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EXTENSION SERVICE

Bulletin B. 10

AGRICULTURAL EXPERIMENT STATION LIBRARY

POULTRY IN TEXAS



ADDRESS

CLARENCE OUSLEY

Director of Extension Service, College Station, Texas

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS.

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\*Died January 17, 1916.



## FOREWORD

This bulletin consists in the most part of lectures delivered at the Agricultural and Mechanical College of Texas during the Farmers' Short Course by Dr. James E. Rice, Professor of Poultry Husbandry of Cornell University. Dr. Rice has recast them for this publication in order to put them in the most concise form. In addition, are to be found several short chapters by F. W. Kazmeier, Poultry Husbandman of the Extension Department of the A. and M. College of Texas, and T. J. Conway, Assistant Professor of Poultry Husbandry of the same institution. Thus the publication as a whole constitutes a complete treatise on the principles and practices of poultry breeding and raising and marketing as easily possible of development in Texas.

CLARENCE OUSLEY,  
Director of Extension.

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# POULTRY IN TEXAS

## CHAPTER I

### FEEDING POULTRY FOR EGG PRODUCTION.

BY JAMES E. RICE, B. S. A.

Professor of Poultry Husbandry, Cornell University, Ithaca, N. Y.

FRIENDS OF THE SUNNY SOUTH: I assure you that it is with great pleasure that I greet you here. I have known a good many students at Cornell from Texas, and they have never tired of singing praises of the blue skies of the Sunny South. You have unquestioned resources. I have been amazed as I came through the country on the train to see the vast fields of cotton and corn, and I realize that one of the things which is your greatest agricultural asset may be one which contributes to your discomfort this morning—the heat. But if you are uncomfortable, the corn and the cotton are revelling in it, and nothing contributes more to the feeding and clothing of the world than sunshine. You certainly have great opportunities for the development of Poultry Husbandry, and with all due respect to cattle, horses, hogs, sheep and mules, I feel that hens have an important place in the agriculture of this State.

Whether or not we realize any great wealth from the keeping of domestic fowls depends largely upon the intelligence, interest and effort which we put into the business. Heretofore, Poultry Husbandry has been looked upon as a side line, a mere auxiliary of the farm, the main interest being corn and cotton, hay and grain, or live stock of various kinds other than poultry. But today we are finding the demand for poultry products so great and the supply of the right kind so comparatively limited that probably no other one product today goes from the American farm that commands a greater premium or offers a greater promise of reward for the person willing to give the subject proper attention. Therefore, I think it is well that your Dean Kyle and others here who have taken such keen interest in the welfare of the poultry industry have arranged to devote one period a day, and most days two periods, during this course to this subject.

You undoubtedly have a wide variety of soils, some of which, at least, are adapted to the production of crops which will go to feed poultry profitably for meat or eggs, for the fancy market, and, with the fine asset of heat units from the sunshine to make things grow, this State should look to its poultry interests as one of the greatest live stock possibilities. The subject for this morning is "Feeding for Egg Production."

It seems to me we can not get a very fair or proper understanding of the subject of feeding poultry or the producing and handling of

