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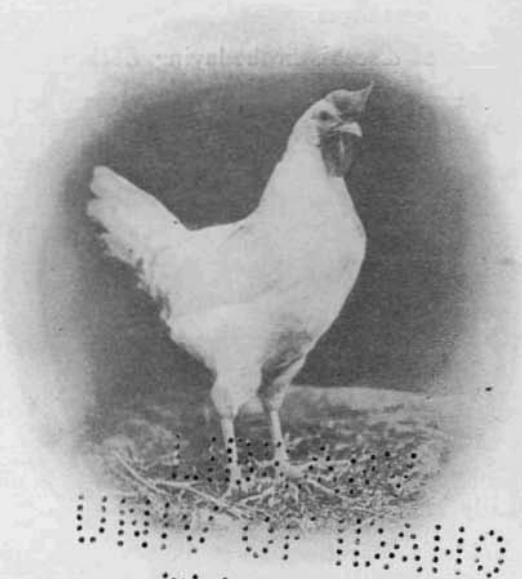
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# Prevention and Control of Poultry Diseases

*(Extension Circular 57 Revised)*

By

E. M. GILDOW, C. E. LAMPMAN, PREN MOORE,  
and GLENN C. HOLM



The production of vigorous disease-free pullets is the  
poultryman's major problem.

COOPERATIVE EXTENSION SERVICE IN AGRICULTURE AND HOME  
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## POULTRY SECTION

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## Summary

LOSSES from poultry diseases are most effectively controlled by the application of adequate precautionary measures. The major factors in their control are:

1. Chicks from disease-free and disease-resistant stock.
2. Elimination of outside traffic.
3. Well-balanced rations for the control of nutritional diseases.
4. Sanitary brooding practices.
5. Clean growing ranges.
6. Prevention of diseases in the laying flock.

Pullorum disease (bacillary white diarrhea) can be prevented by procuring chicks from pullorum-free stock (Page 4).

Coccidiosis, the most common disease of growing chicks, can be controlled by sanitary brooding practices (Page 10).

Roundworms can be eliminated in one season (Page 14).

Tapeworms are difficult to eliminate, therefore annual treatment may be necessary; eliminate contact between flies and other intermediate hosts and the birds, and between these hosts and the droppings (Page 14).

Tuberculosis can be eliminated in one season by following a simple sanitary program (Page 21).

Fowl pox can be satisfactorily controlled by vaccinating susceptible birds annually (Page 22).

Paralysis, keratitis, enteritis, and peritonitis associated with ruptured egg yolks, are the diseases chiefly responsible for laying flock mortality. Control measures consist of sanitation, flock selection, and the breeding of resistant stock (Pages 16-21).

# Prevention and Control of Poultry Diseases

By

E. M. GILDOW, C. E. LAMPMAN, PREN MOORE, and GLENN C. HOLM<sup>1</sup>

**P**REVENTION and control of poultry diseases would eliminate a major problem for the poultry grower. That disease constitutes one of the major problems of poultrymen is amply demonstrated by the large number of inquiries received, and by observations of conditions that prevail on farms throughout the State. Elimination and control of paralysis, coccidiosis, worms, and tuberculosis would be of decided value to the flock owner by reducing economic losses and by increasing the profit of the poultry enterprise. *Is it not advisable then, to have some definite knowledge of the diseases prevalent in Idaho and a satisfactory program for their prevention and control?*

## Poultry Diseases in Idaho

The three fundamental causes of mortality in poultry in Idaho are inherent susceptibility to disease, infectious and parasitic diseases, and nutritional disturbances. Occasionally mechanical injuries and, rarely, poisoning may be responsible.

A survey of the cases diagnosed at the Idaho Agricultural Experiment Station indicates that such diseases as paralysis, leukemia, tuberculosis, and peritonitis associated with ruptured egg yolk are responsible for the major losses. Flocks are now being developed which show a high degree of inherent resistance to some of these specific diseases. Tuberculosis is found to be more prevalent in flocks on general farms.

In both farm and specialized flocks, considerable mortality may be caused by pullorum disease, coccidiosis, roundworms, tapeworms, fowl pox, nutritional disturbances, lice and mites.

Most inquiries concerning diseases are for methods of treatment rather than for methods of prevention. When disease is detected much damage that can never be remedied by treatment already has been done. Furthermore, such diseases as tuberculosis and paralysis are incurable and must be prevented rather than treated. *The program of disease control here outlined deals largely with preventive measures rather than with treatment.*

## Basic Factors in Disease Control

The basic factors necessary for the prevention and control of these diseases are as follows:

1. Vigorous chicks from disease-free and disease-resistant parent stock.

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2. Elimination of outside traffic. Allow no visitors inside the brooder or laying house.
3. Brooding practices that will prevent the chicks from becoming infected through contact with adult stock or contaminated environment.
4. Conditions and practices that provide a clean range and sanitary range management.
5. Management practices in the laying house that will prevent the spread of disease from old hens to pullets.
6. Well-balanced rations for the control of nutritional diseases.

In general, treatments for disease conditions of poultry are not satisfactory; however, treatments for certain parasitic disturbances that cannot always be prevented, such as tapeworms and coccidiosis, should be considered as part of any control program.

#### Sources of Disease-Free Stock

The important points to be considered in obtaining disease-free stock are: (1) baby chicks or hatching eggs must come from vigorous disease-free and disease-resistant flocks; (2) chicks must be hatched in incubators or clean compartments separate from chicks of questionable quality; (3) no mature or partially mature birds should be introduced into the flock; and, (4) there must be continuous culling of weak and unthrifty stock.

**Disease-free Parent Stock.** Vigorous disease-free chicks are the basis of any good flock; therefore, one must obtain chicks from a reliable source. It has been proved definitely that pullorum disease (bacillary white diarrhea) is transmitted from an infected hen to the chick. Some evidence indicates that paralysis may be transmitted in a similar manner.

**Disease-resistant Parent Stock.** It is definitely known that hatchability, livability of chicks, and resistance to specific diseases are heritable characteristics. Experiments have shown that pullet mortality in different strains of birds under identical conditions may vary from 10 to 50 per cent. It has been found at this Station that there is a decided difference in the inherent resistance to paralysis in different strains of birds of the same breed. The selection of hens not only for high egg production, but also for high hatchability, good livability of chicks, and high resistance to disease is essential in any program for disease control.

*Any bird that has lived and produced while her pen mates have died must be resistant to disease; therefore, the older the breeder, the greater the likelihood that she is disease-resistant.*

**Hatch Chicks in Clean Incubator.** Not only must chicks be selected from a desirable source but they must have been hatched in compartments or incubators separate from any chicks suspected of carrying disease. Pullorum, typhoid, paratyphoid, navel ill, and

chick bronchitis must be controlled by proper incubator and hatchery sanitation.

**Do Not Introduce Adult Stock.** The purchase of mature or partially mature stock involves a greater disease hazard than does the purchase of baby chicks. Such birds are often affected with round and tapeworms, paralysis, pullorum disease, tuberculosis, colds, and fowl pox, or even contagious bronchitis, fowl cholera, or fowl typhoid. One infallible rule to follow is to introduce only baby chicks or hatching eggs, and these from disease-free vigorous flocks. Excellent cockerels and basic breeding stock can be more economically introduced in this manner.

**Eliminate Traffic from Outside Sources.** Any visitor or any poultry equipment, such as poultry crates that may come on the farm, should be considered as potential carriers of disease. Poultry buyers, peddlers, or anyone else traveling promiscuously from farm to farm, may carry a disease from one flock to another. This is particularly true in the case of highly contagious diseases such as fowl pox, contagious bronchitis, and chick bronchitis. Other diseases which may be carried in this manner are pullorum, tuberculosis, colds, roup, and coccidiosis.

