

Coccidiosis of the Chicken



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Coccidiosis is the most prevalent infectious disease known to specialized poultry farming.

Strict sanitation alone positively controls the disease. Applying strict sanitation depends upon a knowledge of the parasite and the nature of the disease.

In addition to sanitation, liberal milk feeding for a limited period is used to control severe outbreaks of the *cecal type*.

SUMMARY

Coccidiosis is the most wide-spread infectious disease in Oregon's specialized flocks, causing losses in both brooder or mature stock.

The cause is a parasite indistinguishable to the naked eye. When eaten by the fowl the parasite attacks various parts of the intestines.

Six kinds of coccidia have been identified. All cause losses in egg production and some cause mortality.

Fresh droppings can not produce the disease. About twenty-four to forty-eight hours is required under favorable conditions for the droppings to become infective.

Four to seven days are required for the parasite to develop after being consumed and for the droppings to contain oöcysts.

Severity of the disease is determined by the number of parasites consumed. Small numbers of the most severe type may produce no symptoms.

About a month after inoculation surviving fowls are free of the parasite or nearly so unless reinoculated.

Immunity or resistance develops to all species of coccidia if a sufficient number of parasites are consumed. One species does not produce immunity to another.

The parasite may be distributed by infected fowls, shoes, flies, birds, brooder equipment, streams, and used, unsterilized feed sacks.

Warm weather accompanied by occasional rains decidedly favors the occurrence of coccidiosis.

Considerable pure blood in the droppings or intestines is most characteristic of coccidiosis. Sudden death after symptoms are shown, lingering illness and finally death or gradual recovery may result.

There is no definite evidence that paralysis and coccidiosis bear any relationship.

Sanitation is the foundation of coccidiosis control.

All sudden or acute outbreaks are controlled by daily cleaning, and the cecal form, in addition, by feeding a ration containing twenty per cent powdered milk for a week or ten days. The milk ration alone can not be expected always to control even the cecal form.

