a mysterious ailment which causes sudden death in cattle while feeding in cornstalk fields late in the fall or early winter.

From a disease producing standpoint the term "cornstalk disease" is meaningless, but it serves to explain in a general way certain fatalities which cannot be explained otherwise.

This disease is restricted to those sections where farmers harvest their corn by picking the ears from the standing stalks, and then turn their cattle into the cornstalk fields. Apparently it is limited in its distribution to the middle and northern portions of the Mississippi Valley.

The disease frequently causes death in animals before its presence is suspected. The cattle appear to be in perfect condition before they are turned into the stalk field, but the following morning one or more of the herd may be found dead. Sometimes after losing a few cattle no further losses may occur in the herd. Postmortem examination does not furnish any conclusive or satisfactory evidence as to the cause of death.

Early investigation of this disease has shown that outbreaks are more likely to occur with or to follow closely after storms, especially cold rain storms. Cornstalk disease occurs under a variety of diverse conditions. It may occur in one herd of cattle, while another herd in an adjoining field under apparently the same conditions is not affected.

Cause: The cause of the disease is undetermined, but due to its sudden onset and rapid termination investigators are inclined to believe that the causative factor may be a rapid-acting poison developed in the stalks in the same manner as prussic acid is developed in other plants known to be capable of producing this poison.

Cornstalks, their foliage, and extracts of these two products are usually negative for prussic acid when examined in the laboratory. Feeding of paunch and stomach contents of cattle dead from cornstalk disease to small laboratory animals has failed to reproduce the disease. Alcohol, ether, or water extracts of cornstalks, cornstalk roots, and leaves, when given as a drench, or by injection into the circulation or beneath the skin, have proved harmless to rabbits and guinea pigs.

Symptoms: The disease comes on rather suddenly with few advanced symptoms. If the cattle are in the stalk field, the affected animal is noticed lying or standing apart from the herd. Sometimes it may become nervous, and apparently develops central nervous disturbances as the disease progresses. The symptoms of suffering and delirium are followed by a complete loss of consciousness and death. Death usually takes place within 24 hours after the first symptoms are noticed.

Postmortem Examination: Impaction of the third stomach and paunch is noticed. Corn husks and corn are found in a dry condition. Occasionally the paunch is tightly filled with feed and gas. The fourth or true stomach contains a small quantity of greenish partially digested material, and the surface lining shows acute inflammation. The small intestines, especially in the upper part, are inflamed. Small pin point and larger hemorrhages on the tissue membranes at base of heart and hemorrhages of the membrane lining the heart are frequently encountered in those affected cattle that live 24 hours or longer.

Affected cattle may be given into the jugular vein injections of sodium thiosulphate or sodium nitrite in aqueous solution. Calcium gluconate may be given by the same method. Methylene blue has been administered in aqueous solution. A surgical operation whereby the paunch is opened for removal of the contents is undesirable, since it has been shown that such operations never relieve the condition.

Prevention: The only method of prevention is to cut the cornstalks when ripe, cure them and feed them to the cattle. Cornstalks fed in this manner are much superior to those which have been weather beaten and bleached in the field.

It is also a good plan to place a few less valuable cattle in the stalk field and allow them to forage over the field in order to determine if any poisonous substance is present before placing a herd of cattle in the field.

Note: This disease is not to be confused with cornstalk disease of horses which has been observed in the east and east-central states.

“PRUSSIC ACID POISONING”

Prussic or hydrocyanic acid poisoning may occur among cattle in any locality where sorghum, cane, Johnson grass, or Sudan grass is fed in an uncured condition. All plants of this group should be fed with caution. Wild cherry has also been known to contain a large amount of prussic acid.