**Continuous Culling Necessary.** The term "culls" as used in this circular refers to birds that have low inherent vitality as shown by head and body characteristics; birds out of condition from mismanagement, parasitic infestations, or disease afflictions; and birds that are deformed sufficiently to interfere with their normal productive capacity. All such birds are a menace to the remainder of the flock in that they are most susceptible to parasitic and infectious diseases and thus serve as a source of disease that may be transmitted to vigorous birds. A cull chick in the flock may be harboring intestinal parasites or a cull hen may contract roup and spread it in the flock. Furthermore, culls are unprofitable in themselves in that they do not normally pay their own way in production.

The continuous removal of all culls from the flock from the time the chicks are placed in the brooder house until they are disposed of as old hens is not only a profitable management practice from the standpoint of production, but also is desirable as a measure of disease control.

### Sanitary Brooding Practices

After a poultryman has taken considerable pains to obtain vigorous disease-free chicks he should consider brooding practices that will insure the continued health and thrift of the chicks. Factors of most importance are: (1) cleanliness of the brooder house; (2) precautionary measures against carrying disease from the hens to the chicks; (3) sanitary feeding and watering methods; (4) type and use of the brooder yard; and (5) length of time that the birds are confined to the brooder house.

**Clean Dry Brooder House.** Every brooder house and all brooding equipment should be disinfected, cleaned, and dried before the chicks arrive (See *Cleaning the Poultry House*, page 25). The house, preferably, should be located handy to the dwelling to facilitate regular and systematic attention to the chicks.

*Wet or foul litter promotes the development of coccidiosis.* The litter should be changed as soon as it becomes damp or dirty, ordinarily at 3- to 5-day intervals. This will depend on the number of chicks in the house, their age, the kind of litter, and whether the weather will permit the chicks to remain outside.

**Do Not Carry Disease to the Chicks.** A separate attendant should care for the chicks. Disease may be carried to the chicks on the hands, clothing, or shoes of the attendant, in the feed or on equipment that is contaminated with infectious material from the adult stock. An extra pair of rubbers should be kept at the brooder house to be used only while caring for chicks. The brooder house should be on the windward side of the laying house and a sufficient distance away to reduce the hazard of tracking contamination and to discourage flies from traveling from the hens to the chicks. Flies may carry tapeworms.

**Sanitary Feeding Methods.** The house should be equipped with feed and water utensils in which the chicks cannot walk (*Fig. 1*). All feeds should be fed in hoppers. Baby chicks should be fed as

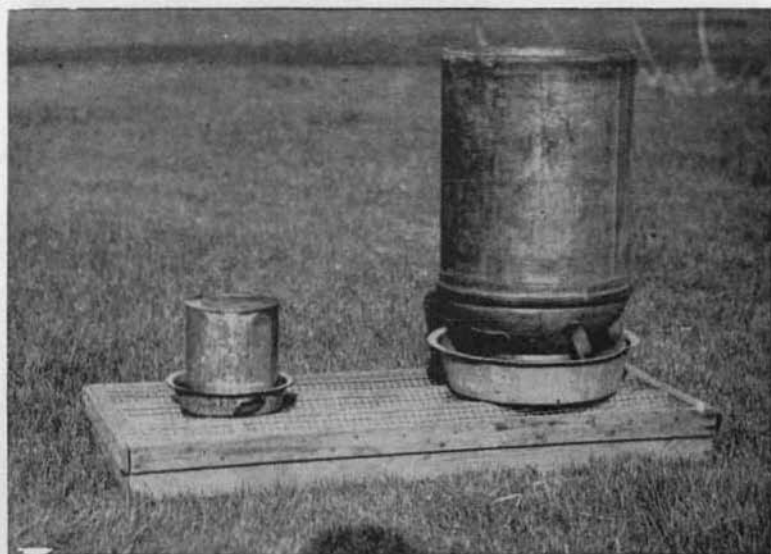


Figure 1.—Fountains for water or milk are so constructed that birds cannot walk in them. Wet areas around the fountains may be eliminated by using wire-floored frames similar to those shown here. Puddles, or wet areas, are to be avoided in the brooder house or on the range.



soon as they are placed in the brooder house; otherwise they are likely to develop digestive disturbances from eating sand and litter.

**Dry Sanitary Brooder Yards.** Early chicks, or those brooded during a wet season, or in irrigated sections, should be provided with some outside run that is floored to prevent them from coming into constant contact with moist soil. A cement or wire floored platform is satisfactory for this purpose. The latter will probably be more suitable in most instances. For convenience and efficiency the wire floor should be constructed in panels, using  $\frac{1}{2}$ - to  $\frac{3}{4}$ -inch mesh wire, stapled to 1 x 4 inch material used edgewise (*Figs. 1 and 2*). The platform should be at least 18 inches above the ground. Waste material and droppings should not be allowed to accumulate under the floor as it tends to draw flies and thus increase the tapeworm hazard.

Other brooder lot devices for insuring chicks freedom from soil-borne disease have been advocated. The most common of these is the portable brooder house that is moved each year to clean ground and can be moved when necessary. *Methods that give the most protection with the least effort are generally found to be most satisfactory.*

**Chick Management.** Chicks should be confined to the brooder house and yard from 6 to 10 weeks, depending upon the date hatched, weather conditions, and the breed. Do not keep the chicks confined longer than is necessary. Early chicks, of course, are kept in the brooder house longest. There are always a few individuals that fail to develop normally, that are low in vitality, or for other causes do not develop with the flock. Vigorous culling of these birds will aid materially in preventing the development of serious disease problems. For further details on chick management see Idaho Extension Bulletin No. 96, *Brooding and Pullet Development*.

### Diseases During the Brooding Period

Common diseases affecting chicks during the brooding period are digestive disturbances, diarrhea, pneumonia, pullorum disease, coccidiosis, and rickets. Digestive disturbances, diarrhea and pneumonia may be caused by eating litter, contamination of feed and water with harmful germs, and either overheating or chilling of the chicks. After correcting the cause of the trouble, a laxative in the form of a milk flush in the treatment advised. (*See Milk Flush, page 11*). Nutritional deficiency diseases are discussed in Idaho Extension Bulletin No. 96, *Brooding and Pullet Development*.

#### **Pullorum Disease** (bacillary white diarrhea)

Chicks affected with pullorum disease may or may not have a diarrhea. Most chicks that die have a retained yolk sac and many of them have gray spots in the lungs. The only method of determining positively that chicks are affected with pullorum disease is by

a bacteriological examination. It must be remembered that chilled or overheated chicks show symptoms similar to those affected with pullorum disease.

Pullorum disease is transmitted from infected hens through the egg to the chick and is spread in the incubator at hatching time, in chick boxes, and in the brooder houses. When present, it shows up in otherwise healthy appearing chicks about 4 to 6 days of age. At first only a few chicks may be affected but others continue to develop symptoms until the peak in the death rate is reached at about 12 days of age. From then on the mortality rate decreases. The mortality varies from 10 to 50 per cent in leghorns to as high as 80 per cent in heavy breeds. There is no specific treatment for this disease. A milk flush, rigid culling, and sanitary brooding are the practices advised. Frequent changing of the litter and disinfection of feeding utensils also are advocated. Placing antiseptics or other medicines in the water or feed has not proved to be practical or advantageous. *The introduction of this disease can be prevented by securing chicks from sources known to be free from Pullorum Disease and by thorough disinfection of the brooder house before chicks arrive.*

**Sources of Pullorum-free Chicks.** A program of testing breeding stock for the purpose of eliminating affected individuals has been in progress for many years. Flocks are tested annually to insure their freedom from the disease or to eradicate it from affected flocks. Sources of pullorum-free stock, and those in the process of

