

OREGON AGRICULTURAL COLLEGE

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By JAMES DRYDEN

Poultry Husbandry.

Reading-Course
Lesson 3

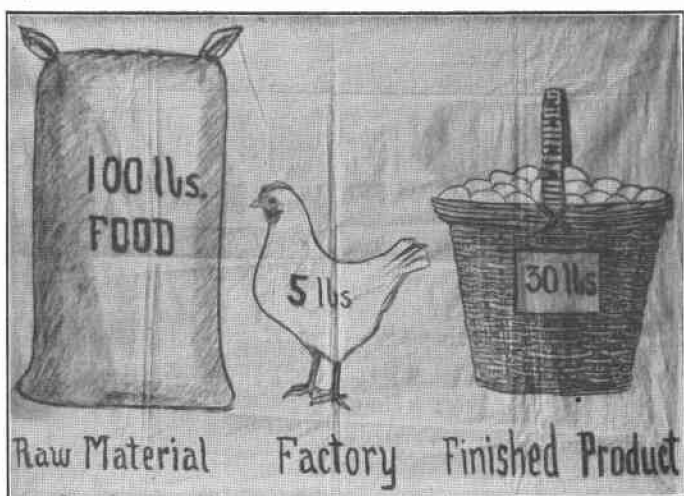
Corvallis, Oregon,
November, 1909.

FEEDING FOR EGGS



FEEDING is one of the four most important subjects in poultry keeping. We have discussed two of the fundamentals, breeds and housing, and this bulletin takes up the third, that of feeding. This lesson will be confined to the feeding of laying fowls.

Most poultry-keepers do not realize the importance of good feeding, others place the whole responsibility upon the food and feeding. Before telling what food will do,



This hen did it

let us first tell what it won't do; let us understand some of its limitations.

First. No amount of good food or anything else will make some hens lay; they are not born to lay. *(R. 1). During the

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past year the writer observed a flock of fowls, all fed alike. One of the hens laid 218 eggs; another did not lay any.

Second. No amount of good feeding or anything else will make a good laying hen lay if she has not good housing or shelter. (R. 2). If you have good fowls and good housing, what will good feeding do toward filling the egg basket?

1. **FOOD AFFECTS THE QUALITY OF THE EGGS**—The hen is very particular about what she puts into the egg, so particular that probably no food could be fed that would render the eggs totally unfit for consumption. At the same time it has been demonstrated by experiments that food affects the quality of the egg, and that to produce eggs of the highest quality attention must be paid to the quality of the food.

Flavor of Eggs.—Heavy feeding of onions, for example, will give a distinct flavor to the eggs and make them almost unpalatable. Hens eating large quantities of beef scrap will lay eggs of strong flavor. These facts the writer personally demonstrated by experiment. (R. 3). No doubt other foods will also give a flavor to the eggs, desirable or undesirable. It is said that a diet of fish will give a fishy taste to the eggs.

It is not necessary, however, to discard these foods on this account, for when fed in normal quantities neither onions nor beef scrap will give a perceptible flavor to the eggs. Only when the hens have been starved on green food or animal food, and then given all they will eat of either for a few days, will any flavor from onions or animal food be noticed in the eggs. But this shows that the hen puts into the egg what she finds in the food, even the flavor of the foods. It is therefore important that good wholesome food be fed at all times.

Feeding Color into the Egg.—It is possible for the skillful feeder to flavor the eggs; it sometimes happens from unskillful feeding, as indicated above. It is possible also to "paint" them. The variation in the shade of yellow in the yolk is due to the difference of the food. The coloring of the egg shell is beyond the feeder's art, but food affects the color of the yolk as we have demonstrated. (R. 4). A pen of fowls fed dried alfalfa leaves produced eggs of good yolk color. A similar pen fed sugar beets instead of alfalfa leaves laid eggs very pale in color. In an experiment at the Oregon Station kale "painted" the yolks a good color of yellow. (R. 3). It is also claimed that yellow corn will give eggs the desired yolk color, but this, as yet, I have been unable to verify. When eggs are very pale in

the yolk it is a sure indication that the hens are not getting green feed enough. Clover, vetch, rape, grass, or other green food, and doubtless certain grain foods, will color the yolks. A too highly colored yolk is not desirable, and it is possible for the hens to eat so much of certain foods as to color it too highly. Where the ration is properly balanced this should not occur. Food therefore affects the quality of the eggs.

2. FOOD AFFECTS THE QUANTITY OF EGGS.—Other conditions being right, good feeding will make the hen productive, and the productive hen is the healthy hen. In a pen of four fowls at the Utah station 804 eggs were laid in one year. Another pen of four, sisters to the others, fed on a different food, laid only 532 eggs. The difference in the ration made the difference in the egg yield. In another test one pen laid 574 eggs in a year, and a similar pen on a different ration, laid 404. (R. 4).

3. FOOD AFFECTS THE SIZE OF EGGS.—Food and feeding influence size of egg. Don't always blame the hens or the breed for small eggs. An experiment has shown that food and management affect the size of egg. (R. 5).

4. THE FOOD AFFECTS THE PROFITS.—A proper study of foods and feeding must include the prices as well as the composition of foods. A ration, although it may give good results in egg yield may not be profitable because it is made up of too high-priced foods. There is no patent on egg-producing foods. It is not necessary to use any certain kind or brand of foods. It is not necessary to pay more for the chickens' food than for the food on the family table. There are impracticable rations because they are too high-priced.

