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BROODING AND PULLET DEVELOPMENT



PREN MOORE and M. R. LEWIS

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THE brooder house should be in order and well heated before the chicks are received.

The drink for baby chicks should be warm to prevent chilling. This precaution especially is necessary for chicks that have been shipped any distance. They may be thirsty on arrival, drink too much and become chilled.

Nature has provided the yolk of the egg as the first feed for chicks. Feeding too soon may interfere with nature's plan.

Wet or sloppy feed should not be fed to chicks. It is likely to cause bowel trouble.

Feed often but sparingly at first. A full feed at night is necessary. Feed early in the morning and late at night.

Yellow corn has the greatest feeding value for growing poultry of any of the grain feeds.

Sour skimmilk or butter-milk is an ideal poultry feed. It may prevent many outbreaks of disease and may even cure some. For best results, sour milk is indispensable in poultry rations.

Get the chicks on the ground as soon as possible. The ground should be sodded with lawn grass.

Separate cockerels from the pullets as early as it is possible to determine sex. By so doing, congestion and overcrowding will be relieved.

Get pullets on the range early. A meadow by the side of a corn field is an ideal summer range for pullets.

Keep the pullets growing from the time they are hatched until they are grown.

Poultrymen must learn to be good feeders. Anticipate the needs of the fowls and feed accordingly.

Move pullets to the laying house when they are well developed and in a high state of flesh.

Control diseases insofar as possible thru sanitary measures.

Use plenty of green feed. Cod liver oil is a good substitute for green feed.

Brooder houses and brooder house yards should be used for no other poultry purpose than to brood chicks.

Soil contamination is the cause of many diseases and disorders in poultry.

Worms cost the poultry industry great sums. They should be controlled.

Lice and mites are constant enemies. Treat as recommended.

A practice that has proved successful should not be discarded until a better one is known.

*Brooding and Pullet Development

By PREN MOORE and M. R. LEWIS

Bringing pullets to maturity in a state of development which will make maximum egg production possible involves the greatest problem of the poultry industry. A well developed pullet is one which has strong, regularly formed bones, plenty of muscle, large digestive capacity and veins well filled with rich blood.

The best feeding will not make pullets yield profit if they have not been well grown. In order that the most satisfactory results may be obtained, it is important to understand the factors involved. The most important are: (1) Breeding, (2) Condition of breeding stock, (3) Brooding, (4) Range, (5) Feeding, (6) Sanitation, (7) Disease, (8) Nutrition. Each factor has an influence in the development of chicks which determines the extent to which mature stock may or may not be profitable. The problems of feeding and winter egg production are fewer with pullets that have been well grown than with weak and poorly developed ones. Well developed pullets feed better and thus take on flesh more readily. They are less susceptible to colds, roup and other diseases. Egg production is not a difficult problem with pullets that are well developed.

This circular deals primarily with the problems involved in raising good pullets. However, selection and physical condition of breeding stock are limiting factors which determine to a marked extent the possibility of developing chicks into useful stock. Immature and physically weak stock should not be used for breeding purposes. Stock from which eggs are to be used for hatching should have a long rest period and be well fleshed in advance of the breeding season.

TYPES OF BROODER HOUSES

Plans for a colony brooder house and a two-room brooder house are shown in University of Idaho Extension Bulletin No. 42, entitled "Housing Farm Poultry." The colony brooder system is ideal for broods of not more than 400 chicks. This type of house is portable, which is quite an

*This bulletin was written by Pren Moore, Poultry Husbandman of the Extension Service, and M. R. Lewis, Professor of Agricultural Engineering in the College of Agriculture and Irrigationist of the Experiment Station. The original drawings for the illustrations were made by M. R. Lewis, also the lists of material and specifications.
The subject matter was written by Pren Moore.

advantage under conditions where frequent moving is necessary on account of soil contamination or for some other reason of economic importance. The two-room brooder house will accommodate 1500 or more chicks in one brood. The large brooder house is more economical where many chicks are being brooded, and under proper sanitary conditions is as efficient as the colony system.

The system, a plan of which is contained in this bulletin, is known as the "Furnace System of Brooding." Several poultrymen in Idaho have been using this system for a number of years and they recommend it highly. The furnace system of brooding is increasing in popularity in southern Idaho; so much that many new ones will be built this year. Superior features claimed by users for this system of brooding are that the building is inexpensive, the heating unit is simple and cheap to construct, the heating cost is light, the heat is dependable, there is no ventilation problem, and the plan of brooding is less complicated and more efficient than the stove heated houses. People who have used most brooding systems claim that the furnace type is superior in every way to all others. It is claimed that chicks have less tendency to crowd in the furnace heated brooder house than they do when heated by stoves. The capacity of the house as planned is 1,000 or more chicks.

Either coal or wood may be used as fuel, but wood appears to be the most satisfactory. Apple tree roots, slab wood or some inferior wood may be used. When starting the fire, drop a piece of burlap that has been saturated with kerosene into the chimney, place one in the furnace and light both as nearly at the same time as possible. This will warm the chimney quickly and develop a satisfactory draft. About three days are required to heat the floor properly. When once the floor is heated, the cooling process is very slow. The floor should be covered with clean sand to a depth of about four inches. Dirt floors become very dusty. If clean sand is not available, floors should be made of concrete.

An advantage of the furnace system of brooding is that the house may be moved from place to place on the farm. The heating unit can be torn up and moved at no cost other than a little labor. The house may be opened during summer and used as a range house. If it is used for this purpose after the chicks are ready to leave the heat, it should be located near the corn field or on some land where shade, green feed and, if possible, water will be available. The house may be equipped with removable perches, to be placed for the accommodation of the pullets when they are ready

to go on the perch. The "Open Type Range Colony House" is recommended in preference to the use of brooder houses when the pullets are on summer range.

