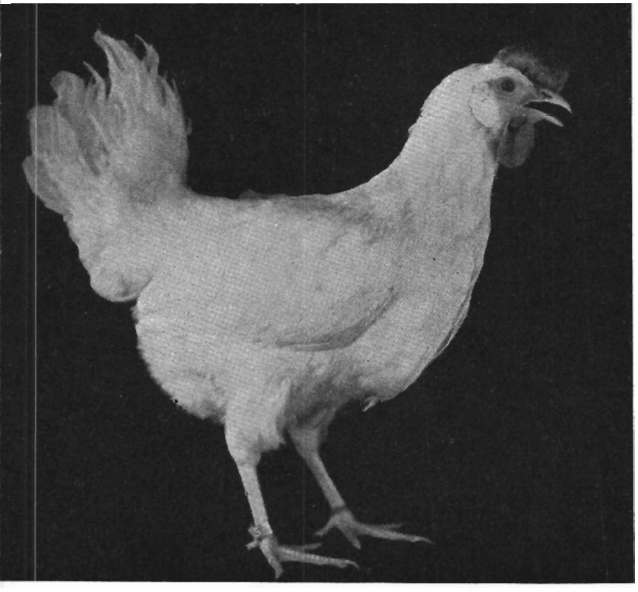
COCCIDIOSIS

Control in Chickens

By E. M. DICKINSON



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FOREWORD

Coccidiosis is one of the most important causes of loss in the commercial flocks of chickens in Oregon. Considerable mortality is caused by this disease, but the loss in cull birds and lowered egg production is even greater.

The problem is complex since the cause is not always a single entity but may be complicated by the invasion of several different species of coccidia. As the cause of this disease is a protozoan animal parasite, studies concerning the life cycle and optimum requirements for the development of the parasite were necessary that the discussion of this bulletin bear practical significance.

Investigations at this station have shown the value of various drugs as coccidiostatic agents. Present investigations are concerned with the value of these agents in a program of artificial immunization.

Wm. A. Schoenfeld

Dean and Director

Acknowledgment: **The author is indebted to Dr. O. H. Muth of the Department of Veterinary Medicine for the photographs in Figures 2, 3, 4, 5.**

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SUMMARY

Coccidiosis is the most widespread parasitic disease in commercial flocks of chickens in Oregon.

This disease is one of the most important causes for economic loss due to mortality, cull birds, and lowered egg production.

Coccidiosis is caused by a one-celled animal parasite that can be seen only with the aid of a microscope.

The term coccidiosis is analogous to referring to eight different diseases under one name since there are eight different kinds or species of coccidia that may infect chickens.

Outbreaks of clinical coccidiosis are commonly caused by only three or four of the species of coccidia.

The severity of symptoms and mortality depends primarily on the species of coccidia involved and the number of infective oöcysts ingested in a short period of time.

Protection or resistance against a species of coccidia develops following a suitable infection with coccidia of that species. The amount of infection necessary to produce protection varies with the different species.

Protection or resistance developed by one species will not protect against infections by other species of coccidia.

Cecal coccidiosis is commonly encountered during the brooding period. Bloody diarrhea is quite characteristic of this type of coccidiosis.

Intestinal coccidiosis is commonly encountered in young pullets. Sudden loss of appetite, drop in egg production, and "going light" are suggestive symptoms.

Outbreaks of cecal or intestinal coccidiosis may be controlled by the proper use of one of the coccidiostatic drugs, such as the sulfa drugs. Supplemental feeding that will stimulate the appetite will aid recovery.

A system of management and sanitation based on knowledge of the parasite may check or prevent the regular occurrence of outbreaks of clinical coccidiosis.

Coccidiosis Control in Chickens

By E. M. Dickinson, Veterinarian

COCCIDIOSIS in chickens is one of the most important disease problems in the commercial poultry flocks of Oregon. Economically, it is responsible not only for mortality in the flock, but it may also seriously reduce the egg-producing capacity of many chickens. Because of the insidious manner in which some of the coccidia affect chickens, there is need for poultrymen to become better acquainted with important known facts concerning this disease.

THE CAUSE

The cause of coccidiosis is a one-celled animal parasite that is too small to be seen without the aid of a microscope. This one-celled parasite that comes from an infected chicken is egg-shaped under the microscope and is called an oöcyst. (See Figure 2.) At present there are eight distinct species or kinds of coccidia that are known to infect chickens. Other farm animals such as turkeys, rabbits, dogs, cattle, sheep, and hogs also have coccidiosis, but the species of coccidia that infect them are not the same as the species that infect chickens. Efforts to infect chickens with coccidia from other animals have been unsuccessful. Danger of cross-infection of coccidia from other animals, therefore, is of no consequence. An outbreak of coccidiosis in a flock of chickens may be the result of a heavy infection by a single species or by any combination of the eight different species of coccidia. The results of autopsy records show that the majority of the outbreaks of coccidiosis are caused by only three or four of the eight known species.