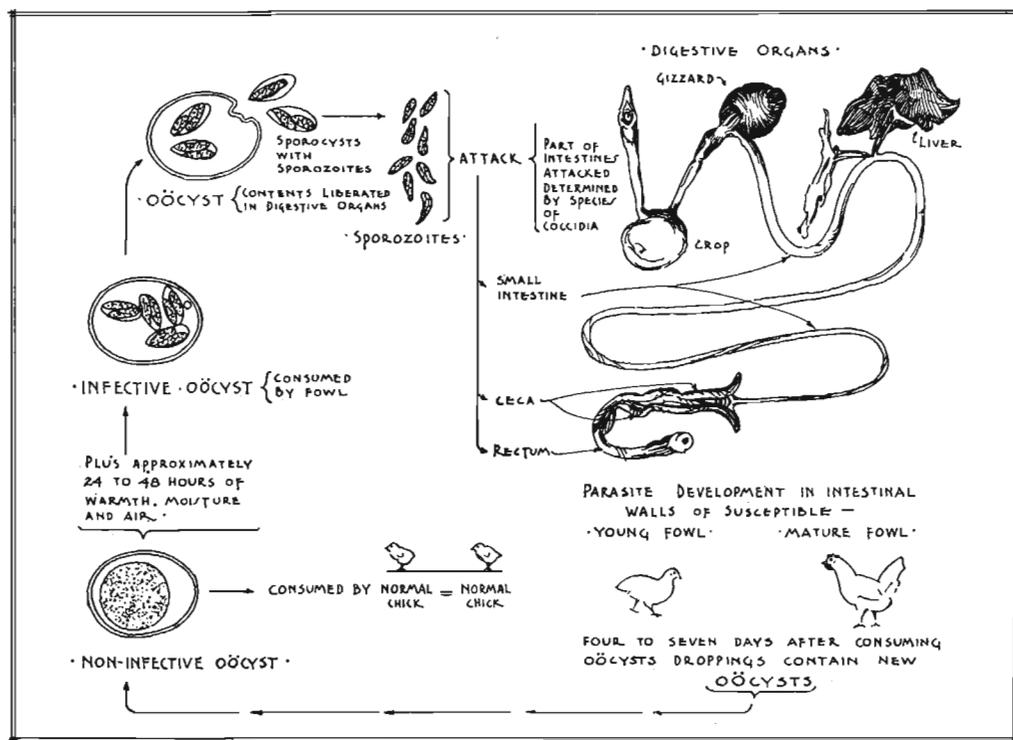


Figure 1. Infection cycle of Coccidia—about five to eight days required to complete.

Coccidiosis of the Chicken

By

W. T. JOHNSON

THE parasite responsible for coccidiosis of chickens is no doubt the most widely distributed disease-producing agent in Oregon's specialized flocks. It is doubtful whether any such flocks entirely escape. According to reports emanating from other parts of the continent, it is probable that this situation prevails elsewhere, and to a more serious degree in those sections where frequent spring and summer rains prevail.

The literature contains numerous misstatements and contradictions pertaining to coccidiosis. The more that is written, the greater the confusion becomes in the minds of many. The fact remains that when one evaluates the substantial experimental work there is a very close agreement regarding the important phases of the disease.

Coccidiosis as a severe disease is largely due to the development of specialized poultry raising. Responsible for it are: (1) the large rearing unit, (2) limited range, (3) continuously used range, (4) proximity of poultry farms, and (5) increased trafficking in fowls.

This statement does not signify that specialized poultry farming is doomed to failure because of coccidiosis. It does, however, emphasize the necessity of recognizing the importance of this problem and becoming adequately informed. Facts are available which definitely determine means of control and make it possible to eliminate many disastrous losses, so prominent only a few years ago.

Although commonly a disease of young stock, coccidiosis sometimes appears to cause serious loss in egg production by developing in mature fowls. It seems probable that the disease is on the increase in fowls of laying age.

THE DISEASE

The cause. A small parasite distinguishable only under the microscope has been established beyond question as the cause of coccidiosis. Various forms of mismanagement or feeding of the flock, resulting in lowered vigor, are often regarded as primary factors in the production of the disease, but erroneously so. There is so much experimental and field evidence to disprove these assumptions, that they would not be worthy of mention here if it were not for the fact that many interested in poultry still cling to such misconceptions. It should be obvious that these muddle the situation, and stand in the way of successful control.

Kinds of coccidiosis. At least six kinds of coccidia are found in Oregon chickens, five of which affect particularly the small intestine and one the ceca and rectum. One is capable of causing severe bleeding from the ceca and rectum, another from the small intestine. The remaining four as a rule cause slight or no bleeding, but do cause excessive amounts of mucous or slime in the small intestine and droppings.

The nature of the parasite and the disease. When the fowl eats contaminated material the parasite gains entrance and passes into the intestines.

In the intestines the parasite undergoes various changes and finally emerges in an egg form, or what is known as an oöcyst, which cannot be distinguished with the naked eye. This oöcyst has a wall that compares with the shell of a hen egg, fluid with the white of the egg, and a spherical body with the yolk (oöcyst, non-infective, see Figure 1). This is as far as the parasite develops in the fowl. It then passes out in the droppings. This stage is not capable of producing disease. The fresh droppings from an infected fowl will not produce coccidiosis.

After being passed in the droppings, the oöcyst undergoes a change (oöcyst, infective, see Figure 1), if proper conditions of moisture, air, and temperature are provided. In this change the part which compares with the yolk of the egg divides into four bodies, which in turn divide. At this stage the parasite is capable of producing disease. This has been repeatedly accomplished in approximately twenty-four to forty-eight hours under laboratory conditions at room temperature.

About four to six days, depending upon the kind of coccidiosis present, are necessary for the parasite to attain much development after being consumed. During the succeeding few days, heavily infected fowls discharge millions of oöcysts in the droppings and thus expose others to infection.