KNOWLEDGE OF POULTRY FEEDING.—While our knowledge of poultry feeding has not yet reached a point, if it ever will, where we can say that certain foods or certain rations will produce certain results, yet a great deal of valuable information is available as a result of experimental feeding at the stations and of chemical analysis of poultry foods. In addition we have the experience of practical poultry keepers, and this constitutes a fund of valuable information to draw upon. But poultry-feeding has not yet been reduced to a so-called scientific basis.

DIFFERENT ELEMENTS OF FOOD.—Foods contain four different elements, the chemist tells us. He looks upon wheat, for instance, as so much protein, fat, carbohydrates and ash. All foods contain these things in varying proportions. Corn is the same thing as wheat because it contains the same constituents, the

only difference being that the proportion of these constituents vary in wheat and corn, and in other foods. Wheat, for instance, has more protein and less fat than corn. What does this signify? We cannot tell exactly, but let us see.

WHAT IS AN EGG?—Analysis tells us that an egg contains the same constituents, practically, as corn and wheat, but has a larger proportion of protein. To the chemist the egg is simply protein, fat, ash, etc., the same as wheat and corn. The only difference between a bushel of wheat and a bushel of eggs is that the eggs are more palatable and more nutritious. They are also more valuable in the market. A pound of eggs is worth from 10 to 30 cents, depending on the season and the markets, while a pound of wheat runs from 1 to 2 cents. By giving the wheat to the hen to market it is converted by a delicate process of manufacture into a form of food so palatable that it is worth ten times as much as it was in the grain sack. More than that, the hen is thrifty; for every pound of wheat she puts into eggs she puts a pound of water, as will be seen later; and she gets a good price for water. In selling eggs at 40 cents a dozen the poultryman is getting 25 cents a pound for water. That is a pretty good price. It is more than the dishonest dairyman gets for the water he puts into his milk.

RELATION OF FOOD EATEN TO EGGS LAID—The hen puts into the egg what the poultryman puts into the hen. If a cabinet maker puts oak lumber into a furniture factory it will come out oak, but in different form. If we put wheat or corn into the hen it will come out wheat or corn, but in a different form.

There is a close relationship between the food eaten by the hen and the eggs laid. That much we know. At the same time no one can say certainly what kind of foods or combination of foods will give the best results in egg yield. Chemistry doesn't tell us. Practical feeders do not tell us. This can only be determined by experimental work which will involve long and careful testing of different foods and different rations in actual poultry feeding. We know, however, that the egg has a certain composition, and we know that to produce eggs the hen must have foods containing the elements that the egg contains. Knowing the composition of eggs, therefore, we must study the composition of foods in order to feed intelligently.

The composition of the egg never varies; at any rate nothing to speak of. The hen is an honest manufacturer, and she doesn't adulterate her product, even though she may be fed

adulterated food. She puts the same kind of food into each and every egg. If she doesn't get the right kind of food she won't make the egg.

An egg contains one-quarter ounce of protein. If the hen be fed on wheat and nothing else she may eat four ounces per day. Of that she will need about three ounces to supply bodily needs. This leaves one ounce to make eggs with. In an ounce of wheat there is about one-tenth of an ounce of protein. Now, supposing the protein is all digested, which is not the case, she won't get enough protein to make half an egg a day. But an egg every two or three days wouldn't be so bad at certain seasons. The egg, however, contains other things. It contains also about one-quarter ounce of lime with which to make the shell. An ounce of wheat contains less than one-tenth as much as one egg contains. The egg also contains fat. It contains less than one-quarter ounce of fat, but the wheat would contain three-quarters ounce of fat formers.

What would be the result if the hen were fed on wheat alone? She would get enough protein to make an egg about every three days; enough lime to make an egg every twelve days and enough carbohydrates and fat to make three eggs a day. What will the hen do in such a quandary? She could put more fat into the egg to make up for lack of protein. She could make a counterfeit article, but she won't. Unless she has the right materials to make it with she won't make the egg. She must get the right kind of food or she won't make eggs. It is poor economy to feed wheat alone; the same thing is true of corn and nearly all the cereals. They are not "balanced" for egg production.

WHAT IS A BALANCED RATION?—A balanced ration is one containing the right kind of nutrients in right proportions for the purpose for which it is fed.

We must know the composition of foods before we can figure up a balanced ration. It may not be necessary in practice for the poultry man to figure up balanced rations for his flock. His experience or the experience of others or the results of tests at experiment stations are a pretty safe guide for the poultryman, but in order that he may intelligently plan improvements in rations, and adjust his feeding to the available food supply, he should understand something of the composition of ordinary poultry foods.

WHAT USE DOES A HEN MAKE OF THE FOOD SHE EATS?—In other words, what is the purpose of feeding? The first use she makes of the food is to supply the needs of her body. The maintenance of her body is her first concern. The body of the hen, like other animals, needs constant rebuilding. There is a constant wearing down or breaking down of tissues, and the food rebuilds the body or repairs its wastes. The work of the poultryman, therefore, does not end with the making of the hen, with the hatching and raising of the pullet; he must

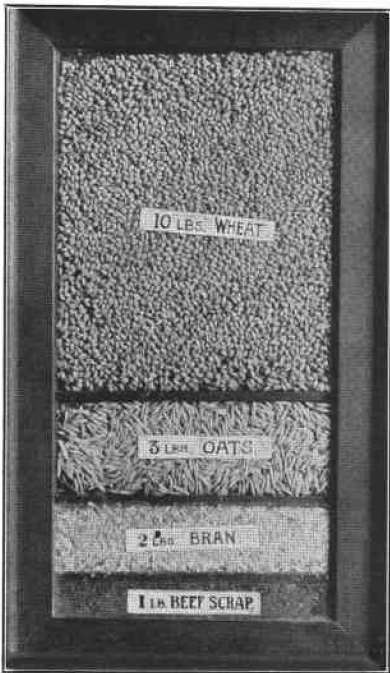
maintain her, and the skill of the feeder comes in in so compounding rations and so feeding them that the health and vitality of the hen may be maintained. That is the first consideration of good feeding — the maintenance needs of the hen, the maintenance of health and vigor.