YARDS

When brooder houses are located with a view to permanency, a plot of land from half an acre to an acre, preferably the latter, is necessary as a brooder yard. Make the land as smooth as if intended for a lawn. The leveling is necessary to make possible satisfactory irrigation. Seed the land to white clover. Each year after the chicks have been removed to the range the bare spots must be reseeded. Fence the brooder house yard with poultry wire netting. The yard must be used for no other poultry purpose than the one for which it is intended. If the colony system of brooding is used, it is necessary to move the houses to new land each year.

RECEIVING THE CHICKS IN BROODER HOUSE

The brooder house should be well heated before the chicks are placed in it. It is essential, therefore, to start the heat three or four days before the chicks are received. The proper temperature in the warm room of the two-room brooder house is 98° to 100° F. The human body makes a good thermometer. If the room is a little more than comfortably warm, it is about right for chicks. Heat a strip of floor about four feet wide thru the length of the furnace heated house until it feels quite warm to the hand, yet not hot. Place the hovers over the warm surface. Cover the floor with a layer of clean sand. Provide some clean litter. Lawn clippings or alfalfa leaves are good. A depth of about half an inch of litter is sufficient. Equip the brooder houses with dark curtains. It is usually necessary to darken the room, at least to some extent, for the first week or ten days of the brooding period.

Use utmost precaution when handling chicks to prevent chilling. Chicks that have chilled are difficult to raise. If chicks are hatched on the farm where they are to be brooded, move them from the incubator to the brooder in lined containers. A clothes basket lined with a blanket is good. Fold the blanket over the chicks when the basket is filled and ready to move. Cover chicks that have come from a distance to protect them from the cold and wind while on the road between the railroad station and the brooder house. Place the chicks in the brooder house, draw the dark curtain and leave them to rest for a few hours.

FIRST FEED

Nature has provided the yolk of the egg as nourishment for the first seventy to eighty hours of the chicks' life. Any attempt to feed before the yolk has been absorbed is an interference with nature's plan. It is not safe, therefore, to do much feeding until the chicks are from sixty-five to seventy-five hours old. If chicks have been shipped from a distance, it is probable that they are old enough when received to be given a light feed. After they have had a few hours' rest, it is well to raise the dark shade and allow them to drink sour milk. Feed the milk warm. If water is the drink, feed it warm also. At the same time they may have a small portion of grain. Feed chicks that have been hatched on the farm where they are to be brooded, sour milk after the first full day in the brooder house. Raise the curtain five times during the day for a period of about one-half hour to permit the chicks to drink. This practice may be continued until the chicks are from sixty-five to seventy-five hours old, when they may have some concentrated feed.

The temptation to feed too soon must be controlled. Plenty of sour milk or butter-milk, as has already been suggested, is sufficient for the first sixty-five to seventy-five hours and is a safe feeding practice. A good first feed is breakfast rolled oats or hull-less oats. Raise the dark curtain in the morning of the first feeding day or when the chicks are from sixty-five to seventy-five hours old and give them a light feed. The amount to feed is what they will consume in about fifteen minutes. Raise the curtain for about half an hour so that the chicks may have time to drink. Place the feed on paper pie plates or cardboard or some smooth surface. After the chicks have eaten the feed, remove the platters. Feed five times during the day. Avoid overfeeding. The last feed in the evening, however, must be sufficient to produce contentment. Continue to feed five times each day for about two weeks. Increase the amount of feed each day, being careful to avoid overfeeding at any time. Keep chicks eager for each feed. Spend sufficient time at the last feeding to insure that they go to roost with a full crop.

After the second feeding day, add some whole wheat or cracked yellow corn to the grain ration. The more liberally yellow corn is included in the ration for chicks, the more likely they are to develop satisfactorily. Continue to increase the corn and wheat until the ratio is equal parts of cracked corn, wheat and hull-less oats. If hull-less oats are not available it may be desirable to make corn and wheat

the entire scratch ration after the first two weeks as rolled oats may be too expensive to continue in the ration.

Begin feeding mash when the chicks are about ten days old. Set the hopper before them for about half an hour the first day. Each day increase the time that the mash is left before them until the fifteenth to eighteenth day, when it may become a continuous feed.

When the chicks are two and a half weeks old, grain may be fed four times each day. From this time on, the feeding times each day may be reduced, until when they are four weeks old two grain feedings a day are sufficient.

Feed a little chick-sized charcoal from the beginning. At first, feed the charcoal in the litter and in the grain mixture. When the mash feeding starts, include the charcoal in the mash formula. Use plenty of green feed from the beginning. Slawed cabbage, lawn clippings, dandelion or lettuce make good green feed for chicks. Cod liver oil is a good substitute for green feed. It is more dependable of supply and is a good insurance against leg weakness and other chick ailments which usually result on account of insufficient green feed. Cod liver oil is fed in the scratch feed. Mix one pint of cod liver oil with each 100 pounds of scratch feed. Mix thoroly so that the oil will be evenly distributed. Two or three weeks' supply is as much as should be mixed at one time.

GET CHICKS ON GROUND EARLY

Get chicks on the ground by the time they are one week old. Drive them out and then into the house several times for the first few days. Driving them back and forth teaches them the habit of going in and out. It may be necessary to drive the chicks back into the house immediately after they have been driven out, if the weather is inclement. Do not leave them out until they chill. Drive them out, however, even tho the weather may be unfavorable. If the room is comfortable, they will not stay out in the cold to chill.