Severity of the disease dependent upon number of parasites consumed. The number of oöcysts consumed determines the severity of the disease in fowls not seriously infected previously. Fowls infected with small numbers appear perfectly healthy. Young fowls infected with a large number for the first infection regularly die with the disease in the case of the bloody types. Older fowls may show considerable cecal hemorrhage or bleeding and recover, but are not so likely to recover with severe small-intestine infection accompanied by bleeding. The fact that the severity of the disease is determined by the number of coccidia is of considerable importance, as it means that reducing the number serves as a control measure. This is accomplished by sanitation.

Coccidiosis self-limiting. All forms of coccidiosis are self-limiting. By this is meant that the parasite goes through a rather definite period of development, stops reproducing, passes out of the intestinal walls and then out in the droppings. The fowl is then free of infection. Since the oöcysts pass out in greatest numbers during the first week after symptoms develop, the value of frequent cleaning during that period is obvious.

Immunity and resistance. Fowls are naturally highly susceptible to coccidiosis infection. Even under commercial flock conditions this may continue until after the fowls are mature. Severe infections, or mild infections, continued long enough result in varying degrees of resistance, if not complete immunity. One kind does not produce immunity to another. Knowing that the parasite is so widely distributed, that the disease occurs so frequently, and that infection develops resistance or immunity, it is logical to expect surviving commercially reared fowls to acquire resistance regularly. The use of highly artificial methods of rearing lessens the chances for infection in young stock, however, and increases the possibility for the disease to occur in such fowls when mature.

The fact that resistance or immunity is produced as a result of previous infection explains why serious coccidiosis does not occur over a period of

years on some farms where insanitary methods prevail. That a given farm has successfully reared a flock of pullets without a severe outbreak of coccidiosis, and with what is generally recognized as insanitary conditions, does not signify that another would be equally successful with similar equipment and management. In these cases control is a chance occurrence and while the fowls may consume a small number of the parasites, they are likely to consume a large number as the first dose. Under the latter circumstances disastrous results are certain to follow with some kinds of coccidia.

The knowledge that previous infection produces resistance points to the possibility of more accurately analyzing management conditions by experimentation. This may be accomplished by a study of resistance shown by fowls on different farms and analyzing the relationship of this to management factors. This and other phases, particularly the possibility of producing immunity by controlled inoculation, require further investigations before practical relationships can be definitely worked out, so that they may be applied by the poultry raiser.

The method of distribution of the parasite from one poultry farm to another is a question frequently raised. Sufficient evidence is available to make reasonably certain what are some of the agencies involved. The parasite may be carried mechanically on the shoes, by flies, birds, used brooder equipment which has not been thoroughly cleaned, streams, or irrigation ditches. Used *unsterilized* feed sacks may also act as a carrier, but are probably not a frequent source. In other instances the purchase of infected fowls is a source of infection. Whatever the source of the infection, it is customarily impracticable to attempt to determine this in each individual case.

The readiness with which the parasite is sometimes distributed is borne out by the not infrequent occurrence of coccidiosis in the case of incubator-hatched chicks placed in a new brooder house, with previously unused brooder equipment, and turned out on ground not used by poultry before. Furthermore, fowls kept under laboratory conditions in cages with half-inch-mesh wire bottoms, so that the droppings readily pass through, and provided with outside drinking and feed vessels, sometimes develop some coccidiosis. It is probable that insects and mice are important carriers in these instances.

It is highly important to remember that mature fowls provide a very likely source of infection for young stock on the same farm. Droppings from the mature fowls, adhering to the attendant's shoes, perhaps afford the most common means of carrying the parasite to the brooder stock.