The second use to which food is put by the hen is to make eggs. After the body's needs have been supplied, if there is any food left, the hen will use it for the making of eggs. Eggs are made from surplus food. After she has eaten enough to supply bodily needs she turns her attention to the egg basket.

If we are feeding for eggs it is poor economy, therefore, to feed just enough to maintain the hen in health and vigor. We must feed

more than that or our efforts will be wasted.

On the other hand, heavy feeding does not necessarily mean a heavy egg yield. In an experiment by the writer (R. 4), two pens of fowls consumed an average of 75.6 lbs. food, not counting the green food, and laid an average of 167 eggs per fowl. With the same amount of food two other pens averaged



A "balanced" ration for laying hens when it is fed with grit, green food and *skill*. Cottage cheese, all they will eat, may be substituted for beef scrap.

117 eggs each. The nutritive ratio was practically the same in each case. While the heavy layer must consume plenty of food, the manner of feeding and the kind of food must be taken into account. In other words, the efficiency of food rests largely on the kinds of food fed and the skill with which the feeding is done.

COMPOSITION OF FOODS.—Poultry foods contain varying amounts of what the chemist calls ash, protein, carbohydrates and fat, in addition to water. All foods contain more or less *water*, and in purchasing foods this should be taken into account. In a hundred pounds of wheat there are about ten pounds of water. There are about 75 pounds of water in a hundred pounds of green clover or alfalfa, and about 90 pounds of water in 100 pounds of skim milk. The poultryman should not pay any more for water in the food than for water in the water mains or in the well. The mineral matter in the food, called *ash*, is found in all foods in varying amounts. The hen is a concentrator; she takes the mineral in the food, concentrates it into egg shells and mixes a little in the contents. All grain foods are deficient in lime with which to make egg shells, and the hen must eat grit, oyster shell, etc., to supply the deficiency. A high value need not be placed on the ash foods, because any deficiency may be furnished by feeding gravel, sand, and either grit, oyster shell or bones. *Protein* is the most valuable part of the food because most poultry foods are deficient in protein, and foods containing a high percentage of protein are usually the most expensive. Protein makes the lean meat and the muscle and a large percentage of the contents of the egg. *Carbohydrates* and *fat* furnish the fat of the body and of the egg. They also furnish the fuel necessary to keep up the temperature of the body, and the hen has a higher temperature than cattle or horses. It requires fat to keep up the temperature of the body just as it requires fuel to keep up the temperature of the room. Carbohydrates and fat furnish the heat, fat and energy. It requires energy to digest the food just as it requires steam to drive the steam engine, and a considerable amount of food is used to produce this energy. Most poultry foods contain a larger percentage of carbohydrates and fat than is required for best results in egg production, while there is a deficiency of protein. The problem therefore in poultry feed-

ing is to compound suitable rations containing the necessary protein for heavy egg production.

THE VALUE OF FOODS.—The value of a food must be determined largely by the amount of protein which it contains, and high prices should not be paid for food of any kind unless it has a guaranteed analysis of high protein content. Generally speaking, foods are cheap or dear in proportion as they contain a high or low percentage of protein.

DIGESTIBILITY OF FOODS.—Another point should be mentioned in a study of foods. The composition does not always indicate the true feeding value of foods. The digestibility of the food is the final determining factor. It is known that all foods are not equally well digested. One food may be more completely digested than another by an animal. In cattle feeding it has been determined by experiment what percentage of different foods are digested. For instance, in a hundred pounds of wheat there are some 11.9 pounds of protein. Of that less than ten pounds are normally digested, the rest of it passing through the animal as waste material. It is the same with the other nutritive elements; part of them are wasted because the particular animal does not digest them wholly.

In the case of poultry feeding we are somewhat at sea. The digestibility of foods when fed to poultry has not been determined. The difficulty of collecting the droppings of the fowls without keeping the fowls under too highly artificial conditions, makes it very difficult to determine by experiment the digestibility of foods when fed to poultry. It is possible to find out how much of the food the hen eats that she digests and assimilates, or how much she makes use of. When this has been done, as it doubtless will before long, it will be possible to build up a system of feeding on a more scientific basis. As it is we do not know the true relative value of different foods when fed to poultry. The chemical composition of foods is the only guide we now have in the making of balanced rations for fowls.

NUTRITIVE RATIO.—The nutritive ratio is the ratio of protein to fat and heat producing foods. For egg production a narrow nutritive ratio should be fed. A ratio of 1 of protein to 4 or 5 of carbohydrates and fat is a narrow ratio and will give good results in egg production. In figuring the ratio the fat is multiplied by two and one-fourth, as it is estimated that

one pound of fat is equal to two and one-fourth pounds of carbohydrates and fat.

At the West Virginia Experiment Station laying hens fed a narrow ratio, or nitrogenous ration, produced 17,459 eggs, while the pens with a wide, or carbonaceous ration, laid 9,708 eggs. During the experiment the former fowls gained in live weight 1 pound four ounces each, while the latter gained only

PERCENTAGE COMPOSITION OF FOODS.