FEEDING SCHEDULE

First Week: On the second day, give sour skimmilk or butter-milk and charcoal. When sixty-five to seventy-five hours old, feed sour skimmilk or butter-milk, breakfast rolled oats or hull-less oats, charcoal and green feed. Add some whole wheat and cracked yellow corn to the oats after the second feeding day. Feed milk, charcoal and green feed same as before. Give hearty feed at night.

Second Week: Increase corn and wheat in scratch feed. Prepare mash as follows: 10 pounds bran; 5 pounds corn meal; 5 pounds oat flour (whole oats ground fine); $\frac{1}{2}$ pound powdered charcoal; 1 pound granulated bone. On the third day of the week set the mash hopper before the chicks for about half an hour. Each day increase the mash feeding time until the fourth or fifth day of the third week when the mash may be fed continuously. Feed grain five times each day as formerly with a hearty feed at night. Feed milk, charcoal and green feed as before. Get chicks out on the ground for a short period each day. If weather is good, they may be left out of doors for an hour or more during the warm part of the day.

Third Week: Prepare scratch feed of equal parts of hull-less oats, cracked corn and whole wheat. Mash is the same as for second week. On the third or fourth day of the third week, feed scratch four times each day. Give a liberal feed of scratch at night. Feed milk and green feed as formerly.

Fourth Week: Use same feed formula as for third week. Toward the end of this week, the scratch feeding periods may be gradually reduced, beginning on the fourth week with two feeds each day. Heavy feeding of scratch at night should be continued thruout the growing period.

If hull-less oats are not available, the breakfast rolled oats may be omitted from the scratch feed beginning any time during the third week. The formula in this event may consist of equal parts cracked corn and whole wheat. Add a little whole corn to the scratch during the fourth week and gradually reduce the cracked corn. Teach the chicks to eat whole corn as early as possible. If skim milk or buttermilk are not available, wet curd may be used as a substitute. Some of the creameries of southern Idaho are now in a position to supply poultrymen with wet curd. If neither the milk nor wet curd are available, it is necessary to make mash formulas containing meat or fish meal. Mash formulas containing meat, where milk or curd are not available, are as follows: second, third and fourth week: 10 pounds bran; 5 pounds corn meal; 5 pounds oat flour (whole oats ground fine); 1 pound meat or fish meal; 1 pound granulated bone meal, and $\frac{1}{2}$ pound charcoal. Developing mash beginning with fifth week as follows: 10 pounds bran; 5 pounds corn meal; 5 pounds oat flour; 2 pounds meat or fish meal; 1 pound granulated bone meal, and $\frac{1}{2}$ pound charcoal.

The formulas herein contained may be varied to suit local conditions. However, corn is necessary for best results and the corn should be the yellow variety. If sour milk is fed thru the growing period better pullets will result.

Some poultrymen feed whole wheat from the start. Some feed no whole or cracked grain. A mash consisting of 80 pounds yellow corn meal; 5 pounds meat or fish meal; 10 pounds bran, and 5 pounds granulated bone meal is being fed by some poultrymen in Idaho with good success. The mash is fed on about the same schedule as outlined in this bulletin, beginning with the first week. No coarse grain is fed thruout the growing period.

REMOVE COCKERELS EARLY

Cockerels should be separated from the pullets as soon as it is possible to determine sex. Pullets will grow and develop better when not annoyed by cockerels. Chicks soon outgrow their quarters and removing the cockerels relieves congestion.

Fatten cockerels and sell them as early as possible. When they weigh about $1\frac{1}{4}$ to $1\frac{1}{2}$ pounds, confine them on a fattening ration. A good fattening ration is 60 pounds yellow corn meal, 20 pounds oat flour and 20 pounds low grade flour. Mix with sour skimmilk or butter-milk to a batter of about the consistency of thick cream. Feed the cockerels all they will eat in three feeds each day. Give some oyster shell and charcoal. Ten to fourteen days are required to finish them for the market after they are placed on forced feed.

GET THE PULLETS ON RANGE EARLY

The date of hatch and the season will determine the age when pullets must be put on the range. The date when chicks should be hatched must be determined by the experience of the poultryman. April is the best date for the person with limited experience. The more experienced may hatch earlier. February is a good hatching date for the expert.

The weather is sufficiently settled by June first in most sections to permit placing pullets on the range with perfect safety. The "open type range colony house," which is illustrated in this bulletin, is especially suitable. It is open, thus admitting fresh air. These houses are intended to accommodate 100 pullets. Crowding must be avoided.

A corn field with a meadow adjoining is ideal for pullet range. Space the houses along the meadow near the corn field, about 100 feet apart. When the pullets are taken to the range, confine them to the house for two days. Late in the evening of the second day, open the doors of the houses and permit the pullets to go outside. Scatter some feed

near the doors so that the pullets may eat and become contented. As night comes on they will go back into the house and to roost. There is not likely to be much trouble from their mixing if they get started out right when first placed on the range.

Provide one field mash hopper for each two houses. A portable granary which will hold about one load of scratch feed is a convenience and a time saver. Keep the hoppers filled with mash and feed grain in the evening. The evening feed had best be in sufficient quantity so that pullets may fill to capacity and leave some for morning. If this feeding practice is followed, one grain feeding each day is sufficient. Clean water must be provided. An irrigation ditch is ideal. Scatter oyster shell in several places on the ground convenient for all pullets.