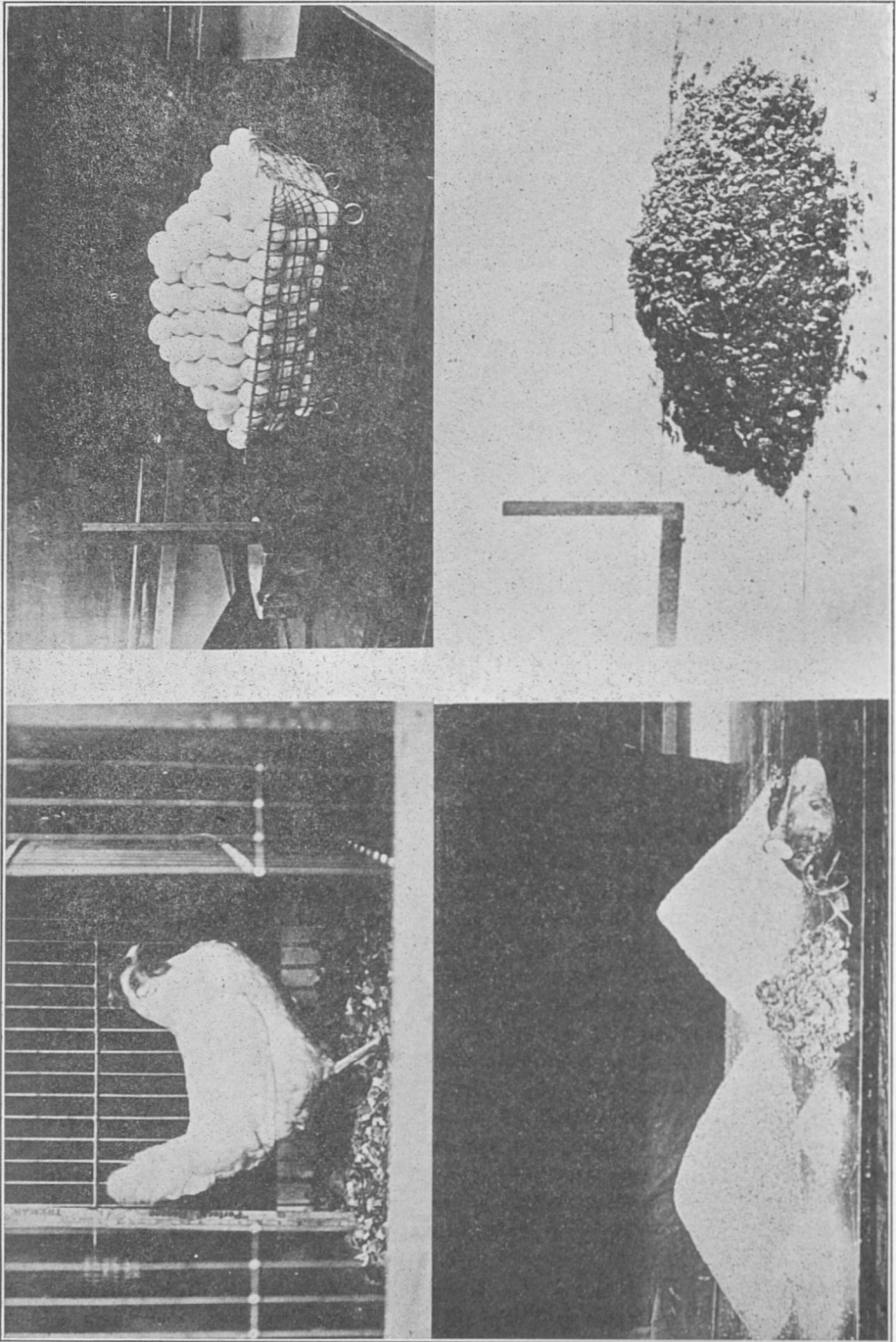


Fig. 1—A S. C. White Leghorn Hen, the food she ate, the eggs she laid and the droppings.



eggs without beginning with the fundamentals. In order to have a proper understanding of how to produce and how to handle eggs, we need to begin with the hen herself. Therefore, we will consider something of what takes place in connection with the manufacture of eggs. The production of eggs is as much a manufacturing business as is the manufacture of shoes, furniture or machinery. We are dealing, it is true, with a different kind of machine. We are dealing with a live, vital machine; one that in a measure renews itself when it wears out. This an inanimate machine will not do.

Here (Fig. 1) we have shown a little hen weighing not more than three and a half pounds, the raw material that she consumed in a year, the finished product, the eggs she manufactured, the waste material and the voidings. This will give us some conception of the nature and extent of the manufacturing process which takes place in the production of eggs when we have the actual weights in mind. This hen has consumed approximately 110 pounds of feed of different kinds in a year, has transformed the raw material into the finished product, and in that time has renewed her coat of feathers, recuperated her body, and is ready for the next year's business. This hen laid 257 eggs, weighing approximately 29 and a fraction pounds. From the 110 pounds of feed, this 3½-pound machine has manufactured 29 pounds of one of the choicest foods known. There is no food which will take the place of eggs. There is no real egg substitute. Eggs and milk constitute the two greatest human foods so far as animal products are concerned. There is no other food so digestible as the egg.