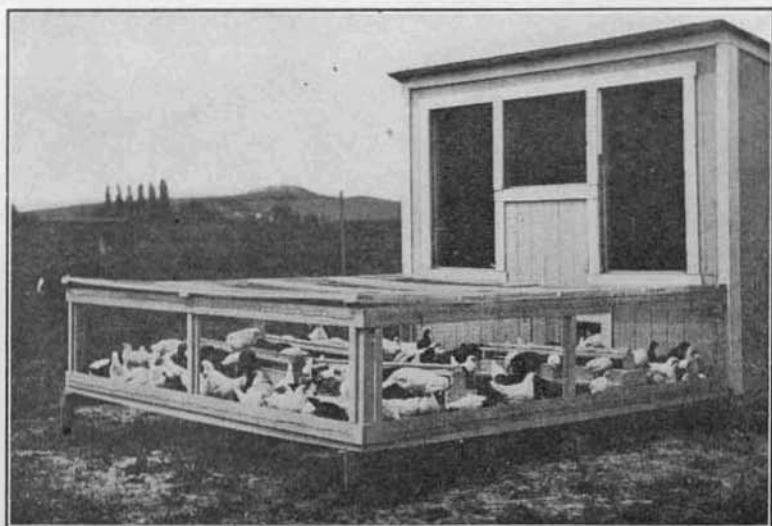


Figure 2—A wire-floored platform is satisfactory for use during the early brooding period. The floor is made of sections of  $\frac{1}{2}$ -inch mesh hardware cloth. The feed hoppers shown are so constructed that the chickens can not get into them with their feet (See Sanitary Brooder Yards, page 7).



eradication, can be obtained from the Idaho Agricultural Extension Service or from the official State Poultry Improvement Association.

**Testing for Pullorum Control in the Breeding Flock.** The control of this disease is accomplished by two main procedures: (1) preventing the introduction of the disease into clean flocks (*see page 5*); and (2) by eradicating the disease from affected flocks.

Eradication may be accomplished in two ways: (1) by the isolation of affected laying stock and the disposal of it at the end of the laying year, and the introduction of well-bred, disease-free chicks from a source known to be clean; and (2) by repeated testing of affected flocks and the elimination of reactor birds.

Eradication of pullorum disease may be accomplished by repeated tests at 1- or 2-month intervals with the elimination of reactors, until two 100 per cent consecutive negative tests have been obtained. A single annual test with removal of reactors will not completely eradicate the disease.

Three testing methods are used for the elimination of affected birds: (1) the standard laboratory tube test; (2) the laboratory rapid serum test; and, (3) the stained-antigen rapid whole-blood field test. Authorities agree that the laboratory tube test is the most accurate though it is more costly. The rapid whole-blood field test has merit as a control program but should be followed with a standard tube test as a means of establishing 100 per cent clean flocks. Repeated tests at short intervals are necessary for satisfactory control of this disease. The national breeding plan, with which the Idaho Poultry Improvement Association is at present affiliated, specifies certain regulations for the testing of flocks in the several pullorum-control phases.

### **Paratyphoid**

Paratyphoid infection in young chicks is in many respects similar to Pullorum infection. Low vitality, due either to nutritional deficiencies or to poor brooding conditions, is the major predisposing factor. Recent autopsy data at the Idaho Agricultural Experiment Station indicate that this disease is responsible for a considerable portion of the mortality in baby chicks. The agglutination test used for pullorum will detect most of the adult carriers of this infection. Good brooding and feeding practices constitute the only satisfactory treatment.

### **Coccidiosis**

Coccidiosis is the most common disease of growing chicks. It is usually contracted between 3 and 12 weeks of age, although it may occur at any age. The disease very often develops when the chicks are moved or when the artificial heat is eliminated. Young chicks that are affected have ruffled feathers, droopy wings, lose their appetite, and stay under the hover. The droppings may be tinged with blood. If a dead chick is opened, the ceca or blind intestines usually

will be found filled with blood or with a blood-tinged cheesy plug (Fig. 3). With the aid of a microscope large numbers of coccidia can be detected in this material. *It is usually carried to the chicks by the caretaker from old hens or through contact with contaminated feed, yards, or ranges.*

Coccidiosis is an infection of the digestive tract caused by a single-celled animal organism. Several species of coccidia attack chickens; consequently, the location and severity of the lesions produced depend upon the type of infection present. Chickens up to three months of age usually are affected with the cecal form of the disease. Coccidia multiply in the digestive tract, eventually producing oocysts, or egg-like forms, which must pass out of the digestive tract and come in contact with the air where they embryonate or incubate before they become infectious.

The time required for a coccidium to have completed its reproductive cycle in the intestines of an affected bird and for oocysts (eggs) to have been eliminated in the droppings is in most instances not more than two weeks.

If, then, a group of chickens can be prevented from becoming reinfected; that is, from picking up fertile oocysts (eggs) with their feed and water for two weeks time, they will automatically be free from the disease. This feature of the disease has led poultry pathologists to classify it as a self-limiting disease. Birds that recover from coccidiosis have developed some immunity to that specific form.

The disease may be satisfactorily controlled if treatment is started early. This program consists in: (1) limiting the area of contamination to the brooder house; (2) treating the birds with the milk flush; and (3) eliminating sources of reinfestation.

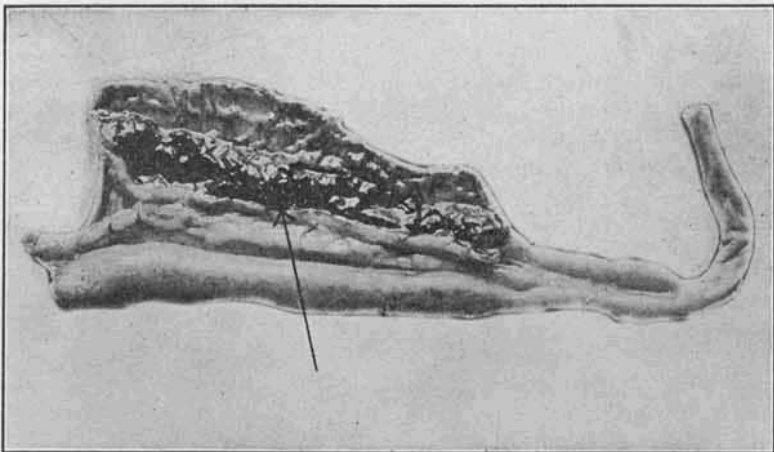


Figure 3.—Cecal coccidiosis of a three-months-old pullet. This is the type of coccidiosis commonly encountered in the brooder house and on the range. One ceca has been cut open to show the bloody content (indicated by the arrow).

Segregate or kill visibly affected birds and, if possible, confine the remainder of the flock to the brooder house and sun yard (of wire or concrete), being sure that they are not overcrowded and that they have sufficient heat if the weather is cold.

**Treat the birds with a milk flush.** This consists in supplying them with an abundance of milk in their diet for a period of 4 to 7 days. A very satisfactory way to supply the milk is by adding powdered milk to the regular mash until the milk content is up to 25 per cent. This mash should be kept before the birds continuously. No scratch feed should be fed during the treatment period. An abundance of water should be available since the birds will drink approximately three times the normal amount during this heavy milk feeding. A fairly satisfactory flush can be produced by supplying the birds with liquid skim milk or buttermilk in quantities sufficient for their sole drink for a similar period. A material saving in the amount of dried milk can be made in treating birds of over eight weeks of age by giving them an initial flush with epsom salts, (1 pound per 500 pounds of birds followed by a milk flush mash containing 20 per cent dried milk, for a period of 3 to 4 days).