Seasonal conditions exercise a distinct influence on the development of coccidiosis. This is due to the fact that moisture and warmth provided during the spring and summer months permit of rapid and regular development of the oöcyst to the stage which is capable of producing the disease. Therefore, it more frequently occurs in severe form at such times. In Western Oregon, the month of April can regularly, and March occasionally, be expected to provide such conditions. Coccidiosis is, therefore, more readily controlled in early hatches. Even though moisture is provided during the early hatching season, the necessary warmth is lacking for the rapid development of at least some coccidia.

It is possible for severe coccidiosis to develop during the winter. When this occurs the source of infective oöcysts is likely to be soil or material contaminated during the warm season or contaminated material kept warm by the brooder stove.

Where the poultry yard has standing water during the summer, or is traversed by streams, the period of favorable conditions for oöcyst development is prolonged, increasing accordingly the chance for coccidiosis.

Symptoms and diagnosis. The symptoms in many cases of coccidiosis may not differ from those of a number of other diseases. This is particularly true when moderate infection exists. Where very mild infection occurs there may be no outward evidence. These cases can be diagnosed only with the aid of a microscope. There are times, however, when the average poultry raiser could hardly be mistaken in making a diagnosis.

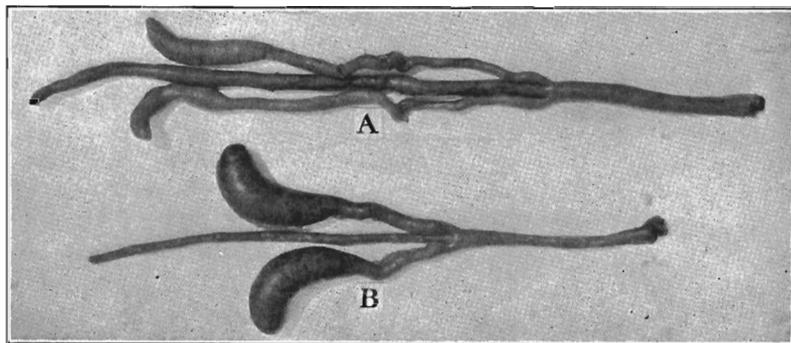


Figure 2. A. Normal ceca or blind intestines. B. Fatal cecal coccidiosis of a two-months-old fowl. Ceca bulging with pure blood. More often fatal to young fowls than older. The more common severe type.

Severe sudden outbreaks of cecal and sometimes small-intestine coccidiosis are accompanied by the passage of distinct amounts of pure blood in the droppings. Sometimes, especially under brooder conditions, these bloody droppings may be readily overlooked or minimized. Young fowls affected with severe coccidiosis may die suddenly, without any symptoms having been noticed other than a pale comb, and a slight amount of blood on the vent fluff. Fowls dying under such circumstances should be examined and the condition of the intestines noted. Such fatal cases of coccidiosis will often show the ceca or blind intestines bulging with pure blood (Figure 2), or in other instances such material will occur in the small intestine usually some distance below the gizzard. When the small intestine is so affected, it is common for it to be distinctly enlarged where the infection is most severe. The enlarged portion is very readily torn and numerous blood spots, which are readily seen from the outside, occur in the intestinal wall. The opened intestine often gives off a distinctly foul odor at time of death. Fowls dying with this condition may be in perfect flesh and show no symptoms until a few hours before death.

If the infection is moderately severe, the fowl will usually be droopy for several days up to a week or two, lose weight, and die during this

period, or gradually show less symptoms and possibly come back to normal weight. Under commercial flock conditions the fowls are less likely to recover, as they are then subjected to more trampling and fighting.

The presence of brick-red or salmon-colored material in the droppings must not be interpreted as definitely signifying coccidiosis. This type of dropping is frequently passed by young or mature stock without infection being present. Considerable reddish, grayish, or greenish slime or mucous in the droppings occurs from heavy infection with some forms of coccidiosis. This may also be caused by some chemicals as well as by various other causes.