This hen produced 72 pounds of waste material, which, considering the fertility problems in modern agriculture, has a wonderful significance, because the effect of a live stock industry is soil building and not soil depleting.

This morning we want to see if we can learn some of the lessons connected with the manufacture of eggs by studying the machine concerned in their manufacture. We must recognize the fact that the production of eggs differs from the production of milk in this respect: that every egg that is laid is a part of a process of reproduction. In the case of the dairy cow there is but one reproduction in a year, followed by a nearly continuous secretion of milk; but in the case of the domestic fowl there is both reproduction and albumen secretion whenever an egg is laid. It is a good deal to ask of a little hen to produce the substance to make a chick 125 to 150 times a year, to say nothing of the phenomenal records of laying from 200 to 300 eggs per year per hen.

Dr. W. H. Jordan of the New York State Experiment Station figures that a hen weighing 3½ pounds and laying 200 eggs per year, consumes two and one-half times as much dry matter per pound of live weight as does the dairy cow weighing 1000 pounds, producing 7000 pounds of milk containing 400 pounds of butter per year. In other words, he concludes that the domestic fowl, because of her rapid breathing and great powers of digestion, the rapid consumption and use of food in the

manufacture of this product is the greatest example of the transformation of raw material into a human food product that we have today. So we see how easy it may be by improper feeding to break down the health of the hen, and this may account for much of the mortality among mature fowls or young chickens and the fertility and hatching power of the eggs.

Coming now to the reproductive system which has to do with the manufacture of eggs, we find growing from the muscular tissues of the back of the fowl a cluster of small ova (Fig. 2). This is called the ovary. The part which represents the baby chick is only a small speck, about the size of a pin head. A powerful magnifying glass will show the young ova beginning to develop at a certain age in all breeds. This takes place at approximately six or seven months of age (earlier in some breeds, and later in others). At this time the eggs normally begin to develop and the fowl begins to lay if the environmental conditions are right. That is to say, if the climatic conditions, matters of feeding and care and handling are right the normal flock of pullets will begin to lay with perfect regularity each year at a certain age, and if they do not do so the fault is with the breeding or with the care. It is believed by our best authorities that practically all fowls, whether high producers or low producers, have approximately the same number of ova, and this number has been estimated at from 1500 to 3000 undeveloped ova within the normal fowl. It then becomes a question of inheritance, a question of breeding to produce fowls that will inherit the tendency to develop these ova (Fig. 2). We may have hens that do not lay because they have not inherited a tendency to produce, or we may have normal hens which fail to produce because they have not been given the opportunity.

When the fowl prepares to lay, the ova enlarge until they become the size of the fully developed yolk. This process generally requires about ten to fourteen days from the time the ova are the size of small peas until they are the size of fully developed yolks. You can tell a week or two in advance of the time when the hens are going to lay by the way they eat. Whenever the ova begin to develop, the appetite of the fowl increases in order to supply nourishment for the rapidly developing yolks. When the yolk has reached full size the follicle that envelops the yolk ruptures at the point shown by the little white stigma which nature has provided shall break at that point to avoid rupture of blood-vessels. If you will examine the yolk when killing a fowl that is in a laying condition you will see arteries and blood-vessels on all sides coming up to that suture but not crossing it. It opens at that point and lets the yolk drop out into the oviduct without rupturing any of these little vessels and leaves the skin of the follicle to be reabsorbed. The operation is similar to the pressing of the pulp from the skin of a grape. If, through an injury to the fowl at this time by rough handling or because of weak vitality, there should be premature rupture of the follicle by which the yolk should fall into the oviduct, then there is an escape of blood which forms a clot. That condition fre-

quently happens in the production of eggs. We have found in the testing of thousands of dozens of eggs each year that on an average in every thirty dozen eggs we may expect one to show a blood clot. That one egg would have caused serious trouble if our otherwise fancy eggs should go onto the table where fancy prices are paid. That danger makes it necessary, if for no other reason, for us to test all eggs before they go to market. That is one reason why we get high prices for high quality.

