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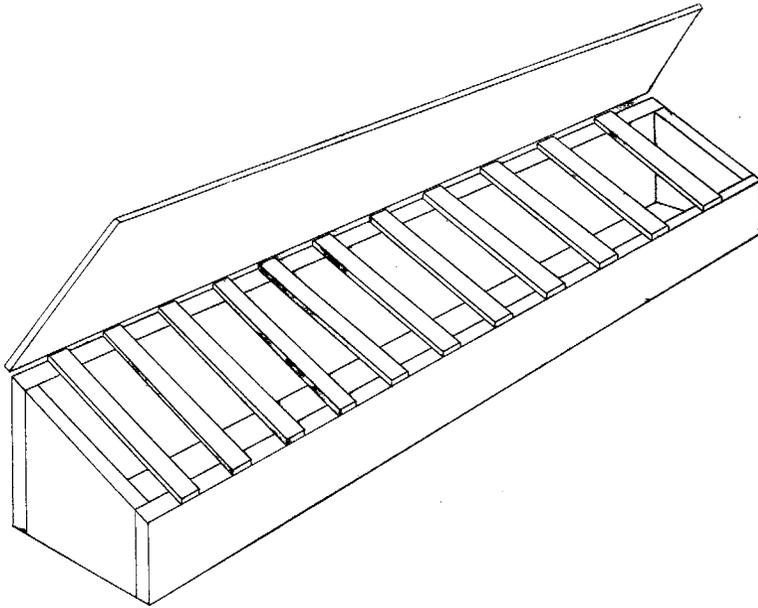
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The Selection and Feeding of Laying Hens.

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THE SELECTION AND FEEDING OF LAYING HENS.

SELECTING LAYERS.

The publication of the records which have been obtained with poultry at the Kansas State Agricultural College has created considerable demand for information concerning the selection and feeding of hens that are kept primarily for the production of eggs. The information given in this circular is gained from the experience at the College and is in harmony with the teaching of other stations upon this subject. If properly used, it should enable the poultryman to greatly improve his egg production.

To insure the best success in his work, the poultryman must first have fixed in his mind the line he wishes to follow and then bend every effort to carry it out. If he wishes to breed hens for eggs, the first thing he must do is to select his stock with that object in view. A farmer who feeds steers for beef production picks out individuals which conform closest to the type of animal which he considers would make the best feeder. This type is entirely different from the one a dairyman would select for his dairy herd.

The man who selects a horse to use on a heavy dray wagon hunts for one which he thinks can best do that work, while the man selecting a race horse would pick one of an entirely different conformation.

Thus, in intelligent selection of our live stock the purpose for which it is to be used is first determined. There seems to be no reason why the same principles of selection cannot be applied to poultry. The Kansas Experiment Station has commenced a series of investigations along these lines to determine the efficiency of such selections.

In applying this principle in the poultry business, there are several things which should be considered in selecting hens for layers: (1) Shape and size, (2) color of head furnishings, (3) actions of the individuals, (4) pelvic bone test.

SHAPE AND SIZE. The first thing to notice concerning the shape is, as to whether or not the hen is rangy or blocky. A

blocky hen indicates a meat producer, while the more rangy one indicates the production of eggs. Since the development of the egg, to a large extent, takes place in the region of the body below the broad part of the back, that part of the body should be broader than the fore part. This gives to the body a V-shaped appearance as viewed from the top, the small part of the V lying toward the front. When a hen is in heavy laying condition, her abdomen is lower than the breast line. This gives the body the appearance of being V-shaped as viewed from the side along the top and bottom lines, with the small part of the V toward the front. This enlargement of the body in the abdominal region makes the back appear somewhat narrower, giving the body a V-shaped appearance from the back downward on the sides as viewed from the rear. Thus, a body V-shaped in three directions indicates large productive powers.