Fowls which survive severe cecal coccidiosis usually have yellowish or whitish cheese-like "cores" in the ceca in a few days following development of symptoms. These cores signify that the disease has run its course. Since cheese-like material may occur in the ceca of young fowls which are not affected with coccidiosis, a careful examination should be made before establishing the diagnosis. If the outer part of the core is skin-like, and the interior is reddish and crumbly, it is very probably due to coccidiosis. The type of cheese-like material which occurs in the ceca of chicks up to two weeks of age is likely to be due to pullorum disease (contagious white diarrhea).

When many fowls in growing flocks appear droopy, and no other cause for disease can be determined, it is usually the safest plan to conclude that coccidiosis is the cause and apply sanitation accordingly.

Selecting fowls for diagnosis. As a rule the infection runs a very limited course and the parasite may be almost entirely passed out in the droppings within a period of several days. For this reason it is practically useless to send fowls to a laboratory for diagnosis if they have had coccidiosis a week or two before. This is particularly likely to be the case if fowls are sent which have lost considerably in weight. The most suitable fowl is one which has just developed symptoms of coccidiosis.

Resistant strains of fowls. It is thought by some that rearing fowls under conditions which favor coccidiosis will eventually result in immune strains of fowls which will not develop the disease. If all or a high percentage of those which become infected die and a sufficient percentage are naturally immune, this would be possible. This possibility is almost nullified by the fact that experimental inoculation shows that there cannot be more than a small percentage which are naturally immune. Furthermore, increased resistance or immunity is commonly developed in susceptible fowls by repeated infections taking place and these fowls can be expected to reproduce susceptible offspring.

Effect upon fowls of laying age. Fowls which have not been infected during the rearing period may be disastrously affected in the laying-house. Such fowls consuming large doses of coccidia may show a slight to complete lack of egg production with six kinds of coccidiosis. A heavy death loss may occur in the case of at least three types of coccidiosis. Investigations at the Oregon Agricultural Experiment Station have repeatedly demonstrated these results.

"Chronic" coccidiosis. This term has been used so loosely and apparently signifies so many different conditions to various individuals that its use merely adds confusion unless accompanied by an explanation. There seems to be a general impression that infection of the small intestine or so-called "duodenal coccidiosis" represents a chronic condition and is an especially serious type of the disease. In this connection it may be stated that carefully controlled experiments at the Oregon Agricultural Experiment Station have demonstrated infection of the small intestine without any symptoms being apparent. The mildness of the disease in this work has been due to feeding small numbers of the parasite. Feeding large numbers of the parasite of any of the six known kinds of coccidiosis results in very definite symptoms.

Coccidiosis and paralysis. Paralysis is not infrequently stated to be brought on by coccidiosis. Since coccidiosis is so wide-spread it is not at all surprising that the two are frequently found in the same fowl. This does not signify that paralysis is due to coccidiosis. Paralyzed fowls may show large numbers of coccidia or none at all. This does not prove that coccidia are or are not the cause of paralysis. Fowls which are free from coccidiosis may have been infected in the past and in fowls which are infected the parasites may have no relationship to the paralysis. Substantial evidence at hand contradicts the hypothesis that paralysis is due to coccidia.

CONTROL

Prevention. "Sanitation is the foundation of coccidiosis control. . . . The inauguration of sanitary measures on an economic basis cannot be expected totally to eliminate coccidium infection, but they should result in holding infection down to a low degree, and permit of successful rearing." These statements, made a number of years ago, are still consistent with the known facts.

Rearing fowls absolutely free of coccidiosis is highly undesirable if they are later to be kept under average commercial flock conditions. Such fowls would then be disastrously affected so far as mortality and egg production are concerned, if they obtain large numbers of the parasite. Management factors which allow the fowls to consume small doses during the growing period are more likely to prove satisfactory. This by no means constitutes a recommendation for the use of methods generally recognized as insanitary.

Soil conditions. Well-drained soil provides the most suitable land. This type dries out more readily and therefore assists in preventing development of the oöcyst. Those which do develop are likely to die more quickly in dry soils than in damp soils.