The same feed formula as outlined for development is suitable for pullets on the range. It is a decided feeding advantage, however, to increase the yellow corn. If there are plenty of grasshoppers, crickets or other bugs or worms on the range, meat meal or fish meal or milk will not be necessary in the ration. Feed requirements may be determined from the development of the pullets. Chicks should grow continuously from the time they are hatched until they reach maturity. However, they should not develop abnormally. By abnormal development is meant that they come into production too young. Leghorn pullets which reach maturity at from five to six months of age are best. Larger breeds should mature at correspondingly advanced ages. Full developed means full grown, yet not laying. The poultrymen's problem is to watch development and feed accordingly. The poultryman must be a good feeder. A good feeder is one who understands the needs of his stock and feeds accordingly.

Pullets may start laying too early. This inclination must be retarded if possible until the pullets have reached the age when they should start to lay. This is done by feeding for flesh. Do not retard growth. Increase the corn in the ration and feed for flesh. Make the pullets as fat as possible while they are yet on the range. It may be necessary to increase the corn to the extent of an almost entire ration to accomplish the desired results. Continue to feed mash. Corn meal, however, may constitute as much as 80 per cent of the mash during the finishing period. Eighty pounds corn meal, 10 pounds oat flour and 10 pounds bran make a good finishing mash. When the pullets are fat, they are ready to go into laying quarters. Pullets that have been well finished while on the range are ready for the laying

mash as soon as they are put into their winter quarters. Forcing mashes must be fed with caution. If the pullets show a tendency toward a too rapid increase in production, increase the volume of corn meal in the mash.

DISEASE

Most of the diseases common to chicks can be avoided by proper sanitary measures. Feeding also has an influence. There are, however, outbreaks that appear unavoidable.

Coccidiosis: Coccidiosis is an infectious disease caused by the presence of minute parasites in the intestines. It usually occurs in chicks from four to eight weeks old, altho it may occur at an earlier age. Symptoms are paleness of the skin and head and ruffled feathers. The sick birds have a tendency to separate themselves from the rest of the flock and stand "humped up" with their eyes closed for hours at a time. The chicks may have done well up to the time when the outbreak of the disease became noticeable.

The disease is spread thru water, contaminated feed or droppings of diseased birds. Contamination about brooder houses and yards is more prevalent during damp, cool weather. It is aggravated by a damp, cool condition within the brooder house.

Control: Dr. J. R. Beach and S. B. Freeborn of the University of California give the following as a preventative and cure for Coccidiosis:

"The method of feeding to prevent the occurrence of the disease consists in keeping sour milk or butter-milk constantly before the birds from the time they are put in the brooder, and feeding sparingly of grain and mash. If the amount of grain and mash fed is not restricted, Coccidiosis is liable to develop, even tho sour milk is fed all the time.

"To control outbreaks of the disease no mash and very little grain should be fed. The bulk of the grain should be given at night so that the chicks will have a fairly full crop when they go to bed. A small amount of grain may be fed in the morning, but the greater part of the food in the day-time should consist of sour milk or butter-milk which is kept before them constantly. The houses should be very thoroly cleaned and covered with a thin layer of chopped straw or shavings litter. Feeding large amounts of sour milk will cause the droppings to become very profuse and watery. To keep the floor clean and dry, the litter must be renewed daily. Abundant warmth should be maintained both under the hover and in the brooder rooms.

"This feeding method should be continued until losses stop and the general condition of the flock has improved. This usually will not require more than a week or ten days. After this time, the mash may be again fed, but the amount should be small and increased very gradually. Altho no experiments have been made, it is thought that some of the better varieties of sour milk substitutes, such as semi-solid butter-milk, will give as good results as butter-milk. Other remedies which have been recommended are hydrochloric acid, one teaspoonful to one quart of water; potassium bichromate, 1 to 5,000 solution, and crude catechu, 1 to 4,000 solution. The solutions of the above chemicals are substituted for the drinking water. If any of these are used, the amount of mash fed should be reduced."

This treatment has been tried in Idaho and has produced the results claimed for it.

White Diarrhea: White diarrhea may be caused by a bacterium. In fact, many flocks are so infected. This disease is one that should be watched and kept under control. However, most of the so-called white diarrhea is the result of three easily preventable causes: (1) Chilling, (2) Overheating, and (3) Feeding too soon and feeding improperly. Chilling is the most common cause, which argues for proper and constant heating of brooder houses.

Leg Weakness: Leg weakness is supposed to be caused by improper feeding. Chicks may be fed too much, the ration may be deficient in minerals or lacking in fiber. Lack of exercise is thought to be a cause for leg weakness. Liberal use of yards, green feed and feeds containing sufficient bone building minerals is a safeguard against leg weakness. Large yards with a good growth of lawn grass will provide green feed. If the formula contains plenty of bone meal and oyster shell and the chicks have sour milk to drink and there is ample exercise on green yards, there is not likely to be much trouble from leg weakness. Cod liver oil should be fed to chicks from the time they begin to eat grain. Indications are that it is a good feeding practice to include cod liver oil in the ration for chicks, even when green feed is available.

Sanitation: Prevention is the safest cure for most diseases. Proper sanitation is generally reliable as a preventative measure. Keep brooder houses well lighted and clean. Fence brooder house yards with poultry wire and sod them with lawn grass. Range pullets on fresh land each year. Plenty of fresh air and sunlight are beneficial.

Worms: Worms are causes of untold losses to the poultry industry. Round worms and tape worms appear to be the

most prevalent and the most destructive. Soil contamination is the common source of infestation. However, worms often become a menace under conditions which appear to be ideal. It is apparent, therefore, that every possible precautionary measure is necessary to prevent infestation. Pullets should be treated for worms when they are put in the laying house.