GRAINS—	Water	Ash	Protein	Carbohy- drates	Fat
Wheat	10.5	1.8	11.9	73.7	2.1
Corn	10.9	1.5	10.5	71.7	5.4
Oats	11.0	3.0	11.8	69.2	5.0
Peas	10.5	2.6	20.2	65.5	1.8
Barley	10.9	2.4	12.4	72.5	1.8
Wheat Bran	11.67	5.18	14.5	65.5	3.6
Wheat Middlings	11.8	2.8	15.22	65.7	4.5
Sunflower	12.8	2.1	9.1	51.3	21.2
Linseed Meal (N. P.)	9.9	5.6	35.9	45.6	3.0
Gluten Meal	8.1	1.0	28.3	51.9	10.7
Brewers' Grains, dried	8.0	3.4	24.1	57.8	6.7
GREEN FOOD—					
Alfalfa	71.8	2.7	4.8	19.7	1.0
Clover, red	80.9	1.7	3.1	13.6	.7
Kale	88.2	1.82	2.57	6.79	.6
Vetch	69.2	2.7	3.76	14.22	.49
Rape	85.7	2.0	2.4	9.3	.6
Mangel-wursels	91.2	1.0	1.4	1.2	.2
Cabbage	90.5	1.4	2.4	5.40	.4
ANIMAL FOOD—					
Skim Milk	90.6	0.7	3.3	5.3	.1
Cottage Cheese	72.0	1.8	20.9	4.3	.1
Buttermilk	90.3	0.7	4.0	4.5	.5
Beef Scrap	10.7	4.1	66.2	.3	13.7
Cut Bonest†	32.8	33.0	28.4	2.5	36.6
Dried Blood	9.95	3.68	72.0	1.68	3.15

ANALYSES* OF FOWLS AND EGG.

The analyses of the fowls include the feathers, bones, blood, etc.

Hen	55.8	3.8	21.6	....	17.0
Pullet	55.4	3.4	21.2	....	18.0
Capon	41.6	3.7	19.4	....	33.9
Fresh Egg	65.7	12.2	11.4	....	8.9

*Professor W. P. Wheeler, Geneva, N. Y., Experiment Station.

†Analysis of dry matter.

about one-tenth of a pound each. (R. 6). Other experiments have shown the superiority of the narrow ratio, or the ration rich in protein or nitrogen.

It should be understood, however, that the nutritive ratio in itself does not necessarily indicate the true value of the ration. Palatability and other factors have to be considered. Two rations having the same nutritive ratio were fed to two different pens of fowls for a year. (R. 4). One of them gave a yield of 201 eggs per fowl; the other 133 eggs. There was a difference in the kind of food, but not in the nutritive ratio. The other pens having rations of a similar nutritive ratio gave yields of 101 and 143 eggs respectively. The proper nutritive ratio does not guarantee a good egg yield. Regard must be had to the kind of foods fed, and the feeder must be guided by the results of feeding tests that indicate the feeding value of different foods.

It has been shown, for example, (R. 7), that there is a difference in the protein. Fowls require a certain amount of protein in the ration, but to be effective in egg yield part of that protein must come from animal food. It is protein just the same, but why there should be this difference in feeding value has not yet been determined.

WHAT FOODS SHOULD BE FED.—The table of composition of foods contains the names of foods that are used for poultry. This table does not, however, exhaust the list, as there are doubtless other foods that are used to a limited extent in different localities. The composition of any food not on this list may usually be obtained from the experiment stations.

GRAIN FOODS.—"The hen turns grain into gold."

Wheat.—Wheat is more largely used for poultry than any other cereal, taking the country over. It is a safer food than most other grain foods, and there is probably no other cereal that is better relished by the fowls. It has a near competitor in corn, and whether the one or the other should be fed is largely a question of their prices. If fed exclusively on one grain, fowls would probably give better results in egg yield on wheat than corn. Judging from the composition, wheat has a slight advantage over corn for egg production, while corn is better for fattening.

It is not a question, however, of one kind of grain; no one should expect a profit on fowls when fed one kind of food, no matter what kind of food it may be. When fed in combination

with other foods it is an open question whether wheat or corn is the most economical to feed at the same price per pound for each. No serious mistake will be made by the poultryman if he makes the market price the basis for selecting wheat or corn. But until the digestibility of the two grains has been determined their relative value must be largely a matter of opinion. Wheat that has been slightly frosted is of equal feeding value with good wheat, and may be substituted for the highest priced grade. Shrunken wheat has in fact a higher protein content than plump wheat, and a considerable saving may be made by purchasing at a low price wheat that cannot be used for flour-making purposes. A good quality of wheat screenings may also be substituted for higher priced grain.

Bran and Middlings.—The by-product of wheat, bran and middlings, form an important item in poultry rations in nearly all sections of the country. Bran is richer in protein than wheat, there being 14 pounds in 100 pounds bran and about 12 pounds in 100 pounds wheat. It also contains more fat than wheat. These facts added to its relative cheapness make it an economical food to feed.

Corn.—Corn is an excellent poultry food. A few years ago poultry writers generally advised poultrymen not to feed corn to laying hens. Chemical analysis had shown it to contain more fat-forming elements than wheat, and on this account became very unpopular, and higher priced wheat was fed in its place. Later, however, experiment stations, in actual feeding tests, showed it to be the equal of wheat when fed in proper combinations. The Massachusetts Station secured as good if not better results in egg yield from corn than from wheat.

But either wheat or corn is an imperfect ration, and other foods must be fed to "balance" it. It is a waste of food and labor to feed either wheat or corn alone.

