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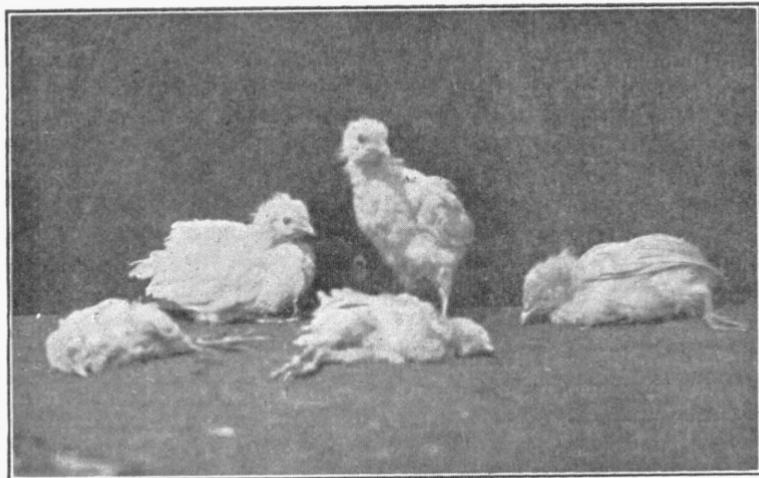
UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

M. F. MILLER, *Director*

Coccidiosis in Chickens and Other Birds

(Bulletin 372 Revised)

A. J. DURANT AND H. C. McDouGLE



A group of chicks affected with coccidiosis. A microscopic examination of the droppings of each one of these birds showed the coccidia in large numbers.

COLUMBIA, MISSOURI

SUMMARY

1. Coccidiosis causes heavy losses annually in young chicks in this State.
2. The parasite which causes the disease lives over in the soil from one year to the next.
3. Contaminated soil and unclean brooder houses are probably the most common sources of infection. Adult birds, pigeons, sparrows, and soiled shoes of persons walking over contaminated grounds may also serve as carriers.
4. Bloody droppings are a sure sign of coccidiosis. If this indication is not present a microscopic examination of the droppings will usually show the parasites.
5. Clean grounds and sanitation will aid in the control of the disease. A three-year-rotation of grounds should be practiced.
6. In case of an outbreak of coccidiosis the feeding of a special ration containing a large percentage of some form of milk will quickly control the disease.

Coccidiosis in Chickens and Other Birds

A. J. DURANT AND H. C. McDouGLE

Coccidiosis is undoubtedly the most common disease of young chicks with the single exception of pullorum disease (bacillary white diarrhea), and it is not unusual for mature birds to be affected with the chronic form. It is often disastrous to flocks of young turkeys, and may at times cause losses in pigeons, geese, and ducks. Wild birds are susceptible, especially when raised in confinement. Heavy losses have been reported in flocks of quail and pheasants on game farms in Missouri. The disease is most prevalent in the spring and summer months (Figure 4). This is due to the fact that (1) the chicks are more susceptible at that time and (2) the warm, damp spring weather is favorable for the development of the coccidia from the resting form into the infectious stage. Unless an early diagnosis is made and treatment is provided heavy losses may occur.

CAUSE

Coccidiosis is a disease caused by a very small animal parasite that can be seen only with the aid of a microscope (Figure 2). The parasite is of the genus *Eimeria* and develops in the inner lining of the intestines, causing irritation and inflammation of varying degrees.

There are six species of coccidia that may commonly cause the disease in chickens, but only two are considered extremely pathogenic. These are *Eimeria tenella* of the ceca and *Eimeria necatrix* of the middle portion of the small intestines.

In turkeys there are two species that cause the disease, *Eimeria meleagridis* Tyzzer and *Eimeria meleagrinitis* Tyzzer.

Only one coccidian species, the common *Eimeria labbeana*, is known in the domesticated pigeon.

There are four distinct species that affect geese. Though ducks appear to be rarely infected with coccidiosis in Missouri, it may be mentioned that they are susceptible and probably have a species of their own. In fact, with few exceptions, it is probable that all birds have a specific species of the protozoan parasite.

It would appear at present that there is only one species of coccidia definitely identified as producing coccidiosis in quail, *Eimeria dispersa*, and it has been shown that this species is cross infective for pheasants and quail. Further work is needed to clarify the number and species affecting quail.