**The house should be cleaned each day and new litter supplied.** This practice is necessary to eliminate the excessive moisture on the floor and to remove the oocysts that are discharged with the droppings. This prevents reinfestation of the birds. Where it is impossible to confine the birds to the house during the treatment it is advisable to move the birds and the house to a clean range. Any number of schemes may be devised to assist in controlling this disease. The main points to keep in mind in prevention as well as control are: (1) do not permit infectious material to contaminate the environment of the chicks; (2) change the litter frequently; (3) keep the birds in a dry house and off wet ground; and (4) use every precaution possible to prevent the birds from coming in contact with poultry droppings.

The continued or intermittent feeding of large quantities of milk, sometimes advocated, will not prevent coccidiosis, and furthermore, reduces the value of the milk flush as a treatment.

#### **Sanitation on the Range**

Chicks may be moved out to the clean range in range shelters (*Fig. 4*), or in portable houses as soon as they will go to roost, provided the weather and condition of the range will permit. The range should be dry; that is, not recently irrigated and not wet from recent rains.

Very often desert land is available adjacent to irrigated sections. This desert land is ideal for a chicken range if cut green feed can be supplied. The desert range supplies the factor of dryness, which is most essential in interrupting the propagation of intestinal parasites and coccidia.

Clean poultry range is one that is free from parasite eggs and from soil-borne disease germs. It is a range that did not have

poultry on it the previous year and on which poultry manure has not been placed during that period. The three main factors to be considered in range sanitation are: (1) abundance of clean dry range; (2) adequate range usage practices; and (3) an appropriate range rotation scheme. The whole farm as range usually means that the barn yard is the range and that it soon becomes polluted with poultry disease organisms from the droppings of the birds. A similar situation soon develops in the permanent chicken yard.

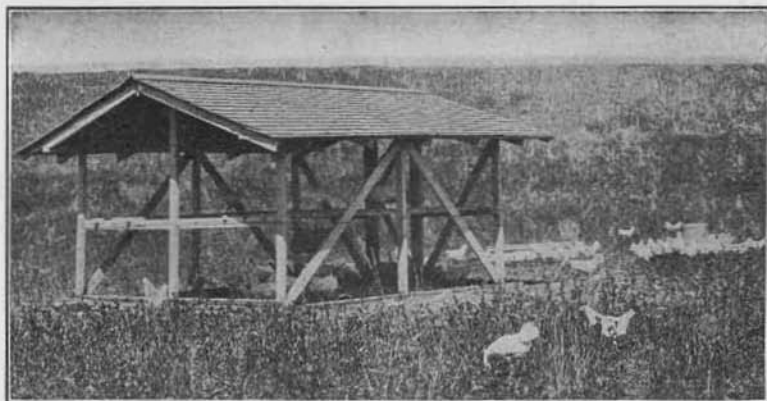


Figure 4.—A range shelter equipped with a removable wire floor is ideal for the housing of pullets on range, especially where a permanent brooder house is used. An adjustable burlap curtain may be added on the side of the prevailing storms.

**Have abundance of clean range.** A range should be large enough so that the droppings will not accumulate to such an extent that the ground becomes foul around the house, shelter, or feed hoppers. Many poultrymen maintain that the birds will not range but persist in remaining near the houses. Such cases are very common and are the result of keeping the feed and water near to or in the range shelter or house.

**Use the range efficiently.** Pullets may be induced to use the entire range by the frequent moving of hoppers and other equipment to clean areas. All feed should be fed in hoppers. Shade, if artificial, should be moved with the other equipment. The commercial poultryman should not congest the range by putting broiler cockerels on it. Vigorous culling of all underdeveloped or sickly appearing birds at all times will assist in preventing the spread of disease.

**The range must be rotated and dry.** Wet and shaded ranges that are used each year and the ranges that are over-stocked are most liable to give trouble. It has been found that worm eggs survive longest in moist, shaded areas. The climatic conditions that prevail in Idaho during the summer season make it easy to provide a dry range. Such a range may be made available on any irrigated farm

by eliminating the water from the land used. Dry ground immediately around the houses and range equipment is most essential. Low areas where the soil remains damp should be avoided. During the summer season in Idaho, worm eggs deposited on dry ground and exposed to the sun's rays will be killed in a short time. An orchard should be used only once in three years for a poultry range.

*The concentration of prevalent disease-producing organisms and worm eggs will develop in the bare areas where excessive droppings accumulate if the above features in range management are neglected.* The elimination of liquid milk in the diet as soon as flies become prevalent in the spring is an additional precaution in tapeworm control.

### Diseases That Develop on the Range

Common disease conditions affecting birds on range in Idaho are coccidiosis, tapeworms, roundworms, paralysis, and tuberculosis. Occasionally birds may become affected with colds, nutritional roup, or fowl pox. The treatment for coccidiosis is the same as that previously discussed. The control of colds, nutritional roup, and fowl pox is essentially the same as that to be discussed later under Diseases that Develop in the Laying Flock.

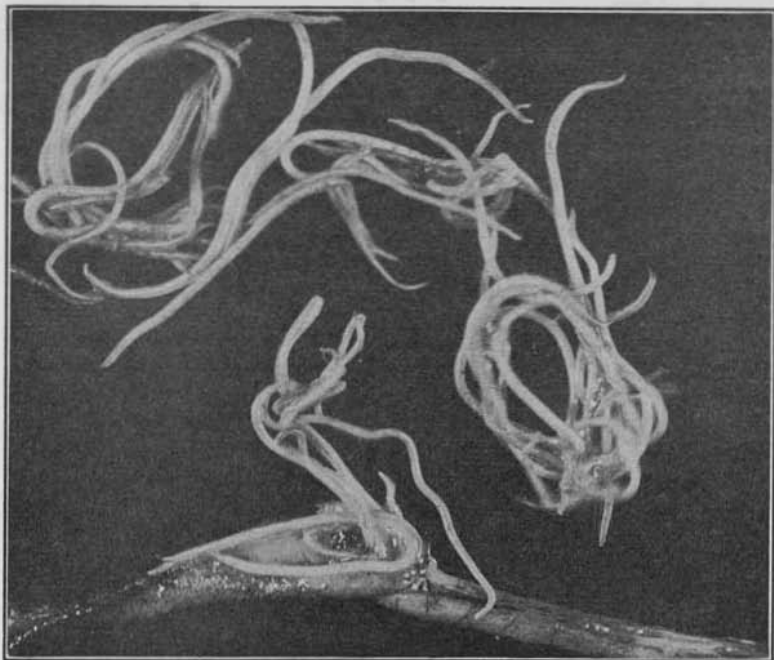


Figure 5.—Roundworms (ascarids) lie free in the small intestines. Worm eggs pass out with the feces and infest material with which they come in contact.

### Roundworms and Cecal Worms

Roundworms and cecal worms may infest range birds if they are running on ground that was used as range the preceding year or on which poultry manure has been spread. Occasionally they become so heavily infested that they stop growing, become pale about the head and legs, show poor appetite, slow feather growth, and a generally unthrifty condition. The best way to detect worms in chickens is to open a few affected birds and slit the intestines through-out with a pair of scissors. Large roundworms, if present, will be detected in the small intestines (*Fig. 5*). Small cecal worms about  $\frac{1}{2}$ -inch in length may be seen in the ceca. Affected flocks should be culled vigorously and then treated for roundworms. There should be no necessity for an annual treatment of birds for roundworms since their development can readily be prevented by following sanitary brooding practices and by rotating the pullet range. Round worms (ascarids and cecal worms) have been entirely controlled in the Idaho Agricultural Experiment Station flock during the past six years by following this procedure. If, however, pullets or old hens are known to be infected they may be safely treated if they are not in production.

**Treatment for Roundworms.** Nicotine sulphate is the most satisfactory remedy for roundworms. This treatment consists of four main steps: (1) fast the birds for 18 hours; (2) after the fast give each three-pound pullet or hen one hen-sized nicotine sulphate capsule (smaller birds should receive a pullet-sized capsule); (3) following this treatment give epsom salts as recommended on page 25; and (4) the dropping boards and floors should be cleaned the following day to remove all worms and worm eggs that have been eliminated. The iodine vermicide treatment, as outlined below for tapeworms, may be used if the birds are laying. Specific information regarding the treatment of birds in production may be secured through correspondence with the Extension Division or College of Agriculture.