When the yolk drops into the oviduct, the follicle shrinks up, but it never wholly disappears, so that it is possible, with a magnifying glass, to count the empty follicles and thus tell approximately how many eggs were matured by the hen during her life.

There are some practical problems in the management of hens involved in this knowledge. While the hen apparently has no power over starting or stopping the development of those yolks, she is largely in the hands of men so far as responding to environmental conditions is concerned. She cannot will to lay or not to lay. She can, however, decide to hold an egg a few days after it is ready to be laid.

Suppose the hen is in full laying and has from one to three yolks, all practically matured and many others partly so, and some condition occurs which disturbs her? It may be fright, it may be excessive heat, it may be a lack of feed or water, or it may be a lack of some simple thing, such as oyster shells, anything which disturbs her and causes her to fail to supply nourishment to complete those yolks. What does she do? If she still lacks the food to supply her body, she withdraws the nourishment from these yolks and takes it into her own body, and she in reality is boarding upon herself, or, as a matter of fact, is boarding upon you. She may be consuming eggs worth forty to sixty cents a dozen. Not many of us can afford to feed our hens on eggs at that price, and that is what may happen when the hens are not properly fed. We all know of instances where forty or fifty eggs are being gathered per day per hundred hens, when a different feeder comes the production goes down, but when the regular feeder returns the production will be likely to come back to normal. However, it is infinitely easier to stop a hen laying than it is to start her again. It is pretty good business when a hen has once started to lay to let her lay.

In the lecture on breeding I will give records of flocks showing individual production day by day and you will see that many of those which produce the highest number of eggs per day were hens that would deposit one of these yolks into the oviduct nearly as regularly as the day comes around, for weeks at a time, with scarcely a skip, and many others would deposit one nearly every other day for a week or so and then skip three or four weeks.

When the ova is deposited into this funnel-shaped opening of the oviduct (Fig. 2), it passes on through this organ, where the white of the egg is laid on. One other lesson to be drawn is that the yolk is the only part of the egg that contains fat (except the merest trace). Approximately 65 per cent. of the dry matter, or 10 to 12 per cent. of the normal yolk, is fat. Being the only fat in the egg, one can see

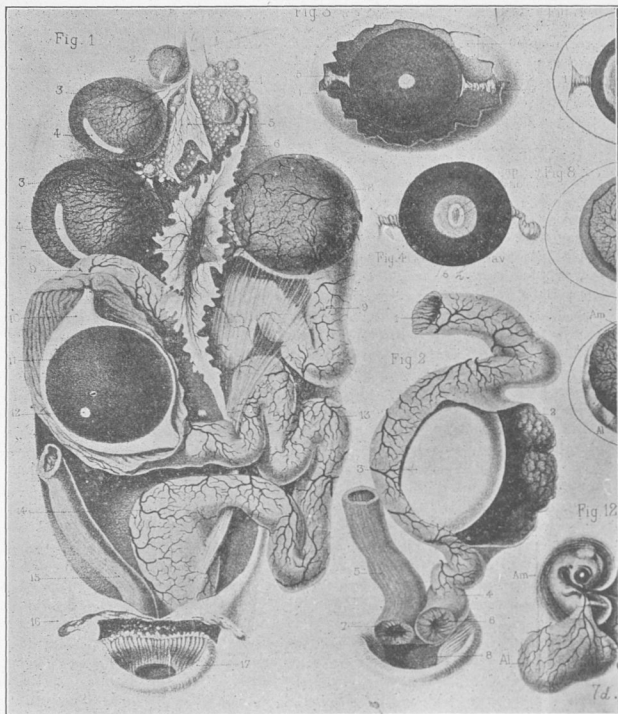


Fig. 2—The ovary and oviduct and the development of the egg.

how essential it is, if the hen is going to lay well, for her to have surplus nourishment to make fat to develop the egg. Unless a hen carries a surplus of fat in her body to supply the egg she will not lay. The first part of the egg to be made, the yolk, apparently takes a part of the hen's own body fat. Hence, it is that a hen which does not have extra body fat, the first food necessary to make the egg, cannot lay.