Hydrocyanic or prussic acid is a violent, rapid acting poison. Plants may develop from 0.02 to 0.2 percent of this poisonous substance. It is not believed, however, that prussic acid is present as such in the plant, but rather that it occurs as a glucoside which is changed into the acid by means of a ferment already present. Moisture seems to be essential to this change, which may account for the fact that at times animals may eat considerable quantities of poisonous plants without showing immediate symptoms of poisoning. In some instances symptoms occur only after the cattle have had access to water.

Studies of sorghums conducted by the United States Department of Agriculture have shown that six grains of pure prussic acid are sufficient to make a cow sick. Plants containing as little as 0.02 percent of potential prussic acid, when consumed rapidly in quantities as little as five pounds, would be fatal for a cow. It has often been found that plants capable of forming prussic acid may contain 10 to 12 times as much potential acid as mentioned above. It is evident that the fatal dose in these plants may be comparatively small and the danger to livestock correspondingly great.

Symptoms: Prussic acid is a rapidly acting poison and frequently kills the animal within a few minutes, although occasional animals may live for several hours after the symptoms develop.

The affected animal first shows excitement which is followed by depression and paralysis. Bloating, difficult breathing, central nervous disturbance, paralysis and convulsions are attributed to the action of the poison.

There is no reliable chemical for counteracting this poison. In the majority of cases prussic acid poisoning causes death so quickly that there is not sufficient time to resort to medical treatment. Potassium permanganate solution as a drench tends to destroy the unabsorbed hydrocyanic acid in the rumen or paunch. Ordinary corn syrup combines with the acid to make it harmless. Remedies administered as a drench are likely to be unsuccessful after advanced symptoms have developed. Solutions of glucose, sodium sulphite, methylene blue and sodium thiosulphate may be beneficial when injected into the blood stream, if administered promptly.

Prevention: Prussic acid is not formed in any appreciable quantities in healthy growing plants. The acid develops only

when the normal growth of plants has been retarded or stopped by frost, wilting, mowing, drought, bruising or other causes. Under such conditions prussic acid is formed by a chemical reaction between a glucoside and an enzyme found in the plant. These substances are not poisonous alone and under normal conditions no reaction takes place. Well-cured sorghum or Johnson grass contains very little prussic acid and may be eaten by livestock without danger of poisoning. The poisonous acid is slowly given off during the process of drying, and since this acid is very volatile it passes into the air. Occasionally plants retain a considerable amount of the active acid even when dried.

It has been noted that cattle on good corn ration are less likely to be poisoned than cattle not fed corn. Since starch is apparently effective in lessening the action of the poison, it is a good plan to give cattle starch feed before allowing them to graze on plants capable of developing prussic acid. Alfalfa hay and linseed meal or linseed cake tends to retard the production of prussic acid, and syrup is especially recommended for lessening the rate of formation of the acid.

If one animal of the herd shows symptoms of prussic acid poisoning, the others should be removed from the pasture immediately.

“MINERAL DEFICIENCY”

Calcium, phosphorus, iron, copper, iodine, chlorine, magnesium, fluorine, sulphur and manganese are the principal minerals required for the growth and maintenance of farm animals. Of all of them calcium and phosphorus are the minerals which cause most concern in feeding deficiencies in cattle. The effects of deficiency in these two minerals are likely to be more pronounced in young growing calves and pregnant or milking cows.

The animal body requires a greater amount of calcium than of phosphorus, but a lack of phosphorus is often encountered, because ruminants subsist largely on roughage which is usually high in calcium and low in phosphorus. However, both calcium and phosphorus deficiencies have been encountered in cattle that have been on insufficient rations over a long period of time. Continuous feeding of rations lacking in these two minerals causes a drain of the store of reserved constituents in the bones and a reduction in constitutional strength, milk yield, and resistance to disease. It is important, therefore, that a calcium-phosphorus-balanced ration be maintained at all times. In order for animals to assimilate properly these minerals it is essential that an adequate supply of vitamin D be provided either in the form of sunlight or supplied in a feed such as cod-liver oil, good grade alfalfa, etc. Less vitamin D will be required if a sufficient amount of calcium and phosphorus is present in the ration.