It is an interesting fact that those states which are the largest producers of corn are the heaviest producers of poultry and eggs. This does not, however, prove the superiority of corn, but it disproves the old notion that corn is not a good poultry food.

Oats.—Pound for pound, oats are not worth as much for chickens as wheat or corn. Fowls do not relish oats as well as those grains. The large amount of hull on the oats is an objection. The hulls are largely indigestible. Minus the hulls, oats would be an excellent food for laying or fattening fowls.

Oats are not as fattening as corn or wheat, and many poultrymen feed considerable quantities of oats to prevent the hens becoming too fat. Special care should be used in selecting oats, as they vary a good deal in quality. Use heavy, plump oats and avoid light oats. The chief value of oats is in furnishing a necessary variety to the ration. This, of course, is true of other foods. Hulled oats, if they could be obtained at a reasonable price, would probably be superior to corn or wheat.

Barley.—Barley is not extensively fed to poultry. Chickens won't eat it if they can get wheat or corn, or, at any rate, they will eat but little of it. Where the price is not more than that of other grains, a little may be fed to give variety.

Peas.—Where peas can be grown successfully they should be used quite extensively as a poultry food. They are richer in protein than any of our common cereals. They contain twice the quantity of protein that corn contains, and on that account are worth more pound for pound than corn or wheat.

Linseed Meal.—In close proximity to linseed oil mills linseed meal can usually be purchased at prices that render it profitable to feed. It contains over 30 per cent protein and more or less oil. It makes an excellent addition to the mash food, but it should not be heavily fed.

ANIMAL FOODS.—“The hen is a meat eater.” Animal food of some kind is necessary for fowls to maintain their health and vigor, and to make them productive either in meat or eggs. A knowledge of this fact has done more to increase the poultryman's profits than any other one thing in poultry feeding. The scarcity of eggs in winter is largely due to a lack of animal food. The fact that chickens when given the liberty of the fields in summer find animal food in the form of bugs, angleworms, grasshoppers, etc., escapes the notice of the farmer, and in winter he does not see the necessity of feeding it. In most parts of the country, during the winter, chickens are unable to obtain animal food in the fields, especially in sections where snow covers the ground. In western Oregon, with its mild and open winters, they find many angleworms, especially during the rainy season. But in most sections, if not in all, fowls must be liberally fed with some kind of animal food for best results.

There are a number of ways in which animal food may be fed. Fresh lean meat is undoubtedly the best kind of animal food. It is the lean meat that furnishes the protein, but there

is no objection to having the lean mixed with a little fat; this may be an advantage at times. *Fresh meat scraps* from the butchers' stalls are an excellent egg maker. Some butchers keep a bone cutter and sell the meat and bones all ready ground or cut up. When one has a sufficient number of hens, say 25 or more, it will pay to buy a good bone cutter and cut the bones. The scraps contain a large proportion of bone, and the fowls eat these very greedily, as well as the meat. They furnish the mineral matter necessary for bone making and for egg shell making. *Skim milk* will take the place of animal food if fed liberally enough. The trouble with skim milk is that it is not concentrated enough; that is, it is largely water, 90 pounds in a hundred being water. In other words, in 100 pounds skim milk there are only 10 pounds food. Even with milk kept before them all the time to drink, laying hens will not get enough of it to supply the demand for animal food. If wet mashers are fed, by using skim milk to mix the mash they will get more of it in this way. By feeding it clabbered the fowls will get more food out of it. Probably the best way to feed milk is to make "cottage cheese" out of it. This is a splendid food when properly made. In that form fowls will consume enough to supply the demand for animal food. Our Dairy department makes it in this way:

"Set a can of skim-milk in a place having a temperature of 75° to 80°. In 18 to 24 hours the milk will coagulate (thicken). Then break up into pieces the size of large peas or smaller; set can in a pail of hot water, stirring the curd until a temperature of 90° to 95° is reached; hold at this temperature for 15 or 20 minutes, without stirring. Then pour the contents of the can into a cotton sack and hang up where the whey can drain off." The milk should not be boiled. Salt it a little. It will keep a day or two. *Beef Scrap* is the most convenient form in which to feed animal food. This is a by-product of the large packing houses, and contains meat and bone in varying proportions which have gone through a boiling process and then dried. It contains therefore little moisture compared with fresh meat scraps. It varies considerably in composition or quality, but should contain from 50 to 60 per cent protein. Beef scrap varies also in quality. It should be light colored with a meaty flavor and somewhat oily to the touch. When boiling water is poured over it, it should have a fresh meaty flavor. If it gives off a putrid odor, don't feed it.

GREEN FOOD.—"The hen turns grass into greenbacks."—Green food of some kind is an essential part of the fowl's ration or diet. Their health and the demands of egg production require it. The lack of a sufficient supply of green food is one cause of the scarcity of eggs in winter. During the summer the farmers' flocks, which furnish the markets with the large proportion of eggs and poultry, usually find all the green food necessary, and in winter, the farmer not realizing the importance of green food, the chickens do without it and we do without the eggs. Spring is the natural laying season, but by seeing



A 20-lb. thousand-headed kale plant. Green food of some kind is an essential part of the fowl's ration.

to it the fowls get the same kind of food in winter that they do in spring or summer, it is possible to overcome largely the egg famine in winter. Fowls should have all the green food they will eat at all times. Green food is cheap, or should be grown cheaply with good management.