Coccidiosis of pheasants may be caused by two species, one already mentioned under quail and the other *Eimeria phasianii*.

NATURE OF THE PARASITE

The complete life cycle of the parasites causing coccidiosis is very complicated and only a general outline will be given in this bulletin. The life cycle (Figure 3) of all species of coccidia in chickens is quite complicated, yet primarily the same. The oocyst, or resting stage (Figure 2) passes out with the droppings of affected fowls. Under favorable conditions for its sporulation or development, which are warm, moist surroundings, the coccidia reach the infective stage in from 21 to 48 hours. The susceptible birds become infected by taking in these sporulated infectious oocysts with food or drink. In the digestive tract the sporozoites are liberated. These burrow into the intestine where they undergo



Fig. 2.—A photo-micrograph showing the resting or resistant stage of the parasite causing coccidiosis. The three oocysts (resistant or resting stage) are enlarged 700 times their natural size.

several transformations. Several stages of merozoites (the active stage) are formed from the intermittently developed schizonts. The parasite is then capable of taking two courses in their development, their cycle may be repeated in the intestine, or microgametes (male) and macrogametes (female) may form, which may unite to form the fertilized gamete which develops into the oocyst. The tissue destruction by the merozoites and schizonts apparently gives rise to the so-called bloody diarrhea, as the burrowing of the merozoites and the rupture of the schizonts cause an enormous destruction of tissue and of the blood vessels of the intestines. The oocysts (Figure 2) are noticed in the droppings usually from the fourth to seventh day after infection occurs.

Different species of coccidia inhabit different parts of the intestine. However, it should be pointed out that the coccidia (*E. tenella*), inhabiting the ceca, and (*E. necatrix*), which inhabits the