Chickens become infected by ingesting live sporulated oöcysts. Unsporulated oöcysts passed in fresh feces may sporulate in 24 to 48 hours under favorable conditions. In the digestive tract the oöcyst wall is ruptured and the sporozoites are liberated to invade the cells of the mucous membrane. The species or kind of coccidia ingested determines whether the sporozoites will infect the cells of the small intestine or the ceca and rectum. The sporozoites develop and various changes take place in the parasite in the cells of the mucous membrane. Within 4 to 6 days (depending on the species) after being ingested by a susceptible chicken some of the parasites will have reached maturity. At this time some of the oöcysts, or mature parasites, will be passed in the droppings. When the oöcyst stage

has been reached by the developing parasite within the body of the chicken, it is incapable of further development until it has spent part of its life outside of the bird's body. (See Figure 1.)

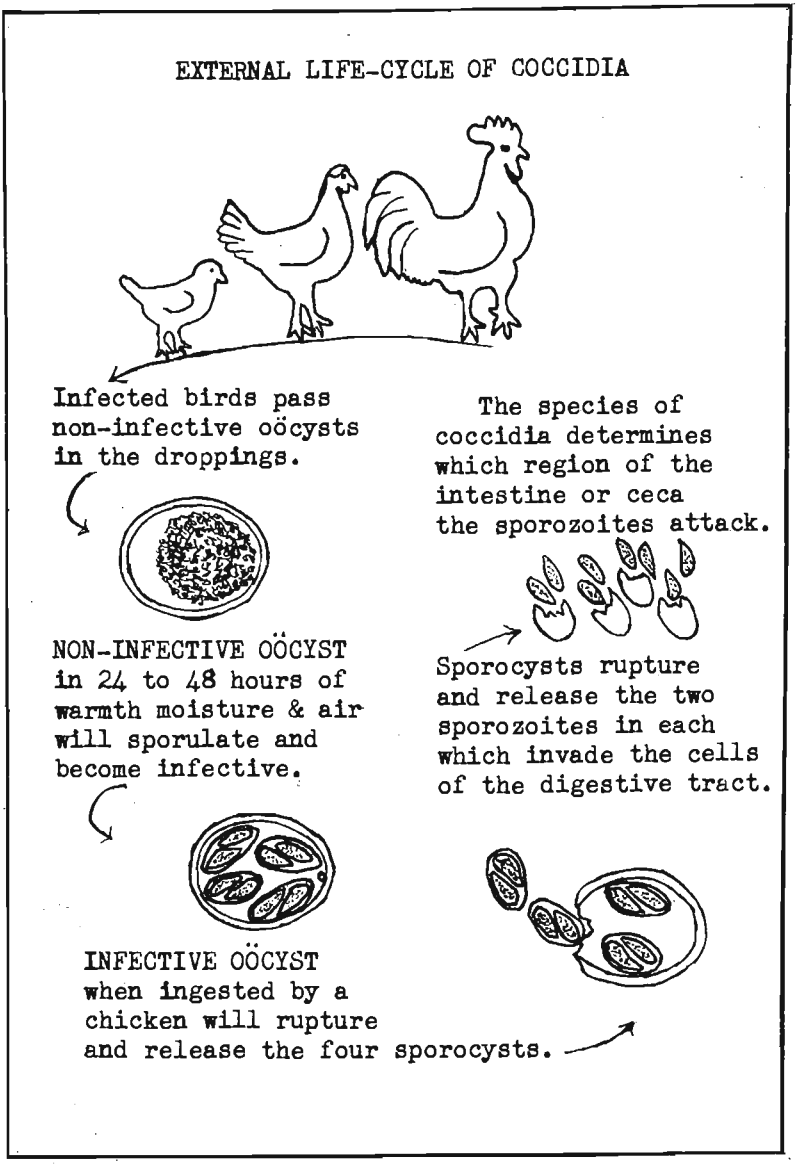

Figure 1. Sporulation of coccidia.