If each part functions properly, the yolk falls into the ova-sac. It is one of the most wonderful things in nature to note how all this development of the egg works in harmony. Whenever the yolk is ready



to be deposited, the open funnel of the ova-sac draws up and envelops the yolk and it works right on down into the ova-sac (Fig. 2). You will notice the yolk is larger than the ova-sac, so that it stretches the tube several times its natural size, and the excitation of the glands as the yolk passes along causes a secretion of the albumen,—the white. If it is a small yolk it moves more rapidly, there is less excitation, and less albumen is deposited. If it is a very large yolk, the reverse is true. So that, generally, there is a very automatic system of manufacture, which is so perfect that the proportion of yolk and white from which to develop the young chick is just what it should be.

It generally takes from twelve to eighteen hours for the yolk of the egg to pass from one end of the oviduct to the other and in that passage the yolk rolls over many times and three distinct layers of albumen are laid on. After, or just before, the yolk has received the proper covering of white the shell membranes are laid on. They are porous and when seen through a microscope appear like a silk veil, and are filled with mineral matter which is necessary to the development of the chick. The young chick absorbs the mineral matter from the shell membrane and air and moisture pass through, if the method of incubation is right. When the egg reaches the lower portion of the oviduct the shell is laid on. (Fig. 2.) This is made up of mineral matter. There is where the color pigments are deposited, which determines the color of the egg, white or brown or spotted, depending upon inheritance. A hen carries certain pigment glands in this part of the oviduct and as the eggs are laid in large numbers, the later ones of any given litter have a slight tendency for the amount of color pigment to decrease as the number increases.

You see, therefore, that in the feeding of our fowls we have to furnish a well balanced ration, because one part of the egg is made up more largely of fat and albumen or mineral matter. The shell is almost purely mineral. Within the normal egg is everything necessary to grow a perfect chick. Hence, if a hen is going to be able to lay eggs of perfect size or proper composition, and with good shells, she must have all those nutrients in her ration. If she is fed on so good a food as corn alone, she cannot make perfect eggs and keep in perfect health, because it is not a perfectly balanced food. And even if she has the best known combination of grain, including alfalfa, corn, wheat, oats, buckwheats, etc., she cannot lay 150 eggs per year and put the shells on them; in fact, she probably could not lay more than two or three dozen eggs at the most without extra lime in addition to the feed, either in the form of bone or oyster shell or old mortar, or something of that kind.

So we see from the study of the reproductive system of the fowl the necessity of having a well balanced ration.

You hear a great deal in the South, as we also do in the North, about the desirability of producing infertile eggs in order that we may have perfect keeping quality in eggs; and this will become vastly more ap-

parent when we come to understand the structure of the egg and the way it is fertilized.

In picture (Fig. 2) we see a little speck that is called the germinal disk. That is the spot where the little chick began to develop, on the surface of the yolk of the egg. In Fig. 2 you find an egg in which the fertilization has taken place and you see there a little light colored area which later becomes streaked with red in the case of a fertile egg, which does not occur if the egg has not been fertilized.

At Fig. 4, in Fig. 2, you find what takes place as early as 16 hours at ordinary incubator temperature, showing the red streak already developed.

Let us see what takes place. In order that we may have a perfect egg to hatch a perfect chicken, there must be the life giving quality of the little white speck on the yolk contributed by the female and the little spermatozons contributed by the male, and when the two come together life takes place and we get a new individual. Where eggs are infertile they may be incubated at 103 degrees for a week or ten days and then taken out, and, while not so desirable as fresh eggs, they will be acceptable to the average consumer as good, human food. Where large numbers of eggs are incubated the infertile eggs are readily sold for human consumption and properly so, if carefully tested and sold for what they are. They usually bring about half price. On the other hand, if they have been fertilized and held at the temperature of the incubator for 26 hours, they have made perceptible development and become worthless for food.