Treatment: Turpentine Treatment for Pin or Round Worms: Mix one-half pint of turpentine with 15 quarts of wheat for each 500 hens. Do the mixing in a metal vessel or on a concrete floor. Keep the poultry off feed from noon one day to the next morning. After the first treatment miss two days and repeat, then miss 10 days and repeat, then miss 14 days and repeat.

The morning following the second treatment, administer a dose of Epsom salts: one pound to each 100 hens. Dissolve the salts in about the amount of water the fowls will drink by 10 or 11 o'clock in the morning. Follow each succeeding treatment with salts in the amount as suggested for 100 hens. Should the number of hens be more or less than 500, have the doses graduated by a druggist. A little more or less would make no material difference, especially if fed to stock out of production.

Tapeworm: Cook a mash consisting of one gallon of wheat (for 150 fowls) with two small tablespoonsful of concentrated lye. After a fast of 15 hours, the cooled mash is fed to the fowls and they are allowed to eat as much as they care to with plenty of water to drink. Should it appear necessary, the dose may be repeated in 48 hours.

It is difficult to say just how much of a dose should be given to young stock. It is safe, however, to mix on the basis suggested, to permit the young stock to eat all they want in the morning, and then to repeat as suggested for old stock.

A good plan in feeding the mixtures is to lay enough boards on the floor so that all of the stock can eat at the same time and to spread the wheat on the boards.

It is not safe to treat hens in high production during winter months. Treat hens for worms during winter months only when it appears to be absolutely necessary. The better plan is to treat for worms early in the fall and before cool weather comes on and at the time when the stock is being moved into winter quarters.

Lice and Mites: Lice and mites are a constant menace to poultry and they should be kept under strict control. Treat pullets for lice at the time they are put in the laying house. Treat the brooder house each season.

Blue Ointment Treatment for Chicken Lice: To one part of blue ointment (30% to 33% mercury) add one and one-half to two parts of Crisco, or some other of the cotton seed oil products, such as Snow Drift. Do not use lard. Place the blue ointment in a warm room or in some place where it will soften to about the consistency of the Crisco. Care should be taken that it does not melt. Spread the Crisco on a smooth surface, such as tin or oiled paper, with a putty knife or some similar instrument. Spread the blue ointment over the Crisco and mix thoroly. The ointment is then ready for use.

Apply an amount about the size of a pea to the vent. Do not smear in the feathers but apply to the flesh. Part the feathers just back of the comb and apply about the same amount to this section of the body. Be sure to get the ointment on the flesh. For the first treatment, should the hens be quite lousy, it may be advisable to treat on the bare spots under the wings. Ordinarily, this would not be necessary. Apply the treatment every four months regularly, whether the hens are lousy or not, and there will be no lice.

The amount necessary for one hen is sufficient for twelve or more chicks. The ointment should be applied to the chicks in the morning. A bright, sunny day is best. Chicks should never be treated in the evening. The best time for treating old stock is after dark. Brooder chicks should not require louse treatment before time to move them into winter quarters.

Treatment for Mites: Clean droppings boards thoroly. Spray or paint with some coal tar preparation, such as Kreso, Carsol Dip, Zenolium or crude carbolic acid. If spraying is employed, use a 2 per cent solution and spray thoroly. Paint the perches and droppings boards and the wall in the roosting chamber as high on the walls as will be touched by the hens. Two or three treatments each season by this method usually are sufficient. Apply the first treatment early in the season, the first warm day of spring. Keep the mites out of the place where hens roost. Do not permit them to get a start and the mite situation is easily handled.

For painting, mix kerosene and some coal tar preparation, equal parts, and mix thoroly. Apply with a paint brush and fill cracks thoroly. Some people use the oil from the automobile crank case, sometimes mixing it with kerosene and at other times mixing with a coal tar preparation. Some spread the oil on the perches just as it comes from the crank case. Many orchardists spray the hen houses with the

orchard sprays and results appear to be satisfactory. They spray the hen house with the same spray and with the same machinery they use for spraying the orchard.

FURNACE TYPE BROODER HOUSE

Construction: At the location selected for the brooder house dig the hole for the furnace and the trench for the flue. The hole for the furnace will be twenty-four inches by thirty-eight inches and thirty-two inches deep.

The trench for the flue is fourteen inches deep at the furnace and eight inches deep at the other end of the building. The furnace is built of common brick without mortar. The bottom is two inches thick and the walls are four inches thick. The walls are carried up to the level of the floor and earth is carefully banked around them above the ground surface so as to prevent escape of sparks. A steel plate with a segment draft control for regulating the fire fits over the top of the furnace and completes it. The flue under the brooder room may be made of eight-inch clay sewer or drain tile, as shown on the plans, or of brick. A single row of bricks laid crosswise will make the bottom and top. The sides will be four inches thick and three bricks high. In this way a flue six inches square inside is built. No mortar is used either in the furnace or flue in order that both may be taken up and relaid in a new location if necessary. The chimney at the end of the building may be made of sewer pipe or of brick laid up in mortar. The former will be much quicker to erect and if cull pipes can be obtained, will be very economical.

When the furnace and flue have been finished the long skids are placed. These skids may be poles hewed flat on top or two eighteen-foot six-inch by six-inch timbers spliced together with two-inch scabs on each side. After the skids are in place and before the building is erected it is best to put in the sand floor. This consists of four inches of clean fine sand. A concrete floor may be built but sand is cheaper and will permit moving the building. Either sand or concrete should be used to avoid the danger from dust. When the sand is placed the flue will be covered to a depth of ten inches next to the furnace and four inches at the other end. This difference provides some slope to aid in starting the fire and also makes the heat under the hovers more uniform since the flue is hotter next the furnace.