The common practice of plowing the yards and growing a crop is to be recommended, but this cannot be relied upon to rid the soil of all coccidia. Annual plowing and leaving the yards idle for three or four years will probably result in practically all of the oöcysts being destroyed since they would, during such time, be subjected to drying, which is very destructive to them. Where only one or two yards are provided, it is perhaps best not to plow at all, but to sweep the yards and haul the sweep-

ings away. Plowing or spading the yards during an outbreak only serves to encourage the disease.

Types of brooding and equipment. The colony brooder, which is moved to new land, offers one means of controlling coccidiosis. Until recent years it has been the most accepted method of brooding to control intestinal parasites. This method has the disadvantage of high labor cost.

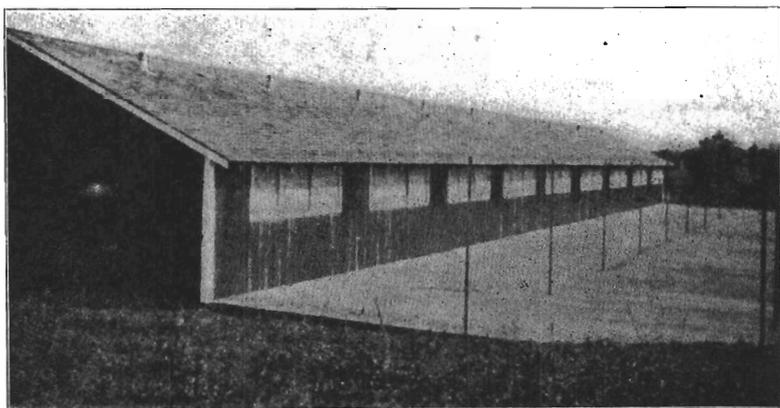


Figure 3. A neat, well-constructed, permanently located brooder house with concrete yard, on a prominent specialized Oregon poultry farm.

In addition, when coccidiosis does occur, it is sometimes difficult to control the disease since it is not practicable to shut the fowls in or move the house frequently. In spite of these objections, it is a reasonably satisfactory means of coccidiosis control.

The permanently located brooder provides a particularly desirable type of brooding from the standpoint of convenience and labor. It is frequently open to objection because of its tendency to aggravate the development of coccidiosis. This is particularly true when the brooder is used for chicks of various ages, or when the same compartment is used for more than one brood during the same season. Providing several yards and using only one each year does not help matters much as heavy contamination may result very quickly with coccidiosis, owing to the relatively short time required for the parasite to develop in large numbers.

In order to overcome the objection to the permanently located brooder, because of its favoring intestinal parasitic diseases, an artificial yard is sometimes used. This commonly consists of concrete or wire netting. Such a yard preferably extends the length of the brooder. It may be up to about twenty feet in width. The wire yard does not require frequent cleaning. While the concrete yard requires more frequent cleaning, it gives some opportunity for the fowls to acquire coccidial infection in mild form and to develop immunity. Having such a yard permits of cleaning it as thoroughly as the house and with slight labor. It is desirable to have the concrete yard sloped about eight to ten inches away from the brooder. It may be covered with sand or not, as desired.

One should not conclude that the concrete yard itself eliminates the losses. It merely provides suitable conditions for assisting in prevention

and particularly for control when a severe outbreak occurs. It also assists in controlling other intestinal parasite diseases, especially roundworms and some tapeworms.