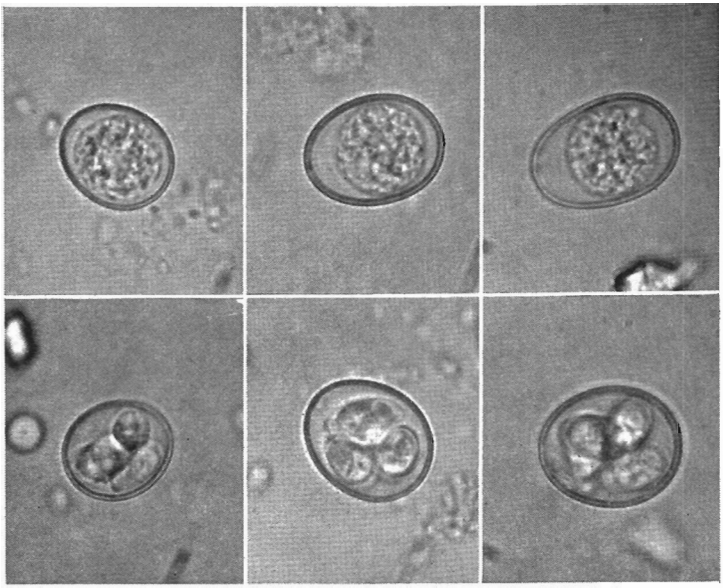

Figure 2. Photomicrograph of coccidial oöcysts, the cause of coccidiosis. Magnified (× 900). *Above.* Noninfective unsporulated oöcysts. *Below:* Infective sporulated oöcysts.

Coccidiosis outbreaks are commonly classified according to the areas of the digestive tract for which the particular species of coccidia seem to have a special affinity. For practical consideration, the disease is often known as either cecal or small intestinal coccidiosis.

CECAL COCCIDIOSIS

Cecal coccidiosis is caused by only one of the species (*Eimeria tenella*) of coccidia. This type of coccidiosis is frequently referred to as "brooder-house coccidiosis" or "bloody coccidiosis." Cecal coccidiosis is characterized by a bloody diarrhea, which is due to the damage done by the coccidial parasite to the mucous membrane of the ceca and rectum.

In the average commercial poultry flock, cecal coccidiosis is most likely to occur during the brooding period. It is observed most often in chicks between 4 and 10 weeks of age. Susceptible chickens younger and older than this, however, may become infected. In most outbreaks the condition appears quite suddenly, and blood in the droppings may be noted before many of the chicks show symptoms.

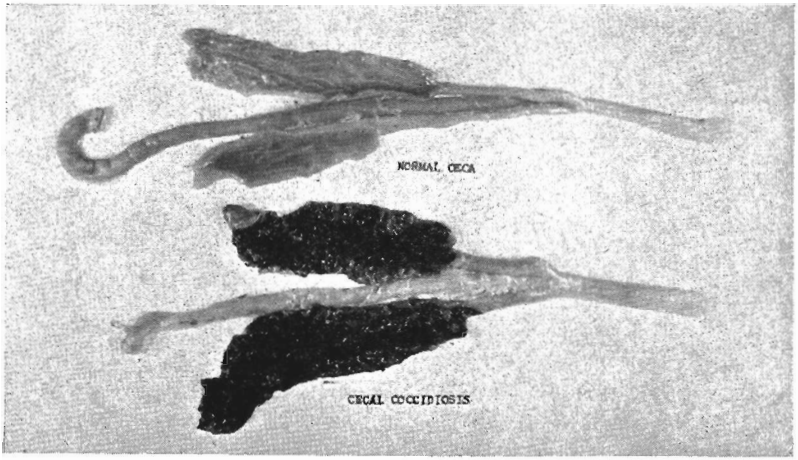

Figure 3. Normal ceca or blind pouches (above) and ceca filled with blood (below), cut open to compare the effect of cecal coccidiosis on a 5-week old chick. Cecal coccidiosis usually occurs during the brooding period.

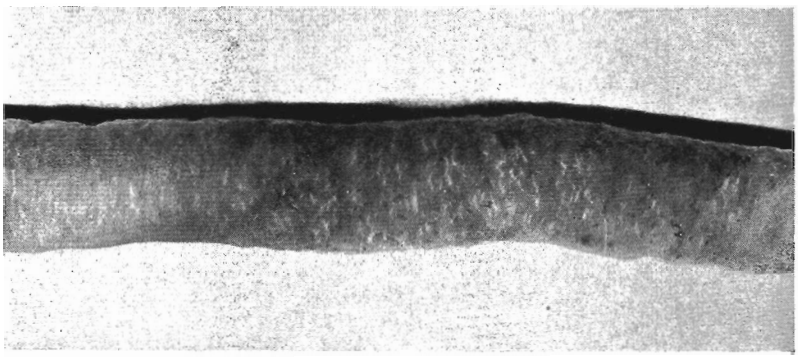

Figure 4. Piece of small intestine from a pullet cut open to show the mucous membrane infected with intestinal coccidia (*E. acervulina*). Note thickened appearance and the whitish patches that are colonies of oöcysts.

Following the blood in the droppings, usually within a few hours, the infected chicks lose their appetite and become droopy. Death soon follows in most chickens that are severely infected.