The skids are then braced by four-by-fours laid across each end and bolted down. These braces are set thirty-four feet apart, center to center. The two-inch by six-inch floor joists for the fuel and feed room are then set and a header

spiked in on each side of the furnace. Two-inch by four-inch studs on two-foot centers are then nailed on each skid and on the four-inch by four-inch brace at the back. The floor is laid and the studding on each side of the fuel room set on it, proper space for the doors being allowed. The plates and rafters are placed and the roof laid. The siding is put on and the doors, windows and muslin frames placed. As soon as the chimney is built the brooder house is ready for use.

All dimensions are shown on the plans and the bill of material includes all necessary materials, but does not allow for any waste.

All the materials except the cover for the furnace may be obtained from local dealers. The flat steel sheet with draft regulator and ring will cost about six dollars and may be obtained from the iron works or machine shops in many of the larger cities of the state. For about fifteen dollars a steel angle frame to fit the top of the furnace having the steel door hinged to it may be built at most machine shops.

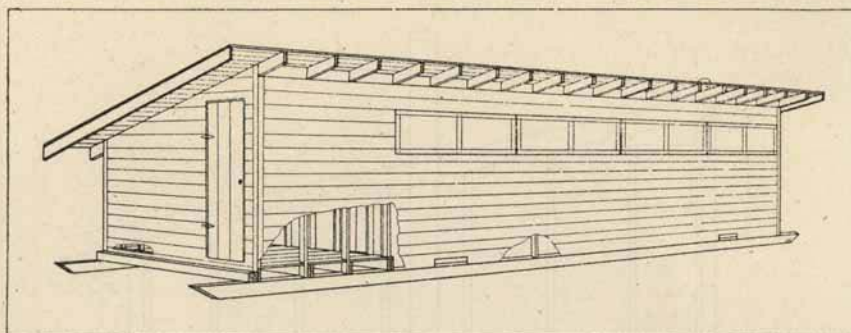


Fig. 1. Perspective of Brooder House

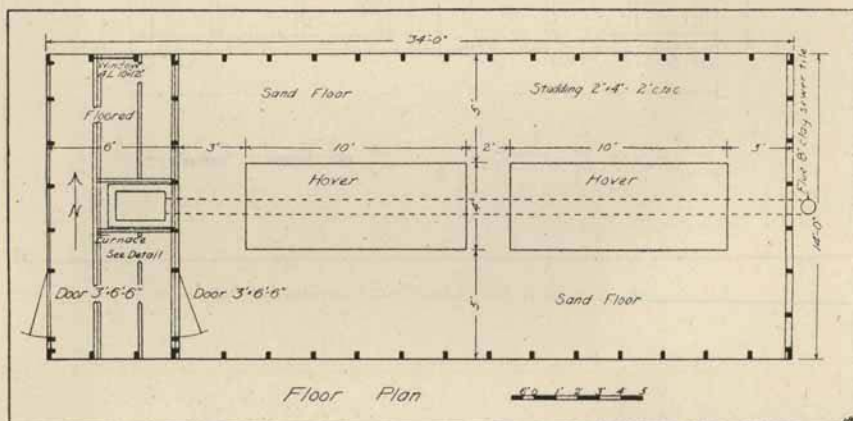


Fig. 2. Floor Plan of Brooder House

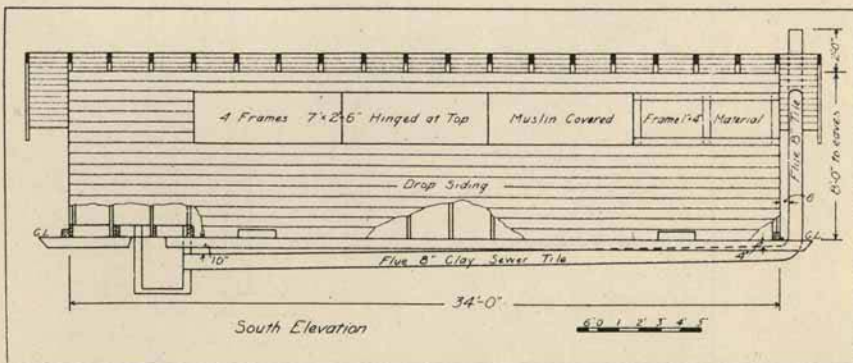


Fig. 3. Side Elevation of Brooder House

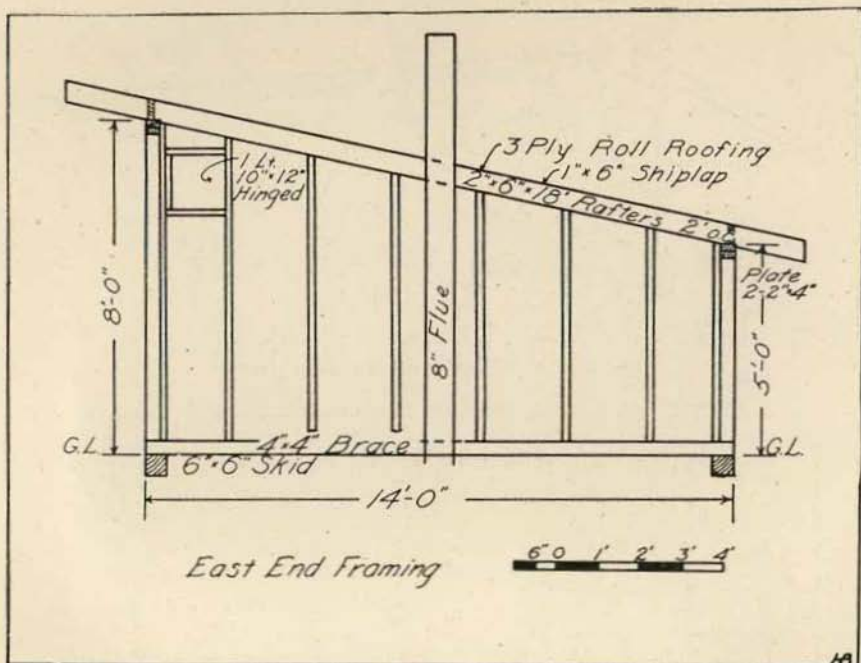


Fig. 4. End Elevation of Brooder House

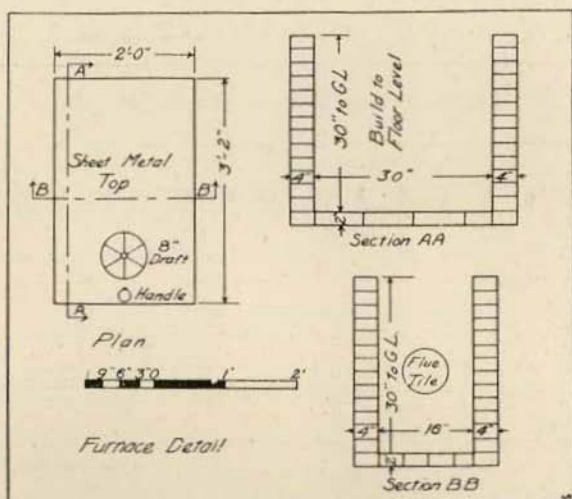


Fig. 5. Furnace Detail

LIST OF MATERIAL FOR BROODER HOUSE

Detail of Framing Material

No. of Pieces	Size	—Length—		Use
		As Used	As Bought	
4	6x6	18	18	Skids
2	4x4	14	14	Cross braces