There is no satisfactory general treatment for cecal worms.

### Tapeworms

Birds affected with tapeworms show symptoms similar to those with round worms. Tapeworms can be detected by opening the intestines in a pan of water as suggested for the diagnosis of roundworms. They may be seen as flat segmented worms floating out into the water, while the head is attached to the lining of the intestines. The presence of tapeworm segments in the droppings is readily detected by the experienced observer. Prevention of tapeworm infestation is difficult. A clean range will not insure freedom from tapeworms, although it is worthy of practicing. Tapeworms are not contracted by birds directly from tapeworm eggs but indirectly through an intermediate host such as the *house fly*, the *garden slug*, the *dung beetle*, or the *angleworm*. These must have become infested with the cystic form of a poultry tape worm through contact with poultry droppings containing the eggs. Since these intermediate



hosts may travel considerable distances through the air, on the ground, or in running water, serious difficulty is experienced in rearing pullets free from tapeworms once they become prevalent on a farm or in a community. Birds affected with tapeworms should be treated before they come into production.

The major factors in controlling tapeworms consist of: (1) breaking up the contact between flies and other intermediate hosts and droppings by storing the droppings in a fly-proof pit; between flies and birds by the use of fly screen on window openings of poultry houses when birds are kept in confinement; (2) worming of all pullets before they come into laying and of all old hens while they are in the molt; (3) using dry ground to discourage the presence of intermediate hosts; (4) employing measures that will discourage flies from traveling from old hens to growing stock—such as brooding on the windward side and as far away as possible from the laying quarters, and discontinuing the use of such feeds as liquid milk during fly time. Institution of these measures has eliminated tape worm infestation from the Idaho Agricultural Experiment Station flock to the extent that no treatment has been necessary for the past five years.

**Treatment for Tapeworms.** Kamala is the most common drug used in the control of tapeworms and has been found in trials at this Station to be the most effective remedy. The Kamala should be fresh since it loses its potency with age. It is used only at seasons of the year when it will not interfere with egg production since its use will throw laying birds out of production. It is used on pullets in the fall before they come into production and on hens during the fall molt. *In certain sections of Idaho, where tapeworms are particularly prevalent all birds should be treated each fall as a regular practice.*

Treatment with Kamala consists of three essential steps: (1) all birds to be treated must be fasted for at least 18 hours; (2) after the fast each pullet weighing over three pounds and each hen should be given individually one capsule or one tablet containing one gram of Kamala. (1 to 3 pound pullets should receive one-half gram doses. Treated birds may be fed 3 to 4 hours after treatment); and (3) the dropping boards should be cleaned and the litter changed 2 or 3 days following treatment. This material will contain large numbers of worm segments and is a potential source of danger, and should be stored in a fly-proof manure pit or be burned.

When birds are found to be affected with tapeworms during the laying season, those out of production may be treated with Kamala. *It is better to defer treatment until the birds molt than to throw them out of production with some drastic treatment.*

#### **Paralysis (Lymphomatosis)**

Paralysis, commonly known as range or pullet paralysis, has become prevalent in Idaho. The common symptoms are lameness, or paralysis, in one or both legs; the drooping of one or both wings;

blindness, caused by contraction of the iris; and often merely thinness and loss of condition. Paralyzed birds eventually die of starvation if not killed. Upon post-mortem examination the nerves leading to the paralyzed parts are usually found to be much enlarged. This phase of the disease is technically known as *neurolymphomatosis*. Characteristic tumor growths are most frequently found in the ovaries, kidneys, and liver; however, such tumorous growths may be found in any of the internal organs or tissues such as the muscle or skin. Such lesions are classified as *lymphocytomatosis*.

Birds showing eye lesions, uncomplicated with other forms, may live indefinitely if sufficient eyesight remains. Paralysis is generally believed to be an infectious disease caused by a filterable virus. Some workers, however, are not entirely convinced as to the exact nature of the causative agent. The disease seems to be contracted early in life. Several European and American workers believe that it may be transmitted through the egg to the baby chicks from the infected hen.

Most infected birds develop symptoms between 3 and 18 months of age with the peak of mortality occurring between 5 and 8 months. Old hens appear to be less susceptible. In some flocks only a few birds contract the disease while in others a loss of 50 per cent of young stock has occurred. Only a few birds are affected at a time, but new cases continue to develop.

This disease passes through a rather definite cycle of infection involving several years. It usually reaches its peak during the first or second year, during which time many of the susceptible birds die. After the peak of infection the mortality continues to drop due to the fact that a natural resistance or immunity is developed.

Experimental work in progress for several years at the Idaho Agricultural Experiment Station has developed significant information about this disease. The data in Table 1 give the results of a

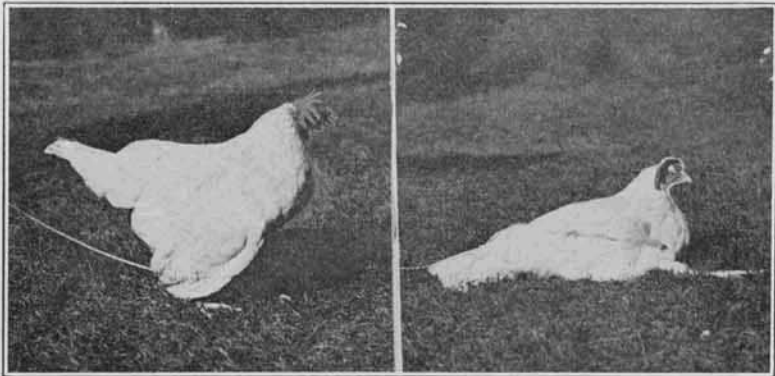


Figure 6.—The drooped wing and extended leg shown above are typical postures assumed by birds affected with fowl paralysis.

TABLE 1.—Paralysis mortality in progeny from various types of breeding flocks (In per cent).

Trial	Affected station stock	Introduced progeny		Station stock		All stock	
		Paralysis-free stock <sup>1</sup>	Resistant stock	Hen chicks	Pullet chicks	Range	Confined
Series I 1933-34	31.1	43.3		27.4	34.7	37.3	37.1
Series II 1934-35	19.9	41.6		17.0	24.6	25.0	26.3
Series III 1935-36	6.9		3.1				
Series IV 1936-37	7.6	Introduced at 1 dy. 6 wk. 12 wk. 41.8 4.0 8.0					
			5.5				

<sup>1</sup>Paralysis-free stock for Series I and IV from same source. Period of mortality included growing period and first laying year.

four-year study of the resistance or susceptibility of individuals from various sources. A comparison was made of the paralysis mortality of a portion of the affected Station flock with progeny introduced from paralysis-free stock and with progeny from a flock which had previously demonstrated resistance to the disease. The outside stock was introduced onto the Station Farm as day-old chicks, except for the two lots as indicated in Series IV, and was mixed with progeny of the same age from the Station flock. The results are briefly summarized as follows: (1) The paralysis mortality of the Station stock decreased from 31 to approximately 7 per cent as a result of increased resistance. (2) Progeny introduced as day-old chicks from paralysis-free stock proved to be extremely susceptible, a mortality of over 40 per cent occurring in each instance. (3) Birds, introduced from the same paralysis-free stock as 6- and 12-week-old pullets, proved less susceptible, the mortality ranging from 4 to 8 per cent. (4) The mortality of 3.1 per cent one year, and 5.5 in another, of the progeny introduced from the resistant strain, proved that this stock was definitely resistant to paralysis. (5) Progeny from pullet-breeding stock proved to be more susceptible than that from old-hen-breeding stock.