Green food may be fed in different forms. *Clover* or *alfalfa* or grass in the fields; clover leaves or alfalfa leaves in the hay mow or in the hay stack, make excellent green food; vetch, peavine, rape, rye, kale, mangels, sugar beets, cabbages, or

turnips will fill the bill. It will be noticed that these green foods have a larger percentage of mineral matter or ash and of protein than the grain foods. Alfalfa and kale are especially rich in protein and ash. Clover, alfalfa, grass, rape, kale and vetch will give good color to the yolk of the egg; beets will not. Alfalfa and clover will give eggs of good quality and flavor. Kale, cabbages and rape will give a slightly undesirable flavor to the eggs if fed heavily, but not enough to injure their selling value materially, if at all. In western Oregon and the Pacific coast generally *Thousand-headed kale* (R. 8) is probably the most profitable crop to grow for winter forage. Here it grows to perfection, and an acre may be made to produce 40 tons of green forage. For winter green food, kale is transplanted in July from seed sown in May or June. For summer forage it is planted early in the season. It is possible in western Oregon to have green kale the year round. For a flock of 100 hens about 200 plants will furnish green food enough for a year where the soil has plenty of fertility and moisture. The plants should average 20 pounds each. The chickens will eat about half the weight of the plant, the balance being stalk which they do not use. Cattle will eat most of the stalk. Planted in July the kale may be fed from October to April. Planted early in the spring from seed sown in the fall it will be ready for use in the summer. In the early part of the season the lower leaves may be stripped off and the rest of the plant will continue to grow. The plants are set about 3 feet apart each way. A very small piece of ground, therefore, will grow enough kale for 100 hens. A strip of good land 16 feet wide and 100 feet long should furnish enough green feed in the form of kale for 100 hens. At that rate an acre of kale will furnish green food for 2,500 hens throughout the year. Kale may also be utilized for shade for fowls. Where fowls are yarded, by having double yards, it is possible where kale grows the year around to make it furnish the green food and shade all the year. Kale will keep the yards in sanitary condition, turning the manure and filth into a revenue. The importance of clean yards was emphasized in Lesson 2.

"Oats and peas sown together very thinly, with a liberal seeding of red clover and a very little rape, make a good combination. The oats and peas furnish a rapid growth of green food, a good deal of which will get tramped down and some will go to seed, but it will serve to protect the clover and rape, which

will make good food for late summer and fall pasturage. Three pecks of oats, two pecks of peas, one pint of rape seed and five quarts of red clover seed will be a good proportion for seeding. The oats and peas should first be harrowed in deeply, then the clover and rape seed should be mixed and sown, then lightly scratched in with a weeder.—(*Prof. James E. Rice, New York Agricultural Experiment Station, Ithaca.*)

Potatoes may sometimes be fed for variety, if boiled and mixed with a mash, but they are not a good egg food; they are better fitted for fattening. Cabbages are very much relished. Apples of sour varieties should be sparingly fed to poultry. On the whole, clover and alfalfa are probably the most satisfactory green food we have. In coast regions, where it grows throughout the year, the thousand-headed kale by reason of its heavy yielding quality throughout the year is probably the most profitable green food to grow.

GRIT.—“The hen coins silver out of sand.” The chickens need grit as well as the poultryman, but of a different kind. There are two views about chicken grit, and I don’t pretend to reconcile them. One view is that the chief function of grit is to grind the food; the other is that grit itself is food. Whatever the function, we know that grit is a necessary part of the diet, and the health and productiveness of the fowls require a liberal consumption of grit. On most farms where the fowls have the liberty of the fields they will pick up all the grit necessary, but on soils having little or no sand or gravel, and where the fowls are confined in yards, it is absolutely necessary to furnish grit just as regularly as food. With a gravel bed located near the poultry yards, the grit question is easily and cheaply solved. Give them plenty of sharp gravel and sand to work over. Where this is not available, grit may be cheaply purchased at the poultry supply houses. Keep it where the hens can get it at any time.

EGG SHELL MATERIAL.—Ordinary grit probably furnishes material for egg shells, but in addition it will be found advisable to feed special shell material. The grains do not contain lime enough to furnish sufficient shell material for heavy laying hens. Ordinary sea shells and especially oyster shells are largely used for this purpose. They are very readily dissolved in the gizzard. The egg-eating habit among hens is sometimes acquired because of a scarcity of lime or shell material in the ration. Charcoal is a bowel regulator, and most of the suc-

cessful poultrymen feed it regularly. It may be kept in a box or hopper where the fowls can eat it at will. *Salt* is an aid to digestion. It may be fed at the rate of about an ounce or two ounces per day to 100 hens.

PEPPER is stimulating and should not be fed except in very small amounts. Hens in good health do not need it. It is sometimes useful in case of sickness in the flock. If the flock should be afflicted with colds a little red pepper may be mixed in the soft feed.

RATIONS.—The following table shows five rations for laying fowls, numbered from 1 to 5. Number 1 is rated as the poorest of the five and number 5 the best. Corn is the only grain food in ration 1. Number 2 is a similar ration with wheat the only grain. Number 2 is placed ahead of number 1 because it has slightly more protein. Both of them are deficient in the egg-making material, protein. Though not ideal rations by any means either 1 or 2 would be an improvement on the average ration fed on the farms, but for heavy egg production they have not enough protein. Number 3 is a better ration than numbers 1 and 2 because it has a variety of grains and a little more protein. Numbers 4 and 5 should give a heavy egg yield if properly fed. They are equal in protein, but number 5 has more fat or heat-producing food. To what extent fat in the food influences the egg yield is not definitely known. In experiments by the writer (R. 4) rations containing a liberal amount of fat gave a better yield than others of little fat. Our experiments have shown that fowls eat more food during the cold weather than during the warm. This is because it requires more food to keep up the heat of the body, and for heat-producing purposes cheap fat foods serve the purpose as well as expensive protein foods. Corn, which has more fat than wheat, should be fed more liberally during the cold weather than during the summer. Ration 5 therefore should be a better winter ration than 4, because it has more corn, and it is possible that ration 1 would give better results in winter than No. 2 for the same reason.