6	2x6	14	14	Floor joists
2	2x6	4	8	Header
23	2x4	7 ft. 8 in.	16	} Studs
21	2x4	4 ft. 8 in.	14	
1	2x4	7 ft. 2 in.		
3	2x4	6 ft. 9 in.	14	
3	2x4	6 ft. 3 in.		
3	2x4	6 ft.		
3	2x4	5 ft. 5 in.	12	
3	2x4	5 ft. 1 in.		
8	2x4	14	14	} Plates
4	2x4	6	12	
18	2x6	18	18	Rafters
1	2x4		16	Door and Window Frames

Summary of Above

No. of Pieces	Size	Length	Ft. Board Measure
4	6x6	18	216
2	4x4	14	37
18	2x6	18	324
6	2x6	14	84
1	2x6	8	8
13	2x4	16	139
18	2x4	14	168
7	2x4	12	56
Dimension stuff			1032
14	1x12	12 No. 1 common	168
2	1x6	18 No. 1 common	18
	1x6	Drop siding No. 3 clear	700
	1x8	Shiplap No. 1 common (roof and partition)	900
	1x6	No. 1 common (eave stop)	34
	1x4	No. 3 clear (curtain and door frames and trim)	68
		80 linear feet 1/4 in. by 1 in. strip	7
Total lumber			2924

- 7 rolls 3-ply roofing.
- 300 bricks 2 in. by 4 in. by 8 in.
- 38 linear feet 8-in. sewer tile.
- 1 90 degree bend 8-in. sewer tile.
- 1 Steel sheet with 8-in. segment draft regulator and ring handle $\frac{1}{8}$ in. by 24 in. by 38 in.
- 1 4-lt. 10x12 sash.
- 1 1-lt. 10x12 sash.
- 2 prs. 3-in. strap hinges.
- 6 prs. 3-in. steel butts.
- 6 sets 3-inch gate hooks and eyes.
- 2 rim lock sets.
- 15 lbs. 16d nails.
- 30 lbs. 8d nails.
- 1 lb. 3d nails.
- 10 yds. unbleached muslin 24 in. wide.

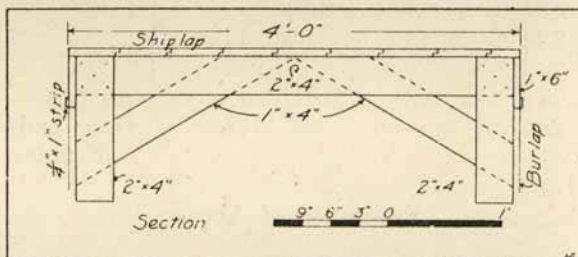
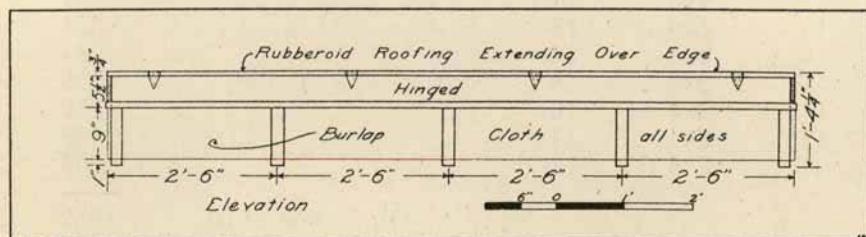


Fig. 6. Section of Hover



Detail of Hover

Fig. 7. Elevation of Hover

LIST OF MATERIAL FOR HOVERS

No. of Pieces	Size	Length	
5	2x4	14	No. 1 Common
4	1x4	12	No. 1 Common
4	1x6	10	No. 1 Common
2	1x6	8	No. 1 Common
14	1x8	10	Shiplap No. 1 Common

- 56 linear feet $\frac{1}{4}$ in. by 1 in. strip.
- 1 roll 3-ply roofing.
- 19 yds. burlap 10 in. wide.
- 8 prs. 4 in. strap hinges with screws.
- 2 lbs. 10d nails.
- 3 lbs. 8d nails.
- 1 lb. 4d shingle nails.