A large hen usually lays the larger eggs. This rule may not hold true if she happen to be a heavy producer, for then the tendency is to produce smaller eggs. With such fowls as the Leghorns, whose tendency is to lay smaller eggs, the selection should be for large size of body rather than small.

A good layer is longer in body, neck and legs than a meat-producing hen. She stands up well and has a well spread tail. Observation has shown that a pinch-tailed Leghorn is not generally as good a layer as is a fan-tailed one.

The character of the head furnishings is an indication of the hen's laying condition. When a hen is in full laying her comb is full and bright red. Some Plymouth Rocks when laying heavily will have lopped combs, and therefore become disqualified as show birds. When hens are molting they lose all their color in face and comb and the size of their combs become very small, but as soon as laying commences, the combs enlarge and the color returns. Many instances have been noted with Leghorns and Minorcas which indicate that the birds with the largest and reddest combs are in heavy-laying condition. Exceptions to this rule sometimes occur, but they are rare.

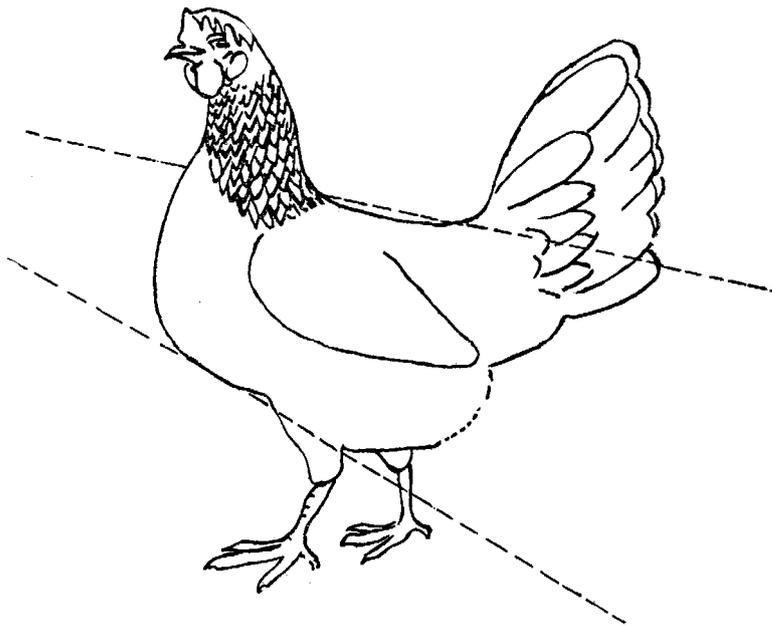
ACTIONS OF THE HEN. A laying hen is nearly always a singing hen. She works and hunts for food all day, is the first off of the roost and the last to go to roost. She is nervous and very active, keeping herself up to the greatest possible pitch.

THE PELVIC BONE TEST. This is a test which some have claimed as final and conclusive. Immediately below the tail at

the end of side pieces of the back are two somewhat bony protuberances. These are called the pelvic or "lay" bones, and are just above the vent through which the eggs must pass. When an egg is laid, these bones must be forced apart to allow its free passage. When these bones are soft and pliable, and spread sufficient to allow three fingers to be placed between them, it is an indication that the hen is laying. If they are hard and bony, and close together, the hen would not be considered as laying at that time. Experience has shown that this method will usually tell whether or not a hen is laying at the time the examination was made.

To sum up, an ideal laying hen should conform as nearly as possible to the following: (1) She must be healthy; (2) comb, wattles and face, red in color; (3) eye bright and lustrous; (4) neck not short, but rather medium to long; (5) breast broad and long, sloping upward; (6) back, long and broad; (7) abdomen, wide and deeper than breast; (8) shanks, well spread and rather long; (9) V-shaped in three ways, viz., (a) on sides, front to rear, (b) top and bottom, front to rear, (c) base of tail, downwards; (10) well spread tail.

FIG. I.



FEEDING.