Calcium and phosphorus deficiencies have been observed in Kansas cattle much more often in recent years. Due to increased production of both meat and milk the requirements of animals for these two minerals are greater, while plants grown on soils in many parts of the state are lacking in these minerals due to neglect of liming and of using phosphate fertilizer. Consequently the forage grown on such soils is deficient in these minerals.

Under most conditions the supply of calcium and phosphorus is sufficient in ordinary rations fed to livestock. However, when deficiency of these two minerals has been diagnosed in the herd, or if the ration is known to be deficient, they can be supplied by adding legume roughage or silage containing considerable amounts of legumes. The addition of alfalfa hay furnishes an exceptionally rich supply of calcium, and an ample supply of phosphorus can be maintained by giving daily a pound or more per head of cottonseed meal, soybean meal, soybean oil meal, or other protein supplement.

Steamed bone meal is highly recommended, since this product is the mineral supplement used most commonly to correct phosphorus and calcium deficiencies.

“ENSILAGE POISONING”

Silage or ensilage poisoning is an acute non-infectious disease which affects cattle of all ages.

Cause: The cause is unknown, but due to sudden onset and rapid termination the responsible factor may be due to prussic acid or some other rapid acting poison. Chemical analysis and the injection of animals with test samples of questionable ensilage have failed to show evidence as to the cause of death. There is no correlation between the physical appearance of the ensilage and its poisonous effect, since bright and apparently well-preserved ensilage may cause death in cattle as readily as partially decayed or moldy silage. Atlas, sorgo, corn and other types of silage have been responsible for losses in cattle.

Symptoms: The highly acute nature of the disease makes it difficult to study from the standpoint of symptoms alone. The affected animals react almost identically with cattle suffering from the so-called “cornstalk disease”. Perhaps both of these diseases have the same common causative factor.

Veterinarians and farmers report that death may occur within thirty minutes to two hours after cattle have consumed poisonous ensilage. The good feeders are the animals most likely to be affected, and it has been observed in young feeder calves, steers and cows. The affected animals apparently develop a nervous disturbance, for they become furious and may chase attendants from the feedlot.

Diagnosis: The fact that cattle may be found dead in the feedlot in the morning or soon after having access to ensilage of a poisonous nature, together with the behavior of the animals is sufficient for making a diagnosis of the so-called "ensilage poisoning".

Postmortem: Postmortem findings are not indicative or sufficient to be called characteristic for the disease. There may be an almost complete absence of postmortem changes or a few small pin point hemorrhages on the lining and reflected membranes together with acute inflammation of the stomach and intestines.

Injections of calcium gluconate, sodium thiosulphate and methylene blue solutions have been given into the jugular vein. Some of these drugs have been reported to be fairly effective if administered in time.

Prevention: Since there is no specific medicinal treatment for this disease, prevention must be resorted to. It is practically impossible to detect an ensilage that possesses poisonous qualities by mere physical examination. Cattle may be fed from the same silo without ill effects until a "pocket" is reached where harmful ensilage may be found. While the remaining ensilage may not cause further loss of the cattle, it is, however, advisable to stop feeding the ensilage in question until feeding experiments have proved the absence of harmful material.

To avoid financial loss and inconvenience resulting from the disposal of the remaining ensilage, samples should be taken from different parts of the silo and fed to a few of the less valuable calves to determine if the ensilage still has a harmful effect.