OPEN TYPE RANGE COLONY HOUSE

Construction

The open type range colony house is built in such a manner that it may be readily moved from place to place. The building as shown on the plans (Figs. 8 and 9) is ten feet by ten feet square. It is built on four-inch by six-inch skids cross braced at each end with four-inch by four-inch timbers. The frame work is of two-inch by four-inch material. The roof with a wide overhang on both sides and ends is made of one-inch by six-inch sheathing with shingles exposed five inches to the weather. The frame work is thoroly braced to withstand moving. Supports are provided so that the perches may be put in at either of two different levels. The outside of the building is covered entirely with one-inch mesh poultry netting.

All dimensions are shown on the plan and the list of material includes all necessary materials but does not allow for any waste.

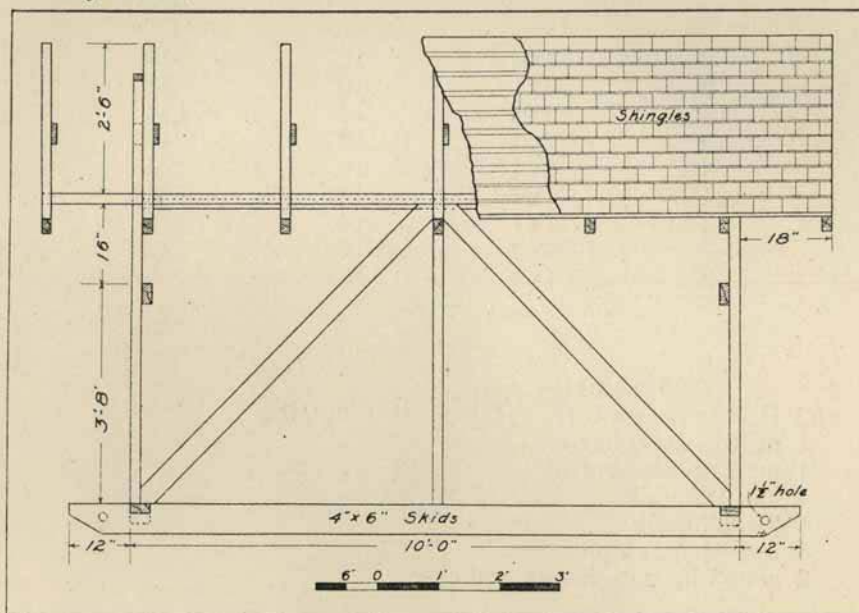


Fig. 8. Side Elevation of Range House

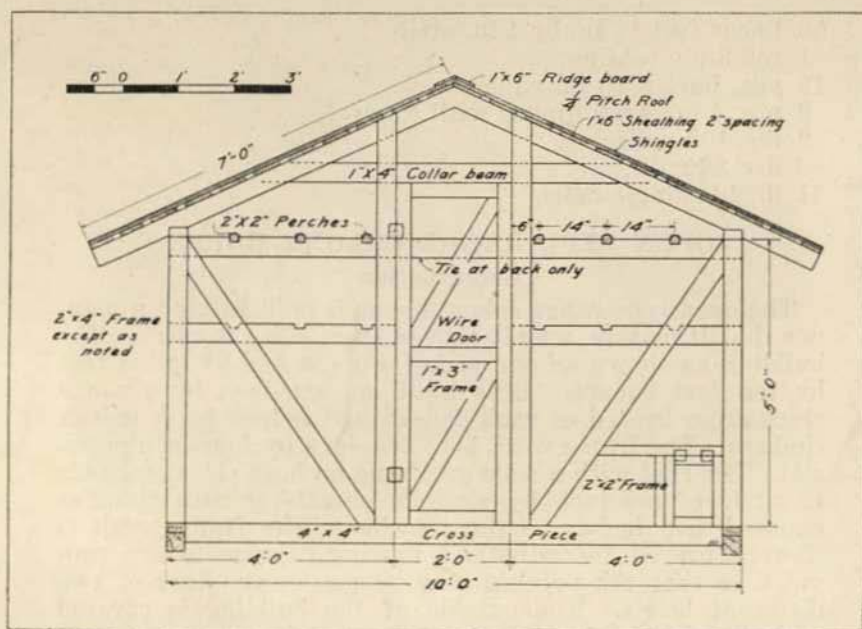


Fig. 9. End Elevation of Range House

LIST OF MATERIAL FOR RANGE COOP

No. of Pieces	Size	Length	Ft. Board Measure
2	4x6	12	48
2	4x4	10	27
13	2x4	14	123
5	2x4	12	40
3	2x4	10	20
24	1x6	14	168
3	1x4	14	14
7	2x2	10	23
2	1x3	12	6

469

1 1/2x1

6

1500 Shingles

52 ft. 1 in. mesh 5 ft. width poultry netting.

1 pr. 3x3 steel butts.

1 pr. 2x2 steel butts.

5 lbs. 16d nails.

5 lbs. 8d nails.

5 lbs. 3/4 in. staples.

2 sets 3 in. gate hooks and eyes.