After selecting fowls for egg production, the next questions of importance are the kinds of feed and methods of feeding.

It should be clearly understood that the principles of feeding apply alike to horses, hogs and poultry. A certain amount of feed is necessary to maintain life. If more than enough food is supplied for this purpose, a small part is stored up as surplus in the form of fat, to be used in the production of eggs and to carry on body processes should sufficient food constituents be lacking. In the heaviest laying hens a small amount of fat indicates proper feeding. The old idea that a hen must be poor in flesh to make a good layer has been disproved. An overfat is as useless a layer as is a thin-fleshed one.

If a hen is to be used for egg production the feeder should first know the analysis of the egg and the body of the hen in order that he may know what and how to feed.

There are three main food constituents which are considered in feeding: proteids, carbohydrates and fats. The proteids constitute the nitrogenous portion of the food and are required to produce lean meat, the white of the egg, etc. The carbohydrates embrace the starches, sugars and digestible crude fiber, and are used as fuel to keep up the animal heat, supply energy, and to make the fat of the body and of the yolk of the egg. The fats contain the fats and oils of the food and are available for keeping the animal body warm, supplying energy, or for storing fat in the body and in the yolk of the egg. Thus, to properly feed poultry, it is necessary to understand something of the composition of the body of the fowl and the egg and then give the foods containing these nutrients in the right proportion.

In the Cornell Reading-Course Bulletin for Farmers, No. 17, are given some compositions, as follows :

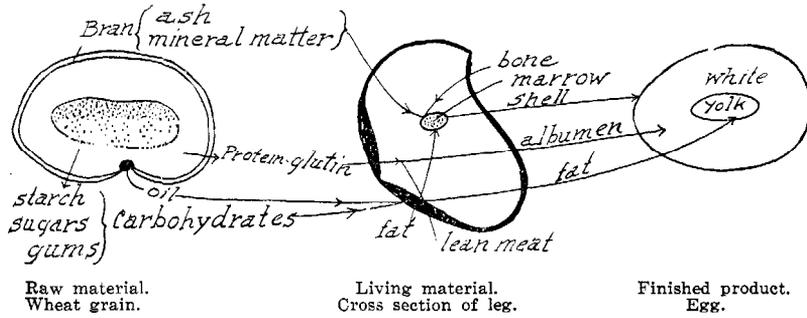
	Protein Per cent.	Non-nitrogenous or total carbohydrates, plus 2¼ times fat.
Hen	21.6	17.0 per cent.
Egg	11.4	8.9 “
Corn	7.9	76.4 “
Beef scrap	66.2	31.1 “
Oats	9.2	56.8 “

The reason that the carbohydrates and fats are used together, is because in a general way it can be said that they do the same work in the body, except that fats do 2½ times as much as will the same amount of carbohydrates. Thus, the

amount or fat is multiplied by $2\frac{1}{4}$ and added to the carbohydrates.

One of the best examples which may illustrate the uses of grains in making the body of the fowl and the egg, is shown as follows :

FIG. II.



A nutritive ratio is the ratio between the energy given off by the protein and the energy given off by the carbohydrates. To find this nutritive ratio, the carbohydrates plus $2\frac{1}{2}$ times the fat is divided by the protein. Thus, the nutritive ratio may be 1 to 4, meaning that something contains 4 times as much of the fat or heat and energy-forming elements, as it does protein or meat-forming elements. It may be seen from the composition of the above examples that chicken feeds differ in the amounts of the different elements. Taking corn for example, the fat-forming elements are nearly ten times as great as the nitrogenous or protein elements. This gives the nutritive ratio of 1: 9.6. With meat scraps, the nutritive ratio is the other way, there being twice as much protein as carbohydrates. Thus, in order to scientifically and properly make up a ration or mixture of feeds for hens, the number of pounds of protein, carbohydrates and fat must be considered as well as the number of pounds of grain.