The mortality following an outbreak of cecal coccidiosis may vary from a few birds to as much as 25 per cent or more. This variation depends upon several factors but especially upon the circum-

stances under which the chicks are being kept. The sudden onset of the disease with bloody diarrhea from the chicks is quite indicative of cecal coccidiosis. Post-mortem examination of sick or dead chicks that reveal the ceca distended with blood is practically certain to be cecal coccidiosis. (See Figure 3.) Some chicks that have survived an infection for several days may have the ceca filled with a cheese-like "plug." These "plugs" are organized blood clots and may have a pinkish color on the inside when cut open. The presence of reddish or orange-colored slimy droppings should not be confused with pure blood in the droppings because this type of dropping may be passed by chickens that are not infected with coccidia. Microscopic examination of material from suspected lesions for coccidial forms is the most dependable means of positively diagnosing cecal coccidiosis.

INTESTINAL COCCIDIOSIS

Small intestine coccidial infections may be caused by a single species or any combination of the seven species (*Eimeria acervulina, E. maxima, E. mitis, E. praecox, E. necatrix, E. hagani, E. brunetti*) of coccidia known to infect the intestinal tract of chickens. The lesions that characterize this type of coccidiosis depend on the species of coccidia causing the disease. It should be understood, however, that the lesions and symptoms of small intestinal coccidiosis are not peculiar to this condition only and may be confused with lesions caused by other diseases. One of the species of coccidia causes a type of condition in the intestinal mucosa that has been referred to as "chronic coccidiosis." (See Figure 4.) The thickened spongy appearance of the mucosa with whitish patches of colonies of oöcysts (*E. acervulina*) presents gross lesions mistakenly termed "chronic."

"Fade-out" or "going light" is a common symptom of small intestinal coccidiosis, although this reaction does not necessarily infer a "chronic" condition. It has been demonstrated experimentally that chickens severely infected with some of the intestinal coccidia may lose body weight. This loss, however, is usually regained within a short period of time. Experimental evidence indicates that the term "chronic coccidiosis" is misleading insofar as the coccidial infection is concerned. One of the most consistent conditions observed with small intestinal coccidiosis is the production of a quantity of slimy mucoid or catarrhal exudate in the intestinal tract, which is frequently passed in the droppings and may incase or form a cast around the small intestinal feces.

Hemorrhage of varying degrees may be observed from the intestinal mucosa as a result of infection with at least two of the small intestinal species (*E. maxima* and *E. necatrix*). (See Figure 5.) Small pinpoint or petechial hemorrhages seen through the outer wall of the intestine are suggestive of this type of coccidiosis. Severely

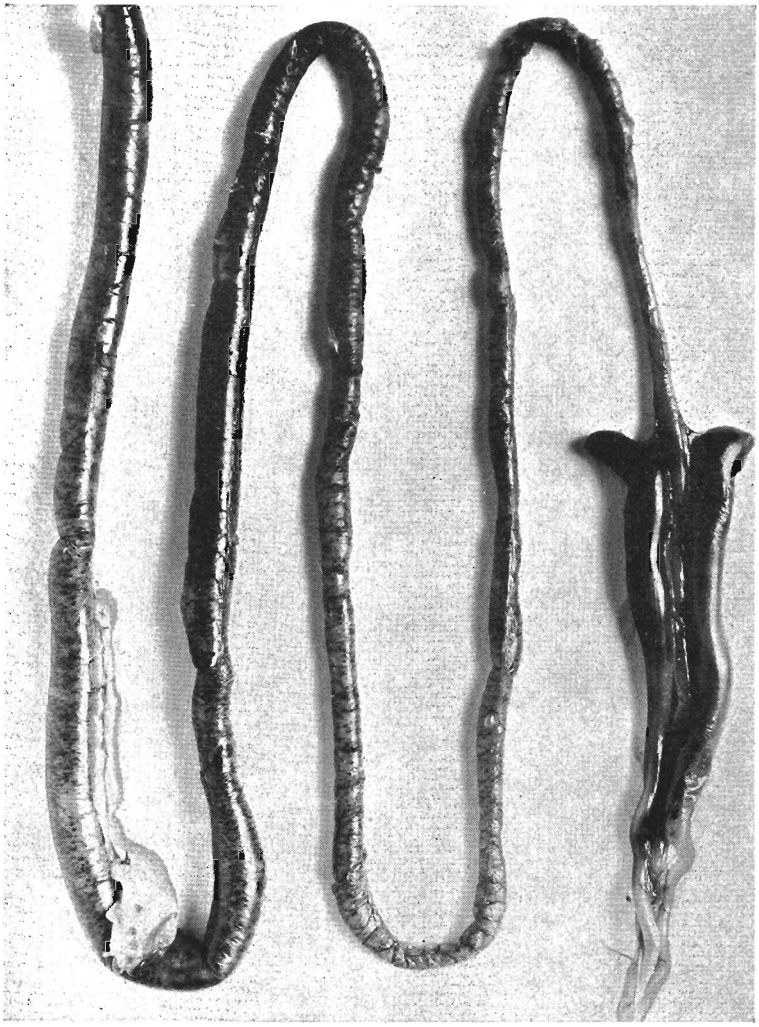

Figure 5. *Eimeria necatrix* infection in the intestinal tract. The first portion is distended and areas of hemorrhage show through the wall. This kind of coccidiosis is uncommon.