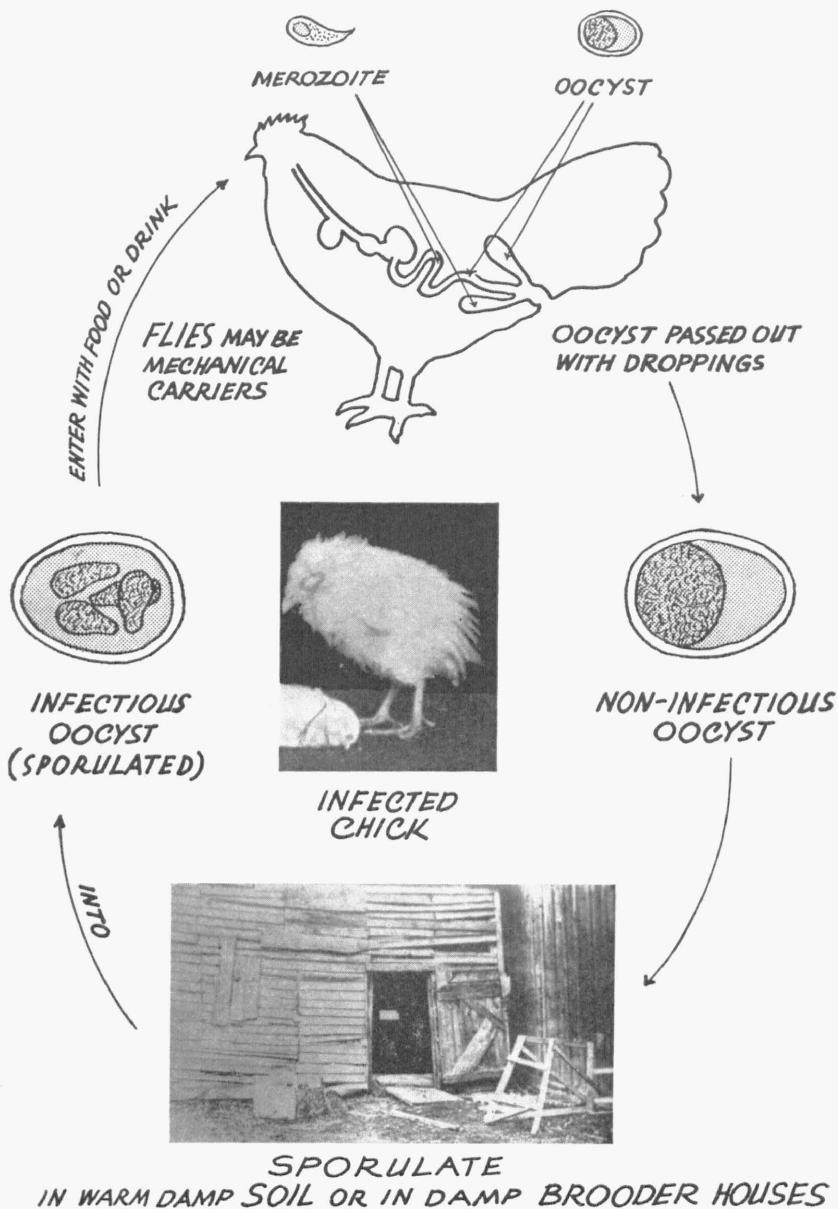


Fig. 3.—A simple life cycle of coccidiosis in fowls.

small intestine (oocysts in ceca) are the two species of coccidia which are the most pathogenic for chickens. The latter, and (*E. Acervulina*) have been described as the species causing so-called "chronic coccidiosis."

SOURCES OF INFECTION

Contaminated soil and brooder houses are probably the most common sources of infection, though the disease may be carried to a flock on clean grounds or into clean brooder houses on soiled shoes of persons who have walked over contaminated ground. It may also be carried by pigeons, sparrows, or by flies, especially if sour milk is fed. The parasite lives over from one year to the next so that the disease is likely to occur year after year on the same ground. Adult birds may carry the disease to clean grounds. Chicks should not be allowed to run in orchards or fields that have been fertilized with chicken manure within the last two years. The disease is not, to our knowledge, transmitted by the eggs from a carrier hen to the baby chicks.

It should be emphasized that it is quite common for coccidiosis not only to occur in brooder houses in the spring before the chicks have been out of the house, but also in battery brooding plants.

SYMPTOMS IN YOUNG CHICKS

In very young chicks ten days to three weeks old the first indication of coccidiosis is usually an inclination to gather close to the stove as if chilled, or blood may appear in droppings. In slightly older chicks (4 to 8 weeks) the symptoms are roughened, dirty plumage, droopiness, unthriftiness, loss of appetite, and gradual loss of flesh (Figure 1). Occasionally, especially in male White Leghorns, a shrunken bluish color of the comb, with sometimes a like discoloration of the abdomen and legs may be evident. Blood may or may not appear in the droppings of these older chicks. The disease may spread rapidly through the brood until 50 or 75 per cent are showing signs of the disease. The symptoms may not be so pronounced in still older chicks (2 or 3 months old) and bloody diarrhea may not be present. They usually appear slightly droopy, have ruffled soiled plumage, accompanied by a white or watery diarrhea, and may develop paralysis of the legs. In chicks ten days to two weeks old the course of the disease is very rapid. In general, the older the bird the longer it lives after becoming infected.

It sometimes happens that birds affected with a slow or chronic form of coccidiosis will develop a condition of the head resembling roup, and this is probably a form of malnutrition brought on by the disease. In cases of this sort it can be distinguished from ordinary roup by the character of the swelling around the eyes and by the fact that there will be a lack of odor, as is found in "swell head" roup.

GROWN BIRDS MAY BE AFFECTED

It has been mentioned that grown birds are subject to a chronic form of coccidiosis, though as a rule only a limited number will contract the disease. In adults there is a loss of appetite, pale comb and wattles, wasting away, and sometimes paralysis of the legs. Sick birds may live for weeks. This form of coccidiosis probably occurs most frequently during the fall months, in pullets which have passed through an attack of coccidiosis in the spring. In flocks of several hundred birds, ten or more may be affected.