Dr. W. P. Wheeler, director of the New York Experiment Station at Geneva, N. Y., says "that 500 pounds live weight of hens in full laying, each hen weighing from three to five pounds, would require—

Dry matter	27.5	pounds.
Ash	1.5	"
Protein	5.0	"
Carbohydrates	18.75	"
Fat	1.75	"

This has a nutritive ratio of 1 : 4.6.”*

Having found the correct amount of each food constituent to give a hen, the principles which must be used in connection with them, need to be considered.

The egg is made from the constituents found in the grain and there is a direct relationship between them. Thus, if the food given, lacks in the elements necessary to make an egg, that egg will not be produced. If too much grain, rich in fat-forming elements, is given, the hen will lay on fat, lose her ambition to exercise, and finally break down. A growing pullet needs food which will not only make eggs but which will also help develop and make her body. To do this, a large amount of protein must be given. A lack of it will make stunted chickens. There is often seen on many farms small and undeveloped pullets which evidently had never received a sufficient amount of protein.

Turkeys are insect hunters, ducks are grazers, and chickens are grain eaters. Experience in feeding different kinds of grain and mixed feeds and noting results in quantity and quality of eggs produced, leads to the following conclusions respective to the different kinds of feed here listed :

Corn is the popular grain in Kansas because it is raised on nearly every farm. Hens are very fond of it and pick it out in preference to anything else, partly on account of its color. It is very fattening and should on that account never be fed alone. It will give the yolk of the egg a golden color. Nutritive ratio, 1:9.6.

Wheat is second in popularity and is a valuable feed. If feed is scarce, it may be fed as the only grain. It is rich in mineral matter and protein and should be in every grain mixture. Clean screenings make a good substitute. Nutritive ratio, 1:7.2.

Kafir corn is especially popular in this state. It is similar to corn in feeding value and should never be fed as the only grain. Nutritive ratio, 1:8.1.

Oats, especially if heavy, are very desirable. They are rich in protein and are considered especially valuable for growing birds. Many poultrymen declare this to be the best grain to feed alone. Nutritive ratio, 1:6.2.

Barley is especially good for fattening when finely ground.

* Reference—Cornell Reading-Course for Farmers, No. 18.

It is sometimes used as a substitute for wheat. Nutritive ratio, 1:7.9.

Rye—do not feed. Hens rarely like it.

Buckwheat is used for fattening because it whitens the skin of the fowls. Nutritive ratio, 1:6.9.

Bran is valuable in a mash, for bulk. It contains a large amount of gluten, which is a nitrogenous food, and considerable ash. Nutritive ratio, 1 : 3.8.

Shorts is almost as good for feed as is a low grade of flour. It is valuable in a dry mash, Nutritive ratio, 1 : 4.7.

Alfalfa meal can be used in small quantities in a mash, It contains a large amount of crude fiber, ash and protein. It is sometimes scalded and used as a substitute for green food, on account of its high protein content. It varies in nutritive ratio, depending upon the quality of the hay from which it is made. Nutritive ratio, 1 : 3.8 (fair average),

Oil meal is high in protein content and is most valuable in the fall when molting is in process. It contains a large amount of oil, hence loosens the old feathers and puts a gloss on the new ones. Nutritive ratio, 1:1.7.

Though fowls are primarily grain eaters, they desire meat food in some form. If, in the summer time, they have free range and can obtain bugs, worms, etc., they will have nearly all the meat that is necessary, but in the winter a meat food of some kind must be given. This helps to furnish the necessary amount of protein to lower the nutritive ratio of the ration. It is seldom safe, however, to feed it in quantities of over one-tenth of the ration.

Beef scrap is probably the best and most convenient substitute for meat that can be used. It is made by the packing houses from scraps of meat that have been cooked and dried. It keeps well and is easily handled. The popular way to feed it is in a dry mash with the other meals, but it may be fed entirely alone. The nutritive ratio varies, and the price is regulated by the protein content. An average nutritive ratio is 2 : 1 or 1 : 0.5.