infected regions of the small intestine are usually dilated, and the lumen is filled with foul-smelling, bloody mucoid content.

Small intestine coccidial infections are most commonly encountered in young pullets within a few weeks after they are confined to the laying house. Small intestinal coccidiosis, however, may prove to be a serious factor in susceptible birds of any age.

There are no characteristic or suggestive symptoms such as the bloody droppings of cecal coccidiosis to warn the poultryman of small intestinal coccidiosis. Recent studies indicate that the most suggestive symptoms of this type of coccidiosis are the effect on food consumption and egg production. Pullets normally come into egg production with a regular increase in rate of lay until they have reached a peak that is held more or less uniformly. When all management factors appear normal and the pullets either do not show the regular increase or if they drop rather sharply from the peak production, small intestinal coccidiosis may be the responsible factor. Unfortunately, such symptoms are merely indicative and may be caused by a number of different disease-producing agents.

Although symptoms and lesions may be suggestive, a microscopic examination of scrapings from the intestinal mucous membrane of two or three sick birds by a qualified person, for coccidial forms, should be the criterion for making a definite diagnosis of small intestinal coccidiosis. A positive diagnosis should not be made unless the number of coccidia present, the history of the flock, and the lesions indicate a severe coccidial infection. Birds selected for postmortem examination should be those that have just started to show symptoms. Birds that have been sick for several days or weeks and are badly emaciated or light in body weight are likely to have passed most of the parasites in the droppings and a definite diagnosis may be questionable.

COCCIDIA CHARACTERISTICS

Before considering a program for the control of coccidiosis, it is advisable to understand the importance of several factors concerning the life cycle and characteristics of the coccidia that infect chickens.

Sporulation

The first of these factors is sporulation. When the coccidia egg or oöcyst is freshly passed in the droppings from an infected chicken, such an oöcyst is not capable of producing coccidial infection if it is picked up by a susceptible chicken. After 24 to 48 hours exposure

to warmth, moisture, and air, however, sporozoites will develop within the coccidial oöcyst (see Figure 1) and such an oöcyst is capable of causing infection. This change in the oöcyst that takes place after 24 to 48 hours is called sporulation. This is an essential step for the completion of the life cycle for all coccidia. (Daily cleaning during an outbreak eliminates the coccidia before they sporulate or become infective.)

Dosage

The dosage or number of live sporulated oöcysts that a susceptible chicken ingests at one time is the most important factor that influences how severely the disease will affect the chicken. Experimental evidence has well established the fact that the severity of a coccidial infection in a susceptible chicken depends on the number of live sporulated oöcysts the bird ingests within a few hours.

When chickens show symptoms and are visibly sick from coccidiosis of any kind, it may be referred to as clinical coccidiosis. On the other hand, a susceptible bird may ingest small numbers of live sporulated oöcysts for one day or for several days, and, although the few coccidia may go through the part of the life cycle within the digestive tract, the attack will be so mild that no symptoms will be noticed. Such a coccidial infection that is so mild the chicken does not show symptoms may be referred to as subclinical coccidiosis. (Daily cleaning during an outbreak reduces the number of oöcysts available, thus reducing the danger of a heavy dosage being picked up by susceptible birds in the flock.)

Self-limitation

An important factor in successful control of the coccidial parasites from an infected bird is self-limitation. Experimental evidence has shown that if a bird infected with coccidia is not allowed to ingest more infective oöcysts the infection within the bird will in due time complete its internal life cycle and be passed out in the droppings. In this respect, coccidiosis is considered as a self-limiting disease.

The self-limitation of the coccidial parasites is due to the fact that from a given number of infective oöcysts ingested only a limited amount of infection will develop in the intestinal tract. At a certain stage in the internal development the coccidial forms reach a stage that can go no further, and they are passed out in the droppings to complete part of the life cycle outside the bird's body. Thus, self-limitation is a necessary step to complete part of the life cycle of the coccidia.

Acquired resistance

Acquired resistance or protection against coccidial infections is one of the most helpful factors. It has been well established that chickens that have survived repeated mild coccidial infections or a severe infection of a given species of coccidia are usually highly resistant to further attempts to cause clinical coccidiosis with the same species. This factor undoubtedly explains why severe coccidial infections are seldom seen in birds more than 18 months old.