We are not always to blame for the failure of eggs to keep properly, because eggs may start to hatch before they are laid. Let us see about that. This fertilization takes place anywhere between the mouth of the oviduct and the point at which the yolk enters. When the yolk is broken from the follicle and falls into this oviduct there are myriads of these little spermatozons present. At that point fertilization takes place and from that time until the egg reaches the point of exclusion it is held at the temperature of a hen's body, which is 105 to 106 degrees, three degrees higher than the incubator temperature. A hen has the power of carrying in her body for several days an egg after it has been completed.

Dr. Edwards of Harvard University carried on a long series of experiments to determine at how low a temperature development of the chick would begin. He found that the egg of the domestic fowl begins incubation slightly below 70 degrees. We have many living rooms with a temperature of 75 to 80 degrees, and in the country stores in our State, where eggs usually are kept, the temperature many times reaches 90 or 100 degrees. What, then, must take place inside a fertile egg which will begin to incubate at 70 degrees? The hatching process begins.

On each side of the yolk of an egg is a white cord. These are called the chalazae. They have an important function. Anybody who breaks a boiled or raw egg and will examine it carefully may see the chalazae. Some people have sent eggs of this kind to the College, saying that they

thought they had eggs with worms in them. It would be possible for worms to get into eggs before they were laid, but it is not common. These hammock-like cords suspend the yolk in the white so that it will not rise or fall too rapidly, but will stay in suspension. When an egg is normal and unfertilized and is kept at a normal temperature the yolk will usually stay near the center, with only a slight tendency to go through the dense albumen to get to the top. It is lighter than the white of the egg. But it rises slowly, taking several weeks until it touches the top. If the egg lies in dry air, so that evaporation goes on freely, the yolk sticks to the shell. Then, if you turn it, there is the tendency to rise again, and if you handle the egg roughly you have an addled egg. That is why eggs kept for hatching purposes or for table use are kept on the end instead of the side. There is a greater tendency for the yolk to remain in the middle.

If the egg is fertile and subjected to heat, then a change takes place in the yolk and in the white. It makes the white watery and the yolk thicker and denser, as in the case of eggs which we call "heated." Here the tendency is for the yolk to go downward instead of upward.

We can account for most of the phenomena in the handling of eggs. Why do those yolks go to the top? Nature has thus provided for the protection of the young chick by making the bottom of the yolk opposite the germinal disk heavier, so that the yolk will always float like a bottle half filled with water. Whichever way the hen may turn her eggs, the little germinal disk will bob up on the upper side nearest to the body of the hen, instead of being left in contact with the lower side, near the cold ground, as might be the case if nature had not provided otherwise.

In Fig. 3 we have some muscular tissues taken from the back of the fowl. This is the ovary and imbedded in the tissue are these ova, which are so small that one can hardly distinguish them. Occasionally you will find two in one follicle. There may be two inside of one sac. Once in a while a double-yolked egg is formed by two yolks developing at exactly the same time, and both falling into the oviduct together. They pass along and are encased with albumen and are covered with the same shell. There being twice as large a volume of yolk, there will be nearly twice as much albumen and we get an immense egg. Usually this tendency to lay double-yolked eggs is an individual characteristic of certain hens who will repeatedly lay double-yolked eggs. Some persons have had the idea that the double-yolked egg is an egg laid at the beginning from an accumulation of material, just as they consider the little egg the last one laid when the hen has done her best with what she had left. That is not what happens in the manufacture of eggs. Frequently a hen, because of some disturbance, will not have all of the material necessary to make a perfect egg and under the circumstances may lay the yolk without the white being deposited. Occasionally there has been an excitation within the oviduct, sometimes caused by excessive eating of meat, when the white will be secreted without the yolk; and occasionally an excitation causes the oviduct to contract and force an egg back. We have had a half dozen or more eggs sent to the College where one egg was inside another, and in two or three there were three

eggs, one within the other. In this case the first egg, usually a small one, came down to where the shell was put on, then it was forced back, returned again and each time a shell was put on. In the last mentioned case a third shell was put on in the same way.