Green cut bone is probably the best meat food, but should only be used when fresh. Spoiled green cut bone may cause ptomaine poisoning, which in turn causes limber neck and ultimately death. One of the greatest objections to it is the trouble

to get fresh bone and to furnish the power to grind it. It varies in food content. An average nutritive ratio is 1 : 5.3.

Skim milk is valuable as a meat food. It can be fed sweet or sour, with a mash or alone. Its one objection is that it compels the necessity of frequent cleansing of the vessels in which it is fed. It is a splendid food for growing and fattening chicks. An average nutritive ratio is 1 : 4.5.

Green feed. Besides grain and meat, fowls like some green food. The real value of such food has not been fully determined, but it is known that green food is palatable and serves as an appetizer. If chickens are given green grass after being confined there is nearly always an increase in the percentage of fertile eggs. In the winter mangel beets, etc., can be used to advantage and should be hand fed in order to obtain the best results. Alfalfa, clover or blue grass make the best summer pasture.

Water. If a Leghorn hen's body be dried and all the water driven off, it will be found to have contained about 55 per cent of water. An egg contains 65 per cent of water. This water in the hen's body and egg must come from some place, so a plentiful supply of *clean, fresh* water should always be at hand. Fifty laying hens will require four to eight quarts daily.

Grit. The food is ground in the gizzard of the hen. The muscles in the walls are strong and work in a rotary manner. This churning will grind grain, provided there is some kind of sharp grit intermingled with it. The lack of grit greatly impairs the digestive capacity of the hen. Mica crystal grit should always be kept so that the hens may have access to it, even though they can get sand and grit in other places. Round smooth stones are not sufficient. When the grit becomes round it passes off with the droppings. Oyster shell or limestone will not take the place of grit. Experiments have been tried at Cornell University with grit, and it was found that hens deprived of grit retained in their gizzards for twelve months the grit which they possessed before going into the experiment.

Lime. The egg shell is made up mostly of lime, hence something which contains lime that can be easily liberated, is necessary for laying hens. Most of the soft-shelled eggs found on the roosts are due to a lack of the right amount of lime. Ex-

periments have been carried on to prove that hens deprived of lime entirely, would not lay.

Palatability of food. Some years ago observations were made concerning the likes and dislikes of individual hens for different feed. It was found that some hens will eat wheat in preference to corn, while others would not touch wheat if they could get oats. The ration should be so made, that all hens will be satisfied, hence a variety is needed. If the hens have been receiving one kind of a ration and it is desirable to make a change, do it gradually. Experience has taught this.

Exercise. Plenty of exercise is a good thing; activity means good circulation and health. Many a breeding male has proved worthless because of lack of exercise. This holds true with fowls: If they are cooped up without exercise, disastrous results are sure to follow. Free range will furnish the opportunity for exercise, but sometimes the heavier breeds can only be made to work by having to scratch for their food. When hens are confined or are not inclined to exercise, a good deep litter in which they will have to scratch for their food is necessary.