It should be borne in mind that although chickens with acquired resistance to coccidia may show no clinical symptoms to subsequent infections, a mild coccidial development does take place within the bird. This readily explains the fact that so-called "healthy carriers" of coccidia may be found in most adult commercial poultry flocks.

Cross resistance

No cross-resistance or protection between the different species of coccidia takes place. Resistance or protection is acquired only to the species of coccidia with which the bird has been sufficiently infected to produce protection. For example, a susceptible chicken that has acquired resistance or protection by infection with one of the species of coccidia may still be susceptible to the other seven species known to infect chickens. This factor emphasizes that coccidiosis refers to a disease that may be caused by eight different distinct disease-producing agents.

Transmission

The transmission or spread of coccidia is very easily accomplished. A survey has shown that coccidia have been found in chickens from commercial poultry flocks in all sections of the state. Coccidia are without question the most common and widespread disease-producing animal parasites found on commercial poultry farms in Oregon. These parasites are so widespread and easily carried from one flock of chickens to another that any thought of complete eradication is entirely out of the question under present circumstances.

One of the most important factors in this transmission is the fact that a constant source of infection is available from "healthy carriers" in practically all commercial flocks of mature chickens.

Since the parasites are so widespread and are usually in the process of constant reproduction, in most commercial poultry flocks the mechanical transmission of infection to young stock is very simple. The most common means of mechanically carrying coccidia would seem to be on the footwear of the person who takes care of

the chickens. Flies, free-flying birds, and animals may also be factors in mechanically carrying coccidia to chickens.

COCCIDIOSIS CONTROL

A program or system of sanitation to prevent clinical coccidiosis could be worked out for most commercial poultry farms. This would require careful study of the management on each poultry farm under consideration. Although a program to prevent clinical coccidiosis may be worked out for some individual poultry farm, experience has shown that there is no simple formula for coccidiosis control that will work successfully for all poultry farms. Since a simple program of coccidiosis control is not available, perhaps a discussion of the important factors involved will help poultrymen to find the weak spots in management and sanitation that permit coccidiosis outbreaks.

Since it is known that the larger the dosage of live sporulated oöcysts ingested the more severe the effects of the coccidia on the bird, good use can be made of this knowledge to develop a program of control for the individual poultry farm. One should not infer that it would be desirable to raise the birds entirely free of coccidia. On the average commercial poultry farm this would be very impractical if not almost impossible. On the other hand, a study of the management on the poultry farm where coccidiosis has been a regular problem might reveal the time and place where the birds are ingesting large numbers of coccidia that cause the outbreak.

For example, some poultrymen may regularly experience an outbreak of coccidiosis in flocks between the fourth and sixth week of brooding. By cleaning the brooder house more frequently during that period the coccidiosis outbreak might be prevented. If the chicks are running on the ground, however, cleaning the brooder house may not bring about control. It might also require a change to a clean yard or the use of a sunporch with a wire floor in addition to cleaning the brooder house. The amount of sanitation needed to check clinical coccidiosis will vary with each poultry farm because of the highly variable circumstances under which birds are raised on each place.

It should be remembered that the amount of sanitation employed should be enough to check the severe symptoms of coccidiosis and yet not so stringent but what mild infections may occur. This is important because repeated mild infections of a subclinical nature will cause resistance or protection to be built up within the bird so infected. It is highly desirable, therefore, to bring about these mild coccidial infections with the understanding that they are for the purpose of producing resistance or protection for the bird.

The ideal procedure would be one with a cleaning program that would allow for mild infections and yet would be sufficiently rigid to prevent the build-up of massive dosages of coccidia that cause the severe outbreaks. Since on the average poultry farm coccidial infections take place on a chance basis, it is desirable to allow the young chicks to become exposed to mild coccidial infections at as early an age as possible. Excessive sanitation during the first few weeks of the chick's life only delays the time of exposure to coccidial infection. It is advisable, therefore, to clean less frequently during the first 4 weeks in the brooder and more frequently during the latter part of the brooding period.

CONTROL SUGGESTIONS

Although it is not possible to recommend a program of cleaning that would be suitable for the circumstances on all poultry farms, a few suggestions to follow may help to control coccidiosis on some poultry farms.

In the first place, study the past outbreaks, the time of year, the age of the birds, and the circumstances under which the outbreaks have occured. This will often help determine the attack.

It never pays to crowd the birds at any time.