In Fig. 3 we see a magnification of that little germinal disk showing this little hollow tube leading to the center where there is a little gelatinous substance which contains a very important nutriment for the development of the chick. As soon as it is fertilized and heat is applied, granulation takes place (Fig. 3). This shows how the cell tissue granulates and breaks down. If you take a fresh egg from a healthy hen and break it in a saucer, the yolk will stand up perfectly round with a dense white albumen surrounding it and slightly more watery on the outside.

If that egg had been fertile and had been kept under heat for a day

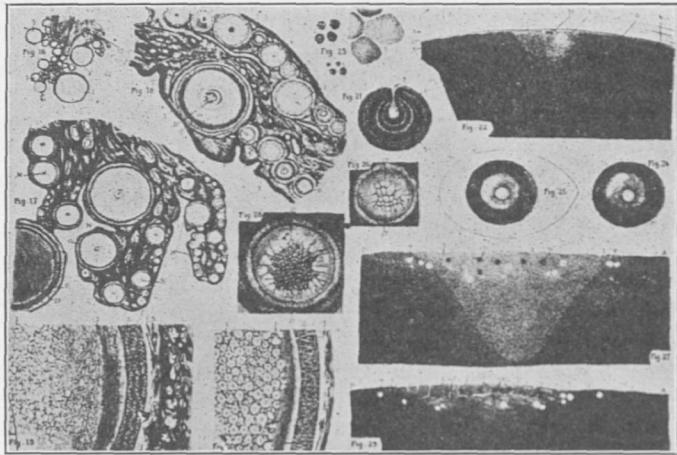


Fig. 3—Some muscular tissues, very much enlarged, forming the ovary, taken from the inside of the back of a fowl.

or so, the vitelline membrane would have been weakened and would have stretched so that the yolk of the egg would have been flattened. That condition would have continued until finally it would be impossible to break open the egg, even with the greatest care, without breaking the vitelline membrane.

Hence, if we desire to produce good eggs, the first point is to have good healthy hens; second, proper food to make every part of the egg. When the hens have laid many eggs and are all tired out, the shell becomes weaker, the egg does not beat so well and generally it is not so good an egg to hatch. If we are to secure the best food product, we should not allow the egg to be fertilized, because it hastens the process of disintegration. If such eggs are to be kept at all, they should be kept at a temperature at best below 60 degrees; indeed, it should be, if possible, around 45 or 55 or colder. If the egg is properly made, kept clean and unfertilized, it can be put in a room at ordi-



nary temperature and kept for months without any noticeable evidence of decomposition. It will become dry, will evaporate until there is nothing left but the hard, dry substance at one side of the egg. But it must be kept clean. The shell is porous and if the egg be kept where it is too warm and wet, moulds will develop. If the air be too dry, then the moisture is taken from the egg too rapidly. It is a question of getting a desirable condition of cleanliness, uniformly cool temperature and proper distribution of humidity.

If we should have this egg with its porous shell come in contact with a bad egg—we know the old adage, "Evil associations corrupt good manners"—we would expect that bad eggs coming in contact with good eggs would be likely to do the same thing. If you were to take a dirty egg and wash it, and then put the egg in contact with dirty eggs, you are infinitely more likely to have trouble, for the reason that, in the last part of the process of manufacture of the egg the hen secretes a mucilaginous substance, which makes the depositing of the egg easy and has a tendency to seal over the pores of the shell. When you use vinegar or any acid to clean the egg, or wash the egg, it takes off this substance so that the air, with its millions of bacteria, may pass through. The best way to get clean eggs is to have clean nests in clean houses, clean stock and clean hands.