These results have been substantiated by field observations and work at other stations. This disease is one in which ultimate control is established as the particular flock involved develops specific resistance. The results at this Station further show that more rapid progress can be made in establishing resistance by selective breeding and progeny testing.

**Control of Paralysis.** No worthwhile method of treatment has been discovered. On the basis of the experiments already reported and field observations, the following program of control is recommended:

(1) In flocks where paralysis has not been present, the introduction of the disease should be prevented by confining replacements to chicks produced from the home flock or purchased from flocks known to be absolutely free from the disease.

(2) If the disease is present the procedure may be influenced depending upon the type of the flock. In the case of laying flocks ordinarily replaced by the purchase of chicks it should be preferable to buy baby chicks from breeding stock which has passed through and recovered from a cycle of infection. Cases have been observed on isolated farms in which the disease has been eliminated in one year by selling all adult birds early in the spring, thoroughly cleaning the brooding and laying houses, obtaining chicks from paralysis-free flocks and growing them on clean ground removed from the laying stock quarters. In the case of breeding flocks where paralysis is present a program of selection should be inaugurated involving the use of old hens as breeders and in the case of a pedigreed flock the use of progeny of resistant families which have demonstrated a high degree of resistance to the disease. If progeny can be introduced from another breeding flock which has passed through the cycle of infection and which has acquired a specific resistance to the disease, more rapid progress can be made in the elimination of the disease.

(3) Regardless of the type of stock, there should be a program of continuous culling of all weak, unthrifty individuals. Birds should be eliminated as soon as symptoms are detected. Individuals that have pale irises or irregular pupils should not be used as breeders.

(4) The institution of sanitary practices already described for the control of coccidiosis and intestinal parasites is advised.

A policy of allowing the disease to take its course usually results in a heavy mortality over a period of years. Such losses can be decidedly reduced by the application of the above control measures.

### Disease Prevention in the Laying House

Pullets are usually moved into the laying house when they are between  $4\frac{1}{2}$  and 6 months of age. Any thin or underdeveloped birds should be culled at this time. The pullets should be placed in clean laying pens separate from any old hens (*See Cleaning the Poultry House, page 25*). Special care should be taken to see that pullets are on the roost at night and that they use the nest boxes from the start. These precautions will largely prevent the development of colds and pickouts.

**Avoid contamination with poultry droppings.** All feed should be supplied in hoppers, preferably off the floor, in order to keep the litter and droppings out of the feed. Pullets, as well as old hens, with the exception of the breeders, should be confined to the laying house during the entire laying year. Yards and runways are not essential for egg production and are a disease menace to the birds, since they soon become bare and polluted with poultry droppings. A cement or wire-floored platform similar to that described for the brooder house may be used if desired. Dropping boards and wire netting under perches are essential equipment.

**Keep litter clean and dry.** The laying house should be cleaned sufficiently often to prevent the litter from becoming damp or dirty. The dampness of the weather and the type of litter used will deter-

mine how often it must be changed. Dryness and the prevention of drafts are essential in the laying house.

### Diseases That Develop in the Laying Flock

It is an accepted fact that during recent years there has been a decided increase in mortality in laying flocks. In former years a mortality of 1 per cent per month, or 12 to 15 per cent for the year, was the average. Recently the mortality has increased to the extent that a loss of from 30 to 50 per cent of birds during their first laying year is not uncommon. Most authorities agree that this increase in mortality is the result of a reduced vitality and lowered resistance brought about by present practices of management and breeding. Some of the major factors which appear to contribute to the present high mortality include: (1) the practice of using pullet-breeding stock; (2) the lack of a definite breeding program based upon the use of breeding stock which has demonstrated an inherent vitality and livability; (3) and the widespread dissemination of disease through the present heavy traffic in poultry. Other factors which contribute to the mortality problem include present practices of feeding and management for early maturity and high egg production, nutritional deficiencies, reduced resistance due to parasitic infestation, or to the presence of a specific infectious disease.

Many of the diseases responsible for this mortality are of such a nature that no cure or treatment is effective. As more facts become available regarding these diseases it is increasingly evident that cures and remedies will not solve the problem.

A sound breeding program, involving the use of birds in the second laying year or older which have demonstrated qualities of vitality, livability, and resistance to certain specific diseases, together with a reasonable sanitary program in management appears to be the most efficient procedure for reducing such mortality. Where pedigree breeding is practiced, the use of progeny from families that have extraordinary livability will increase the efficiency of such a program.

This type of breeding program has been in operation at the Idaho Agricultural Experiment Station for the past several years and has very effectively reduced the mortality as indicated in the following table:

TABLE 2.—Reduction of mortality in experiment station pedigreed stock by selective breeding (Per cent mortality during first laying year.)

	Total Mortality	Paralysis Mortality	Leukemia	Other Mortality
1933-34	44.6	21.4	2.7	20.5
1934-35	37.0	11.1	9.4	16.5
1935-36	23.7	4.9	4.9	13.9
1936-37	27.9	6.0	7.2	14.7
1937-38	17.6	2.5	4.4	10.7

NOTE: Above mortality includes unthrifty birds which were culled as well as those that actually died.

It is to be noted that all phases of mortality have been greatly reduced during the 5 years that this program has been intensively followed.

A marked variation has been noticed in the livability of daughters from the different males. Five years ago the sire with the highest mortality lost 60 per cent of his daughters and the sire with the lowest mortality, 34 per cent. In contrast to these figures, during the year 1937-38 the sire with the highest mortality lost 31.5 per cent of his daughters while the sire with the lowest mortality lost 6.6 per cent.

While it is conceded that birds tend to develop some natural resistance to certain disease complexes it is thought that selective breeding and progeny testing for high livability and disease resistance have been chiefly responsible for the marked reduction of mortality in this flock.

The principal causes of mortality in the laying flocks of this state are paralysis, peritonitis, leukemia, enteritis, tuberculosis, fowl pox, colds, roup, lice and mites, and occasionally coccidiosis and cannibalism. Such diseases as contagious bronchitis, fowl typhoid, and fowl cholera, are not generally present in Idaho. Intestinal parasites, paralysis, leukemia, and tuberculosis, are usually contracted before the birds are moved into the laying house even though the actual symptoms may not appear until after they are housed.

### **Peritonitis Associated with "Ruptured Egg Yolks"**

Peritonitis, which is an inflammation of the lining of the body cavity, is most commonly associated with ruptured egg yolks; this condition occurs only after birds have come into production. If the disease is acute, affected birds may be found dead or, if observed while alive, they exhibit a dejected attitude with the comb dark and limp. In less severe attacks the comb may shrink, become dry and scaly, the bird goes off feed, becomes emaciated, and eventually dies; birds often recover from mild cases. Observations made at this Station have shown that tumors in the ovary, liver, or mesentery (the fold which holds the intestines in place) are many times associated with chronic peritonitis.

At autopsy, yolk material is usually found either in a liquid form adhering to the various organs or as a hardened compact lump, referred to as an egg tumor. In some cases where peritonitis alone is involved the only abnormal condition to be found consists of an inflammation of the abdominal membranes and occasionally adhesions of the intestines.

Various organisms and conditions have been suggested as the cause of this "rupture egg yolk—peritonitis complex." Mechanical factors, digestive disturbances, high protein rations, or the presence of some other disease may be responsible. It has been suggested by some that a specific infection is responsible for some of these cases. In observations made at this Station it has been found, that this



"ruptured egg yolk—peritonitis complex" usually is associated with some other disease or any condition causing a sudden interruption in egg production.

No established method of control has been worked out, but with correction of factors responsible for the sudden drop in egg production, the application of sanitary practices that will keep the feed, water, and housing quarters as clean as possible, together with good management practices that will keep the birds in a good thrifty condition is recommended.