The following are suggested rations for one hen for a year, and estimated relative value of each. Weights are in pounds. The choice of animal food is left to the feeder in each case, 30 lbs. skim milk, 10 lbs. cut bones and 5 lbs. beef scrap being estimated as of equal value. Likewise green food, 15 lbs. of green alfalfa or clover being equal to 20 lbs. of green kale.

RATION NO.....	1	2	3	4	5
Wheat .....	..	60	40	30	20
Corn	60	..	..	10	20
Oats .....	..	..	10	10	10
Bran .....	..	..	10	10	10
Middlings .....	..	..	5	5	5
Linseed Meal.....	..	..	..	5	5
Skim Milk, or.....	30	30	30	30	30
Cut Bones, or.....	10	10	10	10	10
Beef Scrap.....	5	5	5	5	5
Alfalfa or clover, or.	15	15	15	15	15
Kale	20	20	20	20	20

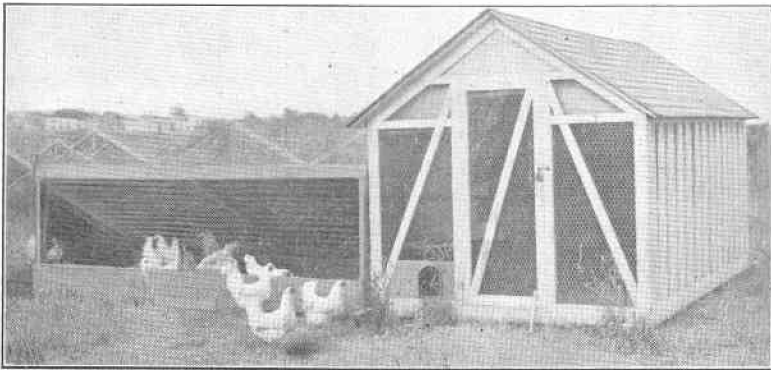
The table gives the feeder the option of three kinds of animal food, namely, skim milk, cut bones and beef scrap. I estimate that 30 lbs. of skim milk is about all that a hen will ordinarily consume. By making the milk into cottage cheese and feeding the fowls all they will eat of it, I believe cottage cheese would meet the requirements for animal food. Milk when closely skimmed has very little fat, while bones and beef scrap have a large amount of fat, and it can therefore be fed to advantage in rations that in other respects are richer in fat than would be necessary or advisable where cut bones are fed. Ordinarily fresh cut bones will give better results than either skim milk or beef scrap.

It is not very material what kind of green food is fed. The safest rule is to give the fowls all the green food they will eat. Alfalfa and clover have about equal feeding value, alfalfa having a slight advantage. Kale has a higher percentage of water, and on that account about 20 pounds of kale should be fed to take the place of 15 pounds of alfalfa or clover.

METHODS OF FEEDING.—No ration, however well it may be compounded or balanced, will give good results unless it is well fed. That is, the method of feeding has a great deal to do with the results.

ACTIVITY IS THE LIFE OF THE HEN.—The vigor of the hen comes largely from her activity, and it is the vigorous hen that lays. The reason hens on free range often do better than others confined in yards is largely because of the active life they live.

Under the free range system the poultryman need concern himself little on this point, but when fowls are confined in yards, which is an artificial condition, great care must be taken to furnish the exercise or the incentive to exercise. A hen that "stands around" all day, only exerting herself enough to eat out of a hopper, is an unproductive hen. The exercise is best furnished by providing a roomy scratching floor or shed covered with a deep litter of straw. This may be from eight to twelve inches deep, and should be kept reasonably dry. The whole grain food should be scattered in this straw. There will be no waste in this, as the fowls will find about every kernel. The skill of the poultryman comes in feeding enough at a time, without having to feed too often, to keep the hens busy at work a large portion of the day. If too much is given at a feed the



A cheap straw shed will keep the fowls busier and therefore more productive.

fowls will soon satisfy their appetites, while if too little is given they will soon clean it up and there will be nothing to scratch for. It isn't necessary to keep them scratching all day. Leghorns, for instance, will do nearly as well when fed in a hopper or box. If they have a yard and a floor they will exercise themselves whether compelled to dig for their food or not. Forced exercise, however, is necessary for the larger or less active breeds. In an experiment (R. 4) three pullets kept in a small pen on a board floor without any litter, laid 116 eggs in a year, an average of 38 2-3 eggs each. One of these was a Leghorn pullet which laid 52 eggs. Leghorns fed in straw averaged 169 per fowl, and others fed in boxes or hoppers averaged 161. Two pens of Plymouth Rocks averaged

141 fed in straw, and two fed in boxes averaged 118 eggs each. In each case the ration was the same. It is seen here that the method of feeding was responsible for a variation in yield of from 52 eggs per fowl to 169. The experiment showed that no exercise, or forced idleness, was ruinous both to production and to health of fowls. Second, it showed that Leghorns, or the active breeds, will do well even though they are not forced to scratch for every kernel of grain, but the heavier breeds need some "forced" exercise.