Where the artificial yard is used, the plan is to confine the chicks to the house and yard for the entire brooding period. They are not permitted to go beyond the artificial yard. The fowls are kept under brooder condi-

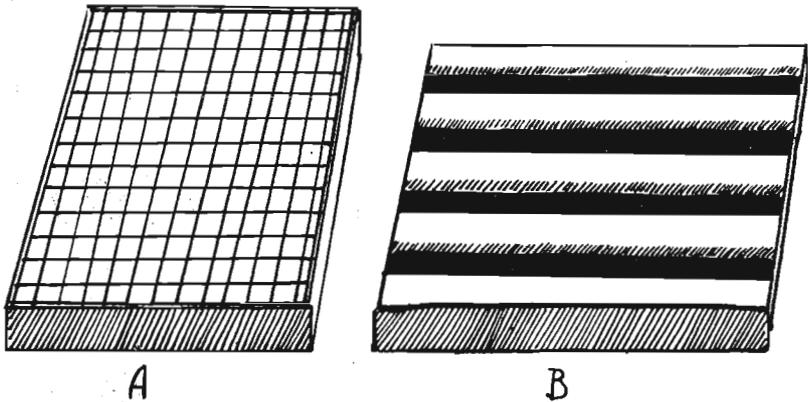


Figure 4. Equipment for preventing access to moist places which harbor infective oocysts found around drinking utensils. A. Hardware-cloth (wire) covered frame—especially suitable for placing brooder drinking vessels upon. B. Slatted platform.

tions no longer than necessary, as with this arrangement there is a tendency toward cannibalism. As soon as brooding is completed, the fowls should be moved to range houses provided with wire floors high enough to prevent access to the droppings.

Drinking vessels placed on wire-covered or slatted frames (Figure 4) will prevent access to moist places. If moisture prevails under the hover, frames covered with half-inch-mesh hardware cloth may be employed to advantage for the chicks to brood upon. This not only assists in preventing them from consuming moist droppings, but also lessens the danger from piling because of being enabled to obtain air from beneath. If the heat is from above, the wire should be covered for a few days until the chicks have become slightly hardened.

Wire floors over the entire brooder floor are undesirable. Coccidiosis may be entirely prevented by such equipment and if the fowls are placed on litter or soil later, serious coccidiosis may result. If one must resort to the use of such equipment to control coccidiosis, it would perhaps be preferable to go out of the business.

Range conditions. Flocks on range present a difficult situation when seriously affected with the disease. Under such circumstances the houses should be moved farther apart to provide the fowls with increased range. This reduces the degree of contamination in the soil and accordingly the possibility of severe infection. It is sometimes advisable to reduce the number of fowls on the range by temporarily moving some back to the brooder-house or laying-house. Daily removal of the litter is in order for such flocks.

Chemical treatment of litter. This subject is receiving serious consideration by some. Investigations involving this practice have not as yet

been extensive enough. Large scale use of such a method is not warranted on the basis of the information available. It is not impossible that this may eventually be satisfactorily used as part of a scheme of coccidiosis control.

Treatment is of secondary importance, and can be recommended only as a means of making the best of an already bad situation, not as a routine preventive. Coccidiosis occurs in spite of any treatment which has been reported. Feeding a ration consisting of about 20 per cent powdered skim milk or buttermilk assists in controlling cecal coccidiosis accompanied by blood. It is applicable only for short periods because of its limited value, expense, and tendency to cause too early egg production. When this amount of dried milk is given, an ample supply of water must be provided, as considerably more is consumed than normally. It is advisable also to provide more drinking space.

It is probable that other milk products high in milk sugar are as efficient as powdered milk and may be had at a much lower cost.

Control of sudden, severe outbreaks. When outbreaks of this nature occur involving *bleeding* from the *ceca*, the above-mentioned milk feeding is advised to be continued for a week or ten days. Milk feeding may have no value for the control of coccidiosis of the small intestine. Its use offers definite objections from the standpoint of causing the droppings to become more liquid, thus favoring development of the oöcysts in the litter. The following, which is essentially the so-called "Wisconsin" ration, may be used as an all-mash ration for the control of cecal infection:

Ingredients	Parts by weight
Ground yellow corn.....	80
Wheat middlings	20
Bone meal	5
Limestone grit	5
Fine salt	1
Dried milk (skim milk or buttermilk).....	30

Other combinations of feeds may also be used—either grain and mash or all-mash rations. Care should be observed in deciding upon a suitable combination not to include too great an amount of pasty or high protein-carrying foods.