Change the litter regularly. Don't wait until the litter "makes good fertilizer." Do not use an amount of litter or a kind of litter that is so expensive it will not be cleaned out for several weeks or months. Wire, slat, or rod frames around the drinking fountains are useful in maintaining good sanitation. A sunporch with a wire floor through which droppings may pass out of reach is very helpful in allowing more space for the birds and maintaining sanitation. (See Figure 6.)

A deep litter program may be used provided the litter is stirred regularly and lime is applied when necessary to help control moisture. In case of an outbreak of any contagious infectious disease it would be advisable to change the litter.

When cecal coccidiosis is repeatedly a problem sometime during the brooding period, plan to clean out the litter more often during the period the outbreak is most likely to occur.

A program of continuous or intermittent feeding of coccidiostatic drugs, such as the sulfas, has been effective in some cases. Such a program should be adopted, however, only after careful consideration of the poultry plant operations. There is no doubt of the value of proved coccidiostatic drugs when they are properly used. However, one may reasonably question the economy of the erratic use of these drugs by many poultry producers.

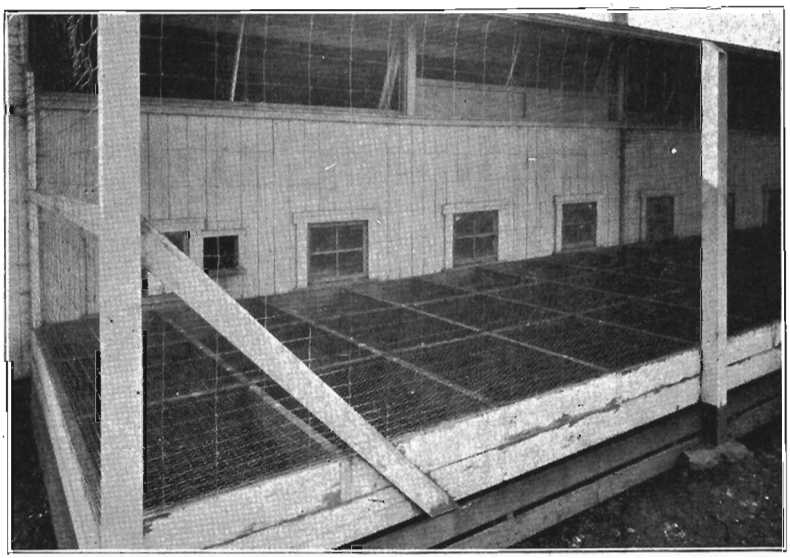

Figure 6. A wire porch in front of an O.S.C. commercial laying house. This provides additional floor space in the sunlight and keeps the birds off contaminated dirt yards. (For construction see O.S.C. Extension Bulletin 480.)

Records indicate that most cases of intestinal coccidiosis occur in young pullet flocks within the first 2 or 3 months after they are put in the laying house. When this occurs on a poultry farm, regular cleaning of the poultry house at more frequent intervals when the birds are first housed may forestall this trouble.

Excessive cleaning and sanitation may prove harmful to efforts of prevention if it is overdone. Try to determine what level of sanition will allow for subclinical coccidiosis and yet stop short of clinical manifestations.

From this discussion it seems logical to assume that deliberate inoculation of the chickens with the various species of coccidia would be the solution to the problem. That might be so, provided it would be accomplished in a practical economical manner. Poultry disease investigations at the Oregon Agricultural Experiment Station are being directed toward the solution of this problem by producing resistance in an artificial manner through inoculation. Although encouraging results have indicated the possibility of this method of control, many factors in regard to coccidia in general must be determined before a comprehensive program of this nature can be undertaken.

HOW TO HANDLE AN OUTBREAK

An accurate diagnosis as soon as trouble is suspected is essential for best results in handling an outbreak. Do not wait until a high per cent of the flock is sick or egg production has been drastically reduced before obtaining an accurate diagnosis.

In the event of a sudden outbreak of coccidiosis one of the proved coccidiostatic drugs, such as the sulfas, should immediately be fed to the birds either in the feed or drinking water. Several sulfa compounds as well as other drugs have been found to be effective coccidiostatic agents. The drug of choice should be the one most readily available at the lowest cost. Several feed concerns prepare a mash with the coccidiostatic drug evenly mixed at the proper dosage. In case poultry producers mix the drug in the mash they must be certain of the correct dosage. The dosage to use may be found on the drug container. Further, for uniform results an even distribution of the drug in the mash by thorough mixing is imperative. Some of these drugs may be fed in the drinking water. Since many of the drugs are not soluble in water, it is important to make certain the drug to be used in this manner is soluble. For the control of an acute outbreak, treatment should be given continuously for at least 3 to 5 days. This treatment should be repeated after 4 or 5 days in case the birds respond slowly or show evidence of a recurrence. No special cleaning is necessary during this period. It is important, however, to maintain reasonable sanitation at all times.