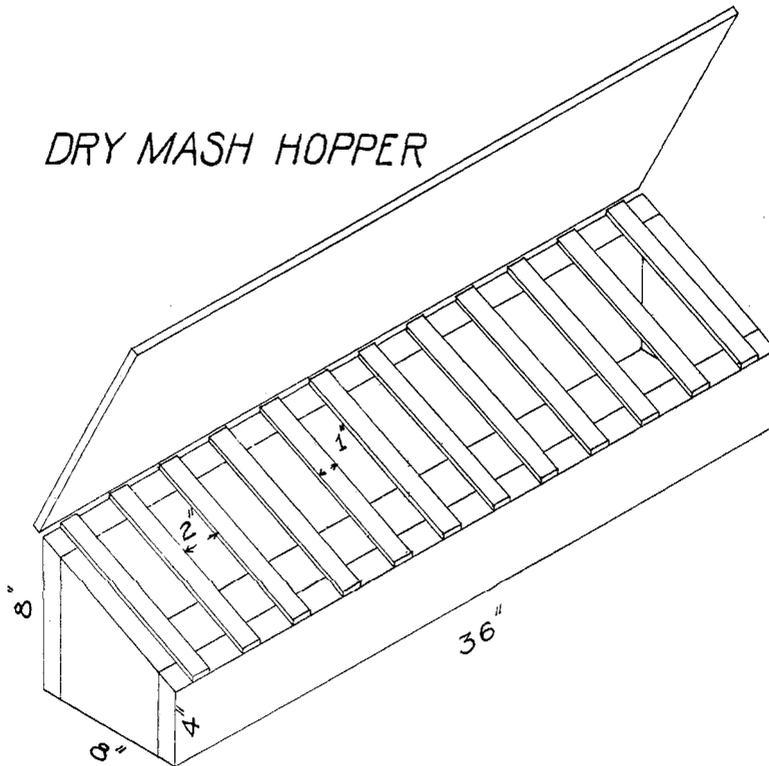
General quality of feed. It does not matter *how much* the hen eats as it does *what* she eats. A large quantity of poor and non-nutritious food will do a fowl little good. Musty, sour or spoiled feed should never be used, and good grain is better than poor grain. All sacks of beef scraps are not alike and 60 per cent protein beef scraps are sometimes cheaper to feed than are the poorer grades sold at a cheaper price. The feeder should know the digestibility of all the feeds used before he makes his ration.

Grinding feed. At the present day many poultrymen grind part of their chicken feed into a meal so that it can be fed either as a wet or dry mash. If all the food eaten must be ground by the fowl, it will use up some energy, which requires food to furnish it. It has been found that in forcing chickens for quick growth or egg production, feeding a portion of ground feed is a great help. Part of the work of digestion has been accomplished by the artificial grinding, and the hen so fed, can use the energy that is saved, for something else. This is the real advantage of feeding ground grain.

Wet vs. dry feeding. Wet vs. dry mash is a question that has received much attention from experimenters during the

past few years. The general concensus of opinion at the present time, is that the dry mash is the most desirable. Many practical poultrymen, however, still prefer the wet mash. Labor is one of the greatest problems that the poultryman has to consider, consequently if he can find a method which will be labor-saving and yet give results, it is worthy of consideration. Dry mash, fed in hoppers, is easier to handle than any kind of wet mash. Hoppers are now made which are rat proof, sanitary and convenient. These can be filled once a week and are found

FIG. 111.



satisfactory. Experiments have proved that eggs produced by hens fed a dry mash are more fertile than those laid by hens fed a wet mash. Wet mash is slightly more forcing, is inconvenient to feed, and requires care in keeping the feeding vessels clean.

There is no ration which is suitable for all laying hens. So

many conditions exist which influence results. Housing, for example, may have a marked influence on the method of feeding; if the house is very cold, is not protected or is likely to be draughty, more feed containing carbohydrates will be necessary to keep the birds warm. On the other hand, a more protected house will require less feeding.

There is one thing true in all life, whether it be bird or beast, and that is, adaptation to existing conditions. The digestive organs are so made that in case of a deficiency of carbohydrates or fat-forming elements, the protein in the body may be called on to help out, until more of the proper elements are supplied. Fowls raised in cold regions of the north can be brought south and in a short while become acclimated to existing conditions. This adaptation to circumstances makes some possibly undesirable ration serve all the purposes desired.