Feeding yarded fowls in the litter, therefore, is a decided advantage with some breeds, and it is not detrimental to any breed. A Leghorn given the liberty of a yard and a floor to scratch on, even though all grain be fed in a hopper or box, will take exercise enough to produce well. The chief disadvantage of feeding in the litter is that the grain is liable to become contaminated with the droppings of the fowls, which is a fruitful method of carrying disease from one fowl to another. This method, however, is usually necessary with most fowls, and with care in renewing the straw often enough little danger need be feared from this source. The droppings from the fowls at night should not be permitted to mingle with the litter.

GROUND OR UNGROUND GRAIN.—It pays to feed part of the grain ground. It is a saving of energy, and energy is furnished by the food; therefore, it will save food to grind some of the grain for the fowls. It is more quickly digested and assimilated ground than whole. The hen can manufacture the eggs faster with ground food than whole grain. Experiments (R. 9) by Wheeler showed that fowls having half their grain ground and moistened required 20 per cent less food to produce a dozen eggs than fowls having all whole grain. Fowls, however, relish the whole grain, or a large percentage of it whole. Probably one-third of the grain ground would be a safe limit to feed. The danger in feeding one-half or more of it ground would be that they would be liable to lose appetite and not eat enough to fill the demand for heavy egg yield. When a third or more of it is fed ground it should be fed in the afternoon in preference to the morning. If fed heavily on wet mash in the morning the fowls would gorge themselves and would not be as active the rest of the day as if fed a light feed of grain in the litter in the morning. A good feed of mash about an hour before going to roost, followed by a feed of whole

grain, will give satisfactory results. In cold weather especially the practice of feeding whole grain liberally the last feed of the day is a good one. Whole grain will "stay with them" better throughout the long cold night than mash, and keep up the heat of the body better. It will save feeding in the morning if at the last feed at night enough grain is thrown on the litter to more than satisfy the fowls and leave some for them to begin scratching for in the morning. If light mash feeding is practiced I would prefer to feed it in the morning, just as soon as the fowls come from the roost, but to feed only just as much as they will eat up clean, so they will go to work scratching in the straw for the whole grain. It is not so material at what time of the day the soft food is fed as it is that the fowls be kept active and retain their appetites.

FEEDING THE RATIONS.—The following method will give good results in feeding rations 4 and 5. Mix the bran, middlings and linseed meal with water or skim milk and salt it a little. Mix it into a crumbly mash and feed it the first thing in the morning, but don't give them more than they will eat up in thirty minutes. Shortly after, scatter a little wheat or oats in the litter and kick the straw over the grain. Feed them enough to keep them busy during the forenoon. About noon scatter a little more grain in the straw, and about an hour before sundown give them all the wheat or corn they will eat, so they will go to roost with a full crop. Keep dry straw in the pen all the time. Where the fowls have free range it will not be necessary to feed them so often, as they will get exercise wandering over the fields.

DRY OR WET MASH.—Dry feeding saves labor. Fowls relish the wet mash better. Wet mash economizes in the ration. By feeding the mash dry it may be fed once a week in hoppers. When fed wet it must be fed once a day. Fowls will eat wet mash more greedily than dry, and for that reason more care is required in feeding it. If given too much they will gorge themselves and stand around lazily most of the day, which should be guarded against. Where skim milk is available it is possible to cheapen the ration by feeding wet mash. Cheap by-products, such as bran and middlings, may be made to make up a large proportion of the ration by mixing them with milk. By making a mash with the milk more milk may be fed to the fowls. It will also cheapen the ration where skim milk is cheap and save on higher priced animal foods. Where heavy

feeding of ground grain is desired it should be fed wet.

When skilfully fed I believe the wet mash will give better results in egg yield than dry, though this has not been clearly demonstrated by experiment. Results of experiments by Rice are slightly in favor of dry mash (R. 10). Gowell also secured results favorable to dry feeding (R. 11). In mixing wet mash, enough water or milk should be used to make the mash crumbly. It shouldn't be sloppy. Usually about half as much ground grain, by weight, as milk or water will be about right, the amount to use depending on the kind of grain used.

Cut bones may be fed every day, or three times a week, as much as the fowls will eat up clean in 15 minutes. Three to four ounces per hen per week may be fed. More should be fed during heavy laying than at other times.

In feeding dry mash, it should be fed in hoppers or boxes large enough to hold about a week's supply, and the fowls allowed to eat it at will. Beef scrap is fed in the same way.

BOILING FOOD.—It doesn't pay, usually, to boil foods. Most foods give better results when fed raw. Starchy foods, such as potatoes, are improved by boiling, but usually it is better not to boil foods. In feeding raw meat foods there is some danger of the fowls contracting diseases. If liver or lights are fed they should be boiled to kill any disease germs there may be.

CLEANLINESS.—It is important that feeding troughs and drinking vessels be kept clean. They should be scalded frequently with boiling water. Do not throw feed on dirty, filthy ground. (Lesson 2).

CHANGING THE RATION.—Radical changes in the ration should be avoided. The feeder should first map out his system of feeding and stay by it. Remember that the food and feeding isn't everything, and when the fowls are not laying do not conclude that it is the fault of the ration unless you have definite knowledge that it is. A sudden change to new food, even though the new food may be better than the old, will check egg production for a considerable time. If changes are to be made, it is better to make them gradually.

REGULARITY.—Stated times should be given to the feeding. A "feast and a starve" won't satisfy the laying hen. During the winter the hen should go to roost with a full supper to sustain her through the long night, and just as early as she can see to eat in the morning her breakfast should be ready.

SUMMING UP.—Feed wholesale food; feed liberally; feed regularly; feed a variety. After that, the only secret in feeding to feed *activity* into the hen.

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