When it is possible segregate visibly sick birds from the main flock. They will respond to care better than when they must compete with the more active healthy birds in the main flock.

Since the appetite is affected, any method of feeding that will encourage the birds to eat will be helpful. Supplemental feeds, such as moist mash or fresh cut greens fed once or twice daily (an amount that is eaten in 20 or 30 minutes) may be helpful.

MISCONCEPTIONS ABOUT COCCIDIOSIS

Coccidiosis and "range paralysis"

The statement is made that coccidiosis is the cause, or is a secondary factor, in "pullet" or "range paralysis." Such statements are without sufficient definite evidence to establish them as true. On the contrary, evidence obtained during experimental studies of coccidia at this station indicates that a coccidial infection in chickens will neither cause nor enhance the occurrence of pullet or range paralysis, or any of the other "leucosis complex" manifestations such

as "big liver disease" or "gray eye." Finding coccidia in birds affected with "range paralysis" is no proof that coccidia are either the direct or indirect cause of the disease.

Inherited resistance to coccidiosis

Some persons feel that using as breeders birds that survive severe coccidial infections will ultimately result in a strain of birds that have a natural protection against coccidia. Experimental evidence and practical experience indicate that at present this possibility has no practical value. In many flocks resistance or protection to coccidia is frequently developed by repeated mild coccidial infections without the poultrymen being aware of the presence of the infection. Because of this there is an inclination on the part of some poultrymen to regard such flocks as naturally immune or resistant. This often leads to the statement that "I have never had coccidiosis in my birds." Actually what is meant in most instances is that clinical symptoms of coccidiosis have not been observed. By inoculating with large numbers of coccidia some susceptible chicks from such a breeding flock it has been shown that the chicks have not inherited a natural resistance to coccidia.

Not transmitted through the egg

The fact that broods reared with new equipment and housing facilities on a new farm that has never had chickens on it before, come down with coccidiosis causes some persons to feel that coccidia are transmitted through the egg. Experimental evidence has conclusively shown that coccidia are not transmitted through the egg. When newly-hatched baby chicks are brooded under highly artificial laboratory conditions designed to prevent the chicks from becoming infected, they regularly may be raised free of coccidia although the parents may be "healthy carriers" of coccidia.

Effects on egg production

Question: Will it be worthwhile to keep for egg production a flock of pullets that has suffered an attack of small intestinal coccidiosis? There are so many factors involved in answering such a question that one could be readily misled unless a thorough knowledge of the circumstances was available. Experimental data, however, have shown that pullets that have recovered from a setback due to small intestinal coccidiosis may return to profitable egg production. Field observations on flocks of pullets that have had severe small intestinal coccidiosis indicate these birds also may return to profitable egg production.

Battery brooders

Many poultrymen feel, and with more or less justification, that chicks can be reared free of clinical coccidiosis in a battery brooder. This is due to the fact that when battery brooders are properly used, there is no opportunity for the chicks to ingest a heavy dosage of coccidia. On the other hand, some very severe outbreaks of coccidiosis have occurred in battery brooders when the wire floors failed to clean properly and infected droppings collected within reach of the chicks.

Battery-brooded chicks are likely to be highly susceptible to most species of coccidia. It is wise, therefore, to give special sanitary consideration to such chicks for several weeks after they have been placed on the floor or range where they may have access to infected droppings.

Coccidiosis treatment

During the past few years there has been an increasing number of drugs found that have been effective for the control of coccidiosis in chickens. Some of the sulfa drugs in particular have been used extensively to control the disease. Successful control, however, depends on prompt recognition of the disease so that treatment may be started immediately.

There is a variety of feeding schedules recommended for the use of these coccidiostatic drugs. When intermittent feeding is used the schedule should conform to the calendar work week. Poultry producers who follow a pattern of 2 days on treatment and 3 or 4 days off frequently become confused and lose track of the pattern. On the other hand, if they put the birds on treated mash each Monday and take them off each Thursday it provides a pattern within the work week that is more readily followed by the average poultry producer.

The dosage of the different coccidiostatic drugs varies greatly. For example, one pound of sulfaguanidine in each 100 pounds of mash gives about the same coccidiostatic effect as sulfaquinoxaline fed at the rate of one pound in each 2,000 pounds of mash. It is, therefore, very important that the proper recommended dosage be used. Under no circumstances should the dosage fed exceed the recommended dosage since most of these drugs are toxic when fed excessively. Some feed processors prepare a mash with the coccidiostatic drug evenly mixed with the proper dosage for use in the control of coccidiosis.

Although proved coccidiostatic drugs are of value in the control of coccidiosis, poultry producers should be reminded that these drugs are effective only when properly given in the correct dosage. It is false economy to use these drugs in an erratic, irregular program.