MALNUTRITION

Malnutrition seems a peculiar designation for a disease, but during the past few years following the drought which extended throughout the west and southwest, numerous losses among cattle have been attributed to deficiency in feed in both quality and quantity. In many instances aged cattle have been purchased in Texas, New Mexico, Arizona and other places and shipped into Kansas for the purpose of wintering and producing a spring crop of calves. Some of these cattle show a well marked thinness or wasting of the body, and in addition some are in the early stages of pregnancy, when purchased. It is among this type of animals that losses have been the greatest. They have existed on feed of low nutritive value for so long a period that their body is entirely depleted of the needed reserve of minerals, vitamins and other essential food elements. During late winter and early spring the cattle in advanced pregnancy are unable to withstand the exposure to severe weather, together

with the extra drain on their bodies by the developing unborn young, and die from malnutrition or starvation.

Many of these cattle are purchased at a low price and are of poor quality to begin with. In some instances the daily feed they receive consists of a pound to a pound and a half of cottonseed cake and wheat straw. The loss varies from 5 to 20 percent depending upon the type of weather, methods of handling, feeding, watering, and housing.

Prevention: Malnutrition is a difficult problem to handle, since most of the affected animals are old "broken mouth cows". However, well balanced rations should be given to the herd in sufficient amounts. Moreover, the herd should be divided and the less thrifty animals should be placed in separate lots, sheds or barns where they could have special attention. A weakened animal can be easily pushed away from the feed trough by the stronger better nourished animals.

PHOTOSENSITIZATION

Synonyms: Buckwheat poisoning, fagopyrism, clover disease, hypericism, St. Johnswort poisoning, etc.

Feeding of certain plants to white animals or those having white spots to cause local reaction, when exposed to sunlight is by no means a new condition. Black animals are not affected.

Cause: Photosensitization is thought to be a reaction of white skin to light by a certain form of fluorescent matter present in the plant. This condition can be brought about by eating one of many kinds of plants. Different plants have their own poisonous principles. Some types of plants only produce this disease after some changes in their growth, such as drought and retarded growth.

A definite causative factor is yet to be established. However, it has been universally admitted that these poisonous principles render the tissues of an animal susceptible to destruction by the energy contained within the longer wavelength of light which would otherwise be ineffective.

Buckwheat, St. Johnswort, clover and many other plants are capable of producing such condition in animals.

Chlorophyl of plants possesses powerful activity when exposed to sunlight and the injection of such in the blood stream has long been found to produce this disease in animals. It is, however, broken down in the intestinal tract and does not pass through the intestinal wall into the blood stream as such.

Phylloerythrin, which is normally found in the intestines of animals which feed on chlorophyl containing plants, readily passes through the intestinal wall into the blood stream, and, if enough of it is found in the blood, it will pro-

duce this disease. However, unless throwing off of bile is checked, phylloerythrin will be collected by the bile, and thrown back into the intestinal tract to prevent it from reaching a high level.

Symptoms: The symptoms may appear in a wide range from the acute, to the chronic form. Agitation, distress, uneasiness, shaking of the head, twitching of the tail, stamping of the feet, diarrhea, loss of appetite, increased respiration, and rise in temperature from 103.0° F to 108.6° F are regarded as constant symptoms. Skin irritation causes the affected animal to rub, and lick the white parts which become inflamed. A straw colored fluid collects under the skin which later dries and forms crusts. These areas may become dry, cracked, and bloody. The affected skin becomes thickened, wrinkled, and separates from the underneath layer, to be cast off as the animal recovers. The underlying skin returns to normal within one to three months.

Prevention: Stabling or otherwise protecting the susceptible animals from sunlight will relieve or stop the condition. Stop feeding those plants as mentioned above, whenever possible.

Young animals and improved breeds are apparently more sensitive to attack, and should be given additional attention. The hairless and inflamed parts may be cleaned with a mild antiseptic and covered with vaseline.

ERGOT POISONING

Wild-rye and wheat grass of Kansas and Nebraska have long been known to be susceptible to a fungus known as ergot. Although ergot poisoning does not cause as great a damage as some other cattle diseases in Kansas, sickness or death from such poisoning has often been reported.

Ergot is a fungus principally found in clustered form in the head of grasses such as wild-rye and wheat grass grown in this part of the country. It is in the form of kernels somewhat larger than an oat and of a black color. It replaces the grain.