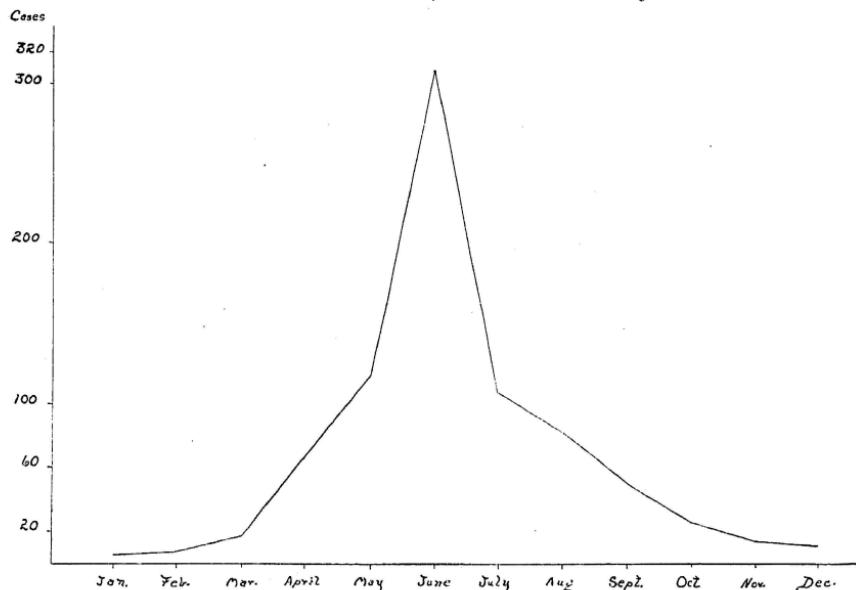


Fig. 4.—Chart showing the seasonal variation of coccidiosis in chickens. These data were compiled from the past seven years' autopsy records on 888 chickens.

CHANGES OCCURRING IN THE ORGANS OF Affected BIRDS

The intestines are usually affected and the most constant changes are found in the ceca (blind pouches) and in the small intestines. In young chicks in which a bloody diarrhea is a marked symptom the blind pouches or the small intestines contain a mass of bloody material and the walls of these two organs are severely inflamed. Both ceca are usually affected. In the more chronic form the pouches are distended and filled with a hardened yellowish-white mass, in the center of which is a cheesy material of a dirty yellowish color (Figure 5).

The changes occurring in the small intestines depend on the species of coccidia that is present, as some produce a more severe type of the disease than others. In general, *E. tenella*, *E. maxima*

and *E. necatrix* are the ones that cause the occurrence of blood either in the droppings or in the intestinal contents. The intestinal lining may show an exudate that is either blood-tinged or contains flecks of blood. In some cases sections of the small intestines will be dotted with hemorrhages which show through the wall. In other cases thickening of the wall with collections of exudates in the lumen actually produce a stoppage in sections two or three inches in length. The presence of blood depends, of course, on the stage at which a post mortem examination is held and on the species of coccidia involved. In some cases there will be no blood and

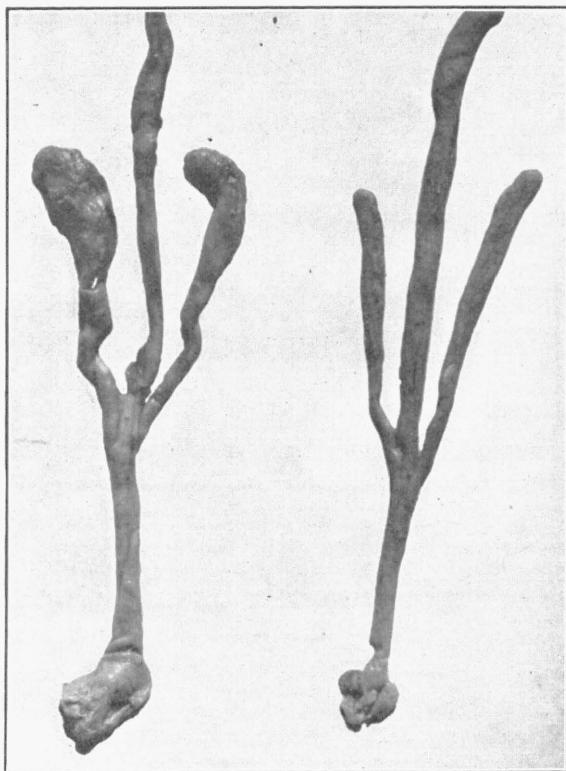


Fig. 5.—(At right) The blind pouches and adjacent parts of the intestines of a normal bird.

(At left) Diseased pouches of a bird, showing distension caused by cheesy core contained in the pouches. This is more often seen in the chronic form of the disease.

in others there will be severe hemorrhages and collections of clots along the intestinal tract. The wall of the small intestine is greatly thickened, due both to swelling of the tissues and to the presence of large numbers of the sexual stage of the coccidia. The ceca

may also be enlarged, and these two abnormalities are often very helpful in making a diagnosis.