Prof. James E. Rice, in his Reading-Course for Farmers, No. 18, entitled "Rations for Poultry," gives the following important points which should be observed in making a ration:

1. "It should be composed of foods every one of which the fowls like.
2. "It should contain a sufficient quantity of digestible nutrients to supply the needs of rapid growth and large production.
3. "It should have enough bulk to enable the digestive secretions to act quickly upon it.
4. "It should not contain an excess of indigestible fiber, which must be thrown off by the system, thus causing a waste of energy.
5. "A certain portion of the feed should be of whole grain in order to provide muscular activity of the digestive organs. This is made necessary in grinding the grain.
 "Under certain conditions a quantity of the ration should be of soft ground food. This is for the purpose of providing quickly available nutrients to supply the immediate demands of rapid growth or heavy continuous egg yield.
6. "It must provide a good variety of foods in which are included grain, green food, meat and mineral matter, in proper proportions.
7. "The age of the fowl, the breed and the kind of product which it is desired to produce, must be taken into consideration,

as to whether the food is intended to grow muscle and bone, or to produce eggs, or to fatten.

8. "The ration must provide the two classes of food nutrients, the protein and carbohydrates, in such proportion that they will supply the daily need of the fowl's system; it must also provide sufficient digestible protein to repair the waste of tissue with new growth and to produce eggs, and provide the proper amount of digestible carbohydrate food to furnish heat, energy and lay by a little surplus fuel in the form of fat.

9. "The ration must consist of foods which furnish the nutrients at the lowest possible cost.

10. "The food in the ration must not have an injurious effect on the color or the flavor of the product.

11. "It is not how much a fowl eats, but how much it can digest, that determines the value of the food. Various classes of animals differ in their power to digest the same kinds of food. Foods also vary in their digestibility when used by the same animal. Unfortunately the proportion of each poultry food which fowls can ordinarily digest, has not as yet been determined, therefore we are obliged to use the standards of digestibility which are used in compounding rations for other animals as the result of many digestion experiments."

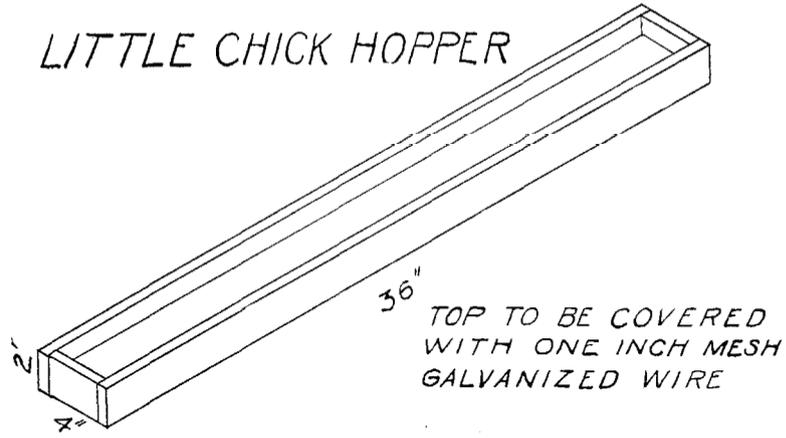
With these principles in mind, it is fairly easy to work out a suitable ration. If the methods of computing a balanced ration are desired, they may be obtained by writing to the Experiment Station for Bulletin No. 115.

Ration used at the Kansas Experiment Station. The poultry department of the College has three rations: for laying hens, for young chicks, and for fattening chicks, which have been very satisfactory.

When a chick is newly hatched, it is allowed to dry off in the incubator and then put into the brooder which has been heated to 100 degrees. When from 48 to 60 hours old they are fed a little of some boiled, tested-out eggs. Following this, they have placed before them in a shallow pan a dry mash made as follows :

2 pounds.....	corn meal.
2 pounds.....	shorts.
2 pounds.....	bran.
2 pounds.....	beef scrap.
$\frac{1}{2}$ pound.....	charcoal.

FIG. IV.



This is kept before them practically all the time, from the time they are large enough to eat it until they have obtained a good growth.