### Leucosis (Leukemia)

Leucosis is a chronic disease of the blood, blood producing organs, liver, spleen, and kidneys, caused by a filterable virus. It is commonly classified as "big liver disease" although enlarged livers may also be the result of other causes. In addition to the enlargement of the liver and spleen, other lesions commonly observed consist of a diffused infiltration of light-colored tumor-like tissue in these organs and in the kidneys. That phase of the disease in which the blood is primarily affected is known as leukemia. Pathologists are not agreed as to whether this disease is a form of paralysis or a closely related disease. The only means of differentiating between leucosis and paralysis in the field is by the presence or absence of definite paralysis symptoms. Inasmuch as this disease is similar in many respects to paralysis the same control measures are recommended (*See page 17*).

### Enteritis

Enteritis is an inflammation of the intestinal tract. It is observed in the mild form as an accumulation of mucous, in the semi-acute form as a sloughing of the mucous membrane and a thickening of the intestinal wall and in the acute form, as definite ulcers, hemorrhagic areas, or bleeding. Enteritis is not considered to be a specific disease in itself; it is ordinarily the result of such predisposing factors as infestations with coccidiosis or intestinal parasites or digestive disturbances caused by bacterial infection or spoiled feed. Birds affected with paralysis, leukemia, or peritonitis, usually have some enteritis present. Treatment should aim at the control of the disease with which it is associated. A laxative is usually advisable.

### Tuberculosis

Avian or fowl tuberculosis spreads rapidly in birds that are allowed to run in the barnyard or kept confined to a small yard year after year where the ground is contaminated. Chickens contract tuberculosis only from other birds. The most common method of introducing tuberculosis is through the purchase of mature or partially mature birds from infected flocks. This disease is common in farm flocks but is rarely found in commercial flocks. *An effective sanitary program, such as is here outlined for handling of young stock, will eliminate this disease in one season.* All old birds

should be sold and the laying house thoroughly cleaned and disinfected before the pullets are brought in from the range.

Tuberculosis can be detected by a tuberculin test or by the symptoms and lesions of the disease. Tuberculous birds usually do not show marked symptoms until they are approximately one year old. At about that age birds will be noticed "going light" or an occasional bird may go lame. If such a bird is opened, one will usually find distinct elevated yellowish spots in the liver and spleen. In some cases nodules appear along the digestive tract (*Fig. 7*). These elevations vary in size from a pin head to that of a marble. There is no specific treatment for this disease. Prevention is the only remedy. More specific information will be found in *U. S. Department of Agriculture Farmers' Bulletin No. 1200 and Leaflet No. 102*.

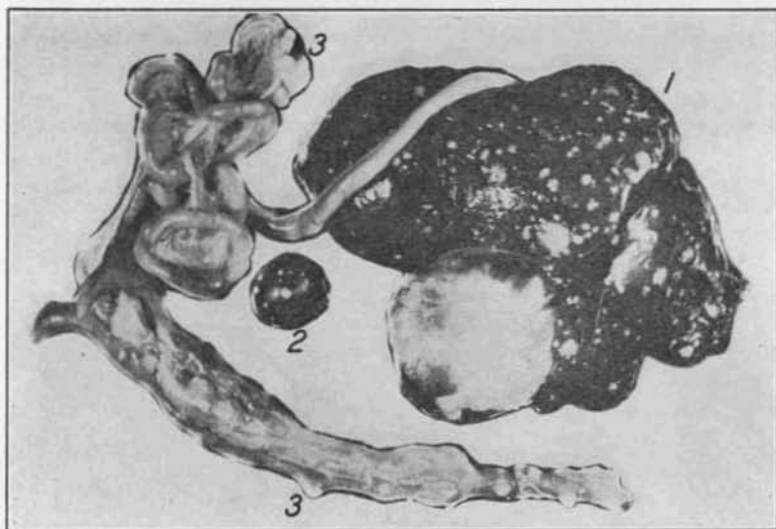


Figure 7.—Tuberculosis of the liver, spleen, and intestines of a yearling hen. The light spots in the liver and spleen (1 and 2) are tubercles. Tubercles of the intestines (3) open into the bowel and scatter the germs of the disease.

### Fowl Pox

Fowl pox usually develops in the laying house. The lesions most commonly seen are yellow vesicles that develop on the comb or wattles. These vesicles soon rupture and a black elevated wart-like scab develops. The eyelids may be involved in some outbreaks of fowl pox and cankers may develop in the mouth. (Avian diphtheria).

**Vaccination.** If the disease is detected early, all birds not already affected should be vaccinated. If the birds are in production many of them will be thrown into a molt. Much less damage will be done, however, than would be caused by the disease, and furthermore, the

setback is over within a month. *Where fowl pox is known to be prevalent in a community all susceptible birds should be vaccinated annually before they come into fall production.*

### Colds (Coryza) and Roup

The common cold (coryza) is a contagious disease, the exact cause of which is not definitely established. It involves an inflammation of the respiratory passages of the head, which results in watery eyes and a nasal discharge. Severe colds often develop into infectious roup. Colds are usually spread by carrier birds or by susceptible individuals coming in contact with houses or equipment previously occupied by infected birds. Individuals become more susceptible when they are low in vitality as a result of parasitic infestation, when the ration is deficient in vitamin A, or when the housing conditions are drafty, damp, or too stuffy.

Preventative measures include: (1) the housing of pullets separate from old hens, (2) thoroughly cleaning and disinfecting houses before the pullets are moved in, (3) good housing conditions—proper ventilation, freedom from drafts, and sudden changes in temperature, and (4) avoiding debilitating influences such as deficiencies in the ration and parasitic infestations.

There are two types of roup common in poultry, infectious and nutritional. Infectious roup usually follows an outbreak of colds and develops more rapidly if nutritional roup is a predisposing factor; it may be differentiated from the nutritional form by the presence of an offensive odor which is associated with the infectious type.

Treatment for infectious colds and roup consists in correcting the improper feeding and management practices, adding an abundance of vitamin A to the ration, isolation of infected birds, and the use of a mild laxative (see page 27). Ordinary soda may be given in the drinking water at the rate of one tablespoon to each gallon of water for 2 to 6 days as an alkalinizing agent.

Guaiacol is a standard drug used in the treatment of respiratory disturbances of all domestic animals. Guaiacol-iodine tablets may be used in the drinking water as a treatment for colds in poultry. The drug and directions for using it may be obtained from the local veterinarian.

In nutritional roup the accumulation in the eyes and side of the face is white, cheese-like and has no offensive odor. White pinhead-sized pustules are present in the throat. Upon opening the bird, urates in the form of a glistening powder-like deposit are found in the heart sac, on the liver, in the peritoneum cavity, in the kidneys and ureters. The most satisfactory sources of vitamin A to be used in the treatment and control of this form of roup are cod liver oil, alfalfa, and fresh green feed; other sources of this vitamin are yellow corn, green peas, and carrots.

### Contagious Bronchitis (Laryngotracheitis)

Contagious bronchitis (laryngotracheitis) is not generally present in the State of Idaho; therefore, every precaution should be observed to prevent its introduction. It is most often introduced by the addition of adult stock, and is an acutely contagious disease and spreads rapidly. The common symptoms are sneezing and gasping for breath. No ordinary treatments have been found to be satisfactory. Control consists of complete eradication through the elimination of all birds in houses where the disease exists, followed by thorough disinfection, or through vaccination of all susceptible birds. There must be absolute proof, however, that the disease is contagious bronchitis before birds are vaccinated since vaccination introduces the disease into the flock. It is unlawful to use live vaccines in Idaho without permission from the Director of Bureau of Animal Industry.