Symptoms: The poisonous effect of ergot appears in late fall and winter due to the continuous feeding of hay and straw that are heavily infected with the ergot fungus. Animals may lose part of their tail or ears. Their hoofs may slough off. In other cattle only severe sores may appear on the teats or on the mouth. Pregnant cattle often have premature births. Ergot acts upon the nervous system and on the circulation by causing the muscular walls of the blood vessels to contract or shrink. This causes a lack of blood to reach the part.

The symptoms are not very marked in the early stages. However, in advanced cases there is local gangrene on the

mucous membranes. The extremities such as the ears, tails and lower parts of the limbs gradually begin to lose their warmth and sense of feeling. Dry gangrene sets in, the part hardens, shrinks, dries, and finally drops off without apparent pain.

If the hoofs are sloughed off, treatment will not be satisfactory. Vaseline or diluted carbolic acid (2 percent) solution may be used on the ears, tails and other affected parts.

Prevention: Ergot infected hay should not be fed to livestock. Fields in which great quantities of ergot are found should not be cut for hay or pastured. Before blossoming time a sweetish liquid is secreted which attracts insects to spread the seeds of the fungus from flower to flower. To check the spread of ergot, susceptible grasses should be cut for hay before flowering. Hay land with matured ergot should be burned. Roadside ergot-producing grasses should be cut several times during the season.

BLOATING

Bloating of cattle is seen frequently and most commonly while pasturing in the early morning and during the cool, moist weather in the spring and in the fall. The danger is further increased by watering immediately after pasturing or after feeding. "Greedy" feeding on succulent feeds is another contributing factor. Green and newly cut alfalfa has produced the disease in calves when these animals are suddenly given access to this type of feed. In the western part of the state, where green succulent feed is frequently scarce during dry seasons, cattle have been known to develop acute bloat from eating an excess of sloughgrass.

Care should be exercised not to turn cattle on pasture until the grasses and clovers have had an opportunity to dry. The cattle are then gradually allowed to become accustomed to the green feed. Once this condition is known to exist in a herd of cattle, the owner should use extra precaution to prevent recurrence by observing the precautions mentioned in this paragraph.

Until a veterinarian can reach the animal it may be given a mixture of four tablespoonfuls of turpentine and one quart of milk. The mouth should be kept open by means of a stick placed crosswise in the mouth. The front portion of the body should be raised in order not to hinder breathing by crowding the lungs. If suffocation is threatened an artificial opening of the paunch is made for immediate relief. This operation is best not resorted to excepting as an emergency step and preferably under the guidance of a veterinarian. If improperly or carelessly performed it is frequently followed by unfavorable after effects.

GLOSSARY

- Chlorophyl:** The green coloring matter in plants.
- Eimeria:** A class of coccidia or one-celled organisms.
- Eimeria zurnii:** The technical name for a coccidia or one-celled organism that causes Coccidiosis or "Red Dysentery of Cattle".
- Enzyme:** A chemical ferment formed by living cells.
- Filter candle:** A device for straining water or other liquids. In this instance filter candles were used to strain watery secretions taken from the eyes of "pinkeye" infected calves.
- Fluorescent-matter:** The property certain bodies especially organic fluids such as plant juices develop when exposed to sunlight. The light they give off differs in wave length from the light they absorb.
- Glucoside:** Any vegetable or plant principle that may be changed into dextrose (sugar) and another substance.
- Grain:** A unit of weight used in weighing very small quantities.
- Hydrocyanic acid:** A colorless liquid, extremely poisonous.
- Photosensitization:** The process of being sensitive to light.
- Phyllo-erythrin:** A product of chlorophyl formed in the intestinal tract of ruminant animals such as cattle, sheep and goats.
- Protozoan:** The lowest division or form of life in the animal kingdom. It includes the one-celled animals.