In mature fowls the changes are not as marked as in younger birds and a chronic inflammation of the intestine is usually the only gross change observed. It is not possible to make an accurate diagnosis without a microscopic examination of the contents of the intestines or the droppings, though in general birds from flocks which were affected when young may be suspected of suffering from the chronic form of coccidiosis, if the symptoms described for adult birds are observed.

HOW TO RECOGNIZE THE DISEASE

Bloody diarrhea is a sure sign of coccidiosis and is most often seen in very young chicks ten to twenty days of age. If it is not present, a microscopic examination of the droppings or the material found in the blind pouches of the dead chick will reveal a large number of the coccidia and definitely establishes the diagnosis. Another finding upon which considerable dependence may be placed is the presence in the blind pouches of the hardened core or the swollen thickened condition of the small intestines, both of which have been described.

It is well to remember that chicks are very seldom affected with this disease under ten days of age. This fact will be of assistance in recognizing the difference between coccidiosis and pullorum disease (bacillary white diarrhea). In general, the former attacks the chicks later in life, when they are 14 days old or older. Typical pullorum disease causes the greatest losses from the 7th to the 9th day.

CLEAN GROUNDS AND SANITATION AID IN CONTROL

Movable brooder houses should be thoroughly cleaned and disinfected, using a can of high-test lye to each 12 gallons of cold water. The house should then be moved to clean grounds from 50 to 75 yards away from the other poultry houses and runs. Select any available slope that is well drained. An effort should be made to have a range on which a three-year rotation can be practiced. This will mean that three sites will be needed, moving the brooder house to one of the sites each year, which will allow each plot to be vacant for two seasons. Trees which are present on the range should be trimmed to allow plenty of sunlight under them during the course of the day.

MANAGEMENT OF OLD RUNS TO HELP CONTROL COCCIDIOSIS

If the runs are limited and it is not possible to furnish clean range each year, the ground should be plowed deeply and seeded heavily with wheat. The droppings and litter should be removed

from the houses and the floor and litter kept clean and dry. A warm, deep litter in the house is conducive to the development of coccidiosis even though the chicks are not running on the ground, and it has been mentioned that not infrequently outbreaks of coccidiosis occur in battery brooding plants.

WHAT TO DO IF THE DISEASE APPEARS

Coccidiosis may sometimes invade a flock even under the best conditions of sanitation and it has appeared in brooder houses on clean range where every possible precaution has been taken. This, however, should not be taken to mean that these precautions should not be observed, since in most cases clean ranges solve the problem of coccidiosis. If chickens are placed on farms where the disease has occurred the previous year, the disease is almost certain to make its appearance in the young stock in from four days to three months after the chicks are put on the ground.

A successful method of combating this disease was recommended a number of years ago by Dr. J. R. Beach of the California Experiment Station, and his recommendations have been followed in Missouri for a number of years with satisfactory results. Although many maintain that the milk treatment is not a successful means of combating coccidiosis, it is recommended unhesitatingly for the control of the disease in Missouri until some other more successful treatment has been devised. The Beach treatment consists in feeding a special ration containing a large percentage of some form of milk. A probable explanation of why this ration containing a high percentage of milk is helpful in this disease is that the milk is a highly nutritious food that helps to maintain the body weight of the bird, and therefore brings up its resistance. It is also thought that perhaps the acid reaction of the milk in the digestive tract might retard the activities of the coccidia. A flock when properly fed on this ration can be brought back to a normal appearance in ten to fourteen days after the treatment is instituted. It should be emphasized, however, that even though the milk treatment is applied to an infected flock the chicks will not respond so well unless the other recommendations are followed. This treatment will work especially well if an early diagnosis is made and the measures recommended are applied soon after the disease makes its appearance.

SPECIAL FEEDING METHODS

There are two systems of feeding which are successful in the control of this disease and it depends on the poultryman's situation as to which one may be applied most economically. *Ration No. 1* is recommended as the most reliable in general, and consists in feeding mash containing 40 per cent of dried milk.

A reliable and successful formula consists of: 20 pounds of bran, 20 pounds of shorts, 20 pounds of yellow corn meal, 40 pounds of dried milk (either dried skim milk or dried buttermilk), 4 pounds of bone meal and, 1 pound of table salt.