### Lice

Lice occasionally cause trouble on range but cause much more trouble in the laying house. A lousy bird cannot develop her maximum production. Several species of lice attack chickens. All are found to be permanently located on the body of the bird. Most often they are found in the vicinity of the fluff and vent. They can be satisfactorily controlled by applying a thin stream of "Blackleaf 40," a nicotine sulphate solution, to the roosts 15 minutes before the birds go to roost. The pens should *not* be closed tightly after this treatment or the birds may be overcome by the fumes. Birds may be treated with sodium fluoride or blue ointment for the control of lice.

### Mites

The common red poultry mite does considerable damage to birds in the laying house, causing loss in egg production and reduced vitality. This mite is found in the cracks and crevices around the roosts and occasionally in the nest boxes. It remains on the hen only long enough to feed. This usually occurs at night. This pest can best be controlled by thoroughly cleaning the house as described under *Cleaning the Poultry House*, and then painting the infested areas with pure carbolenium, crude creosote, or old crank case oil. Feather mites, scaly leg mites, and other mites attack chickens. A complete discussion of these pests is given in *U. S. Department of Agriculture Farmers' Bulletin No. 801, Lice and Mites of Poultry*.

### Cannibalism

Cannibalism in the laying flock is usually a carry-over of a habit that was developed during the brooding period. It is likely to develop among young chicks if they are allowed to become restless under congested conditions. Overcrowded, overheated houses, too close confinement of chicks to brooder house, lack of green feed, and an irregular feeding program are some of the more common causes. The first case starts accidentally in most instances during the stage that the main tail and wing feathers are soft and filled with blood at

the base; after blood is drawn the trouble spreads rapidly. It is suggested, therefore, that measures of control begin with the management of chicks during the brooding period.

Sometimes the trouble starts in the pullet flocks as the result of some bird accidentally picking and drawing blood on some of the exposed tissues such as the comb or vent, or from the quill of new feathers; occasional cases of "blowouts" (eversions of the oviduct) often starts a "pickout" siege.

Extreme difficulty is experienced in effectively controlling any form of cannibalism, especially pickouts, once the birds have developed the habit. Picked birds should be removed from the flock at once and treated by the application of some "no-pick" preparation. There are commercial preparations on the market, some of which are quite satisfactory. A common preparation called "scarlet balsam," which can be obtained from a local veterinarian, has been found to be effective. A simple preparation has been developed at this Station which has proved quite satisfactory. A small amount of iodine and any coal-tar disinfectant or Black Leaf 40 is thoroughly mixed into axle grease. Pullets should be moved into the laying house before they come into production and should be encouraged to lay in the nests. Feeding whole oats and meat meal in separate hoppers temporarily, in addition to the regular ration, will sometimes help to relieve the condition.

To prevent one bird picking another while laying, the platform is often removed from the lower tiers of nests. Various methods may be used for darkening the nests. In some instances nests are arranged so that the birds may enter them from the rear. Many victims of cannibalism are found to be birds that are weak or sick from some diseased condition; therefore, the removal of such individuals from the flock will aid in controlling this trouble. Real control consists of prevention by correct management practices through the brooding, growing, and laying period.

### Cleaning the Poultry House

Every poultry house should receive at least one annual thorough cleaning. The thorough cleaning of a poultry house includes: (1) the elimination of all dirt; (2) the disinfection of the house; and (3) the application of materials for ridding it of insect pests; particularly mites. The most logical time to do this job is during the summer or early fall while the house is vacant. If this is done, the brooder houses will be clean and dry any time that baby chicks arrive. The laying pens should be cleaned as soon as they are empty so that they will be clean and dry any time that pullets are ready to be housed or that old hens are ready to be shifted.

The program here described for cleaning the poultry house is adequate for the elimination of disease germs or organisms that are responsible for pullorum disease, tuberculosis, fowl pox, colds, coccidiosis, worms, and in all probability paralysis as well. One should not abandon a house because it has harbored diseased birds,

for it may be cleaned. It is *impossible*, however, to thoroughly clean a house with a *dirt floor*. Board or cement floors are essential for cleanliness.

**Removing dirt.** All movable equipment and any dilapidated or poorly constructed fixture first should be moved from the house. All the loose dirt, dust, and litter then should be removed. It will be necessary to scrape the dropping boards and portions of the floor. The floors, dropping boards, and side walls, should then be scrubbed with boiling-hot lye water, using *one pound of lye to 15 gallons of water*. An old broom is ideal for the purpose. The lye not only cuts the dirt but it is also a good disinfectant. It may be necessary in some instances to *soak the dirtiest portions* for some time in order to loosen the dirt. After the dirt is loose the house should be flushed out with clean water. This is best accomplished by hosing it out where water pressure is available. The ceiling and side walls can be hosed down at the same time.

**Disinfecting the House.** After the house has been allowed to dry it must be thoroughly sprayed with a good disinfectant such as a 5 per cent solution of cresol (1 pint to  $2\frac{1}{2}$  gallons of water) or one of the standard coal-tar dip solutions. The phenol coefficient of any of the dip solutions used should be known and the price paid for such product should be regulated accordingly. The use of bichloride of mercury or the chlorine disinfectants is not recommended for this purpose, since they rapidly deteriorate when they are in contact with organic matter. Furthermore, bichloride of mercury is very poisonous. Water-slaked lime used on the dropping boards or as white wash on the walls is a good disinfectant. It also makes the house much lighter. Further information concerning disinfectants may be obtained from Farmers' Bulletin No. 926, U. S. Department of Agriculture, *Some Common Disinfectants*.

**Special House Cleaning Features.** Where red chicken mites have been prevalent the roosts, dropping boards, and nests should be painted with pure carbolenium or creosote. Where carbolenium is not available, old crank case oil may be used for this purpose. All equipment that is to be replaced in the house should receive the same thorough cleaning that the house received. As soon as the house dries it is ready for occupancy. This cleaning procedure may be supplemented with the use of disinfectants specific for worm eggs and coccidia, such as iodine suspensoid, or by use of the fire gun, an instrument in the nature of a large blow torch, used to apply heat for the destruction of worm eggs, coccidia, or other parasitic or infectious agencies. The fire gun may also be used to dry the floors of the brooder house during the brooding period. Precautionary measures for the prevention of fire should be amply considered where this instrument is used.

**Whitewash Formula.** Lime which has been previously slaked is mixed with salt and skim milk. The proportions are 4 to 5 gallons of milk and 2 to 3 pounds of salt for a half bushel of quick lime or



50 pounds of hydrated lime. The mixture should be thinned to the desired consistency and, if applied with a sprayer, it should be strained. One pound of glue to the above mixture will cause the whitewash to stick better and last longer. When lime is slaked and allowed to ripen for a week or more much of the lumpiness, common in freshly slaked lime, disappears. Other formulas for making whitewash will be found in U. S. Department of Agriculture Farmers' Bulletin No. 1452, *Painting on the Farm* and No. 1554, *Poultry Houses and Fixtures*.

### Poultry Laxatives

The most common laxative for chicks during the brooding period is the addition of an abundance of milk to the diet for a period of two or three days. It is best added in the form of powdered milk. The mash should contain 20 per cent dried milk and the grain should be eliminated during the period of treatment. Fairly satisfactory results can also be obtained by the use of skim milk or buttermilk as the sole drink for a similar period.

For older birds; that is, birds on range and in the laying flock, epsom salts is usually satisfactory as a laxative. It is used at the rate of 1 pound to each 500 pounds of chickens or for hens at the rate of  $\frac{3}{4}$  pound to each 100 hens. It should be given in the morning in the amount of drinking water that will be consumed during the forenoon. The flock should then be supplied with plenty of fresh clean drinking water.

In the case of laying stock, there are certain occasions when it is desirable to extend the laxative effect for a period of three to five days. This can be accomplished by following the epsom salts with a milk flush mash as described heretofore. During the treatment the scratch should be restricted to a light feed at night.