Scattered in the litter, five times daily for a few days and three times daily thereafter, is a grain mixture as follows :

- 2 pounds..... corn chop (sifted).
- 2 pounds..... cracked Kafir corn.
- 2 pounds..... cracked wheat.
- 1 pound..... millet.

Before then, at all times are pans of fresh water and clean grit. Absolute cleanliness and sanitation is ever present.

When the chicks are large enough to eat whole grain, the cracked is taken away. If the chicks are early hatched and have attained a good growth early in the summer the beef scraps at least and possibly all the mash should be cut out of the ration. This prevents premature development with early chicks and consequent fall molting. The ration above mentioned produced 3-pound White Plymouth Rock cockerels in ten weeks from date of hatch. These sold well on the early market. The nutritive ratio is 1 : 3.5.

Early in the fall, in case some cockerels need to be eaten or sold on a fancy market, it would pay to put them in a crate and fatten them for two weeks. The following ration has not only put 1 pound of weight on 2½- to 3-pound cockerels, but it has improved the flavor of the meat wonderfully.

- 2 pounds..... ground oats.
- 2 pounds..... shorts.
- 2 pounds..... corn meal.
- 1 pound..... beef scrap.

This should be fed twice daily, mixed to the consistency of pancake batter with sour or skim milk. The fowls should be allowed to eat all they desire for ten minutes, at the end of which time it should be removed.

The following laying ration has been a success in feeding White Leghorns and White Plymouth Rocks. Between February 1, 1909, and November 1, 1909, one White Plymouth Rock produced 201 eggs and another 196 eggs, at a cost for feed of 90 cents each. The Leghorns averaged 166.1 eggs for the same nine months at a slightly less cost :

<i>Grain.</i>		
10 lbs.....		wheat.
10 lbs.....		corn.
5 lbs.....		oats.
<i>Mash.</i>		
6 lbs.....		shorts.
3 lbs.....		bran.
6 lbs.....		corn meal.
5 lbs.....		beef scrap.
1 lb.....		alfalfa meal.

This ration has a nutritive ratio of 1:4, if fed exactly as given above. It seems to fulfill nearly every requirement that a proper ration could call for, and is practical. It is best suited to fowls which are confined and have no chance to obtain food on the range. A very practical way to feed it, is to put 25 pounds of the grain in a bucket and the 21 pounds of mash in a hopper. The feed in these two vessels should disappear at the same time, that is, the grain should last as long as the mash. Fowls will naturally eat more grain than they will the dry mash, so it is sometimes necessary to cut down on the grain in order to make them consume the mash. The grain should be fed scattered in the litter.

With Leghorns it is not so necessary to hold them rigidly to this ration, for they can eat more grain with safety and not become overfat. They work off so much energy, which is supplied by the grain, that it will do them no harm. With Plymouth Rocks, the feeder must be more careful, for they become overfat easily. If fowls are allowed range at all, the mash may be reduced, for they will obtain a substitute from the bugs, etc., at practically no cost.

Many farmers do not possess the variety of grains and other feeds mentioned in the above rations, but if they will master the principles of feeding and will adhere to them as closely as their conditions will allow them, better egg production is sure to fol-

low. If the hens have access to stacks and corn cribs in the winter, no objection can be made, providing they are fed in a hopper a plentiful supply of beef scraps. It will pay to buy some good beef scraps and see that the hens get plenty of it.

If a farmer has a large flock of Plymouth Rocks or fowls of the heavier breeds and they have free access to a feed lot, in case they become overfat, some radical change must be made. Either the fowls must be shut out of the feed lots or the variety of stock changed.

Feeding poultry of any kind is an important problem, and with a full understanding of its principles, any intelligent person ought to be able to apply them to his own conditions. No set rule can be made because conditions differ in so many ways.

The poultry division of the Kansas State Agricultural College is continually carrying on experiments in feeding, and will from time to time publish results of such work. The above discussion will serve to answer many questions that are constantly being asked, and the facts stated are the best information obtainable at the present time.