Keep this mash before the chicks constantly, with an abundance of greens, and allow plenty of water but feed no grain.

Ration 2 is one which may be used if the farmer has an abundance of liquid milk, either fresh skim milk, sour milk, or buttermilk. Best results may be expected in using liquid milk if the same kind is used each day, though this is not necessary, and changes can be made with comparative safety.

Ration 2 consists in supplying the chicks with sour milk or buttermilk constantly, removing the mash and water, and giving an abundant supply of greens. A small amount of grain should be fed in the morning and a somewhat larger amount at night. The chicks should have full crops of grain when they go to roost. Allow no other feed during the feeding treatment.

CONTINUE SPECIAL RATION FOR SEVEN TO TEN DAYS

Continue one of these methods of feeding for seven to ten days or until the condition of the flock has decidedly improved. Then gradually replace the special ration until the chicks are again on a normal ration. If the disease reappears the flock should be put back on one of the suggested rations for sick birds. After a brood has passed through the disease it is not likely to be troubled with it any further that season, except for occasional chronic cases after the birds are grown. In most cases birds have acquired an immunity to the disease after one attack.

KEEP AFFECTED CHICKS WARM

In controlling an outbreak of coccidiosis in young chicks it is very important to keep the flock warm, so an abundance of heat should be applied, not only under the hover but also in the brooder house. If this is not done, loss from crowding under the hover or in corners may occur even during the day.

On a large commercial poultry farm where coccidiosis was present an experiment was conducted to determine how many visibly affected chicks would recover on the milk treatment, and in the experiment the importance of having warm, comfortable surroundings for the sick chicks was well illustrated. Two-hundred sick chicks were put in a brooder house on a 40 per cent dried milk ration and a careful check was kept on the mortality. As soon as chicks recovered from the disease they were removed and other sick chicks replaced them, so that the number in the brooder house remained about the same at all times. It was observed that on cold days when the fire went out in the brooder stove the mortality rate was very high, but that when favorable conditions were maintained the losses were practically zero and nearly all of the birds

were restored to a normal appearance. This emphasizes the importance of keeping the birds warm.

It is also important to keep the floors dry and clean. Visibly sick birds should be isolated from the apparently healthy ones, unless the majority of the flock is showing signs of infection.

TREATMENT FOR GROWN BIRDS

If adult birds are affected with coccidiosis it is best to remove all birds that are showing signs of the disease. They should be placed in quarantine and put on one of the rations previously suggested. By culling the flock and treating only those affected considerable expense will be saved and good results may be expected.

TREATMENT OF TURKEYS AND OTHER BIRDS FOR THE CONTROL OF COCCIDIOSIS

In general, the recommendations for the control of coccidiosis in chickens will apply to other birds. These measures have been successfully applied to wild turkeys and pheasants in confinement in State Game Parks in Missouri, in a number of instances.

In applying the milk treatment to birds other than chickens add dried milk to the feed until the total milk content is 40 per cent. Example: For a feed containing 10 per cent milk add 50 pounds of dried milk to 100 pounds of the feed.

Where there is doubt as to the diagnosis consult your local veterinarian or send live affected birds by prepaid express to the Veterinary Department of the Missouri Agricultural Experiment Station at Columbia.

There are various remedies and medicines on the market for the prevention and cure of coccidiosis, but carefully controlled experimental trials with drugs have shown that they are of no value. Hydrochloric acid, acetic acid, catechu, a mixture of bichloride of mercury and sulphocarbolates (coccidiosis powder), potassium dichromate, powdered ipecac, bluestone, quinine, and bismuth sub-nitrate have all been submitted to trial. It is probable that most of the products which are offered for sale as coccidiosis remedies contain one or more of these drugs. Recently sulphur as a preventive of coccidiosis has been recommended in a report from the Wisconsin Experiment Station, by C. A. Herrick and C. E. Holmes. It would appear from this report that sulphur may have some properties as a preventive for the disease, but the authors state that further work remains to be done before it can be recommended. It is much better therefore to watch the flock closely for any signs of disease and depend on the milk treatment, with sanitation, rather than any other method when the flock is attacked.

No measure is going to be successful in the control of coccidiosis unless careful attention is given to sanitation. A three-year rotation for the prevention of coccidiosis, as previously described, should be carried out in preference to any other method of prevention and this system can be carried out on most Missouri farms.