If no concrete yard is available and the house provides ample room, the fowls are confined to the house. Daily cleaning of the house is an advantage and the same holds true for the concrete yard. Under these circumstances the soil on the concrete yard should be omitted and the yard swept or washed off daily for a period of a week or ten days, or until marked improvement in the flock results.

If the weaker fowls are separated from the others, they do much better, the deaths are less, and the well fowls are less likely to become infected.

Moist places frequently occur where the fowls drink. Special precautions are taken to eliminate these moist places during warm weather and near the brooder stove at all times.

Flocks showing a severe outbreak can sometimes be handled to advantage by taking the cockerels out and placing them in fattening crates with wire bottoms so that the droppings pass through and cannot be

reached by the fowls. This management alone will prevent further losses other than those already severely infected.

Additional heat is necessary during acute outbreaks, particularly when feeding liberally of milk or milk products. More careful observation is necessary to prevent losses due to huddling.

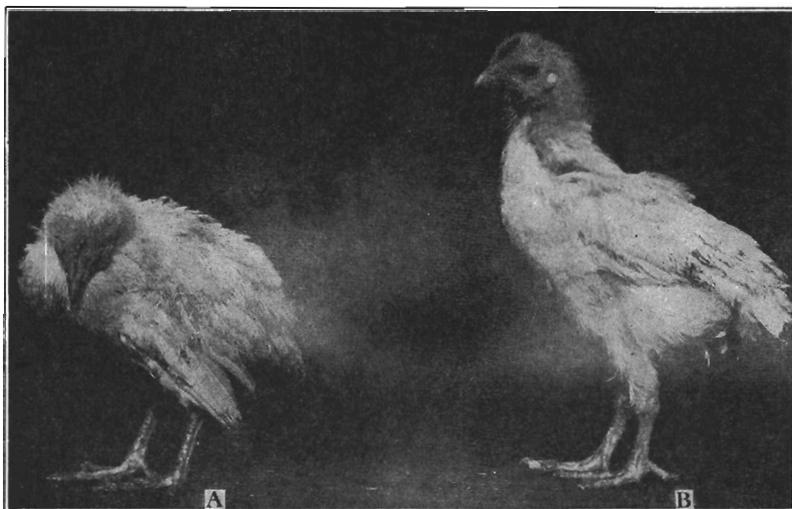


Figure 5. Milk has limited value in controlling coccidiosis. Above chicks were those remaining in a group of four, kept together, given a grain ration and all the sour skim milk (no water) they would drink. Three (A is one of the three) were inoculated with cecal hemorrhagic type coccidia and the fourth (B) was not. Two died of coccidiosis on the seventh day. Above photograph made fifteen days after inoculation.

Feeding coccidia to produce immunity. For a number of years the poultry disease investigations at the Oregon Agricultural Experiment Station have centered around the development of immunity by feeding the parasite of coccidiosis. Certain information has encouraged the belief that this could possibly be accomplished on practical poultry farms with greater certainty and economy than by methods now in use. Essentially, this information consisted of the knowledge that:

1. Coccidiosis in chickens was wide-spread, perhaps existing on all specialized poultry farms.
2. In spite of the wide distribution and potential destructiveness of the parasite, many flocks were reared to maturity with a low percentage of mortality and high egg production was maintained.
3. The severity of the disease was determined by the number of parasites consumed, small numbers causing slight or no symptoms.
4. A high degree of resistance in fowls could be established by inoculation with coccidia.
5. Deliberate inoculation appeared to offer distinct advantage over the customary chance infections, involving wide variations in dosage, age at which inoculation takes place and irregularity in the species consumed.

Considerable progress has been made and it is hoped that this means of control will be perfected and generally used, eliminating the chance inoculations now prevailing.