You can place eggs in connection with materials having offensive odors, like kerosene, gasoline, etc., or those having not necessarily offensive, but pungent odors, like bananas, and they will take on these odors so strongly as to make them unsalable. This same thing applies to the feeding of hens; onions, for instance, in very small quantities, will completely saturate the egg so that you not only can distinguish the flavor when the egg is eaten, but can detect the odor instantly when the egg is broken. We have run several series of experiments in feeding six or eight kinds of strongly flavored foods and the onion has shown the greatest tendency to taint the egg. Heavy feeding of cabbage generally does not do it.

We will now consider the best physical condition of fowls for egg production. A proper understanding of the question is at the foundation of the successful feeding of fowls. In a measure what I shall say is contradictory to what is ordinarily accepted in regard to the best condition of a hen for egg production.

The best laying condition of a hen is when she is in the best health and an animal is in the best health when it has some surplus fat in its body. Fat means surplus energy. We may have a surplus of fat that may be dangerous. We have examined hundreds or more of hens by cutting them open, photographing them, making measurements of their various organs and noting the amount of fat in their bodies. We have never yet found hens in good laying condition that were poor. On the other hand, we have found hens so excessively fat and laying that we would have killed them because of their surplus fat. Nothing will prove a point like actually seeing it. In this picture (Fig 4) is shown a hen which is excessively fat. She had at least a pound and a half of solid fat in her body. She was so fat that her abdomen nearly

dragged on the ground. She was picked out as the fattest hen in a bunch to sell, with the idea that she would bring about \$1.25, and the man would get his money's worth, because a hen in that condition, if in good health, makes the tenderest, juiciest, best flavored meat.

Much to our amusement, when we cut the hen open to prepare her for the table, we found she had an egg in her body hard shelled, ready to be laid, and that if we had not killed her at the time we did, she probably would have laid within a few hours. Her body was filled with well developed ova in a condition which showed that she would have

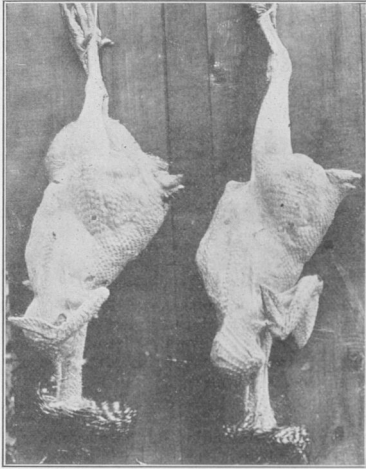


Fig. 4—A hen excessively fat and one very poor.

gone on laying for weeks to come. I have asked persons all over the country about their observations and they say the same thing, that hens that are killed when they are laying are fat. What does the lesson teach us? It is this, that in feeding fowls, we must first find a ration which is properly balanced, so that it will give the hen an opportunity to continue to lay well and still carry fat, and then to feed the ration so as to prevent the hen from dying of fatty degeneration. We must see to it that, by exercise and proper balancing of the ration, while she is carrying a proper surplus of fat that this surplus is prevented from becoming excessive.

To give a little stronger proof of this point we made a photograph

of six hens (Fig. 5), three of the fattest and three of the leanest, from some forty or more hens which we killed. They were killed early in the morning, one immediately after the other, as fast as it could be done. Each one was opened up without picking, as you see here. Those three hens shown on the left were the three fattest and those on the right the three leanest. They were all of the same breed and fed the same way. There was not a sick hen in the lot. We placed the gizzard, liver, ovary and oviduct of each hen directly underneath the fowl from which they had been removed. You see what we found. Each one of the three fattest hens had a hard shelled egg in her body ready to be deposited and a half dozen or more yolks fully developed. These three leanest hens show the oviducts so shrunken that they were not over five or six inches long instead of two feet long, and they would have been incapable of laying an egg under five or six weeks, because they were dormant. This and many other observations prove beyond any question or doubt that a hen to function normally and lay well must carry extra fat.

Fig. 6 will show this fact in a different way. Here you see some plotted curves, which show variations in amount of food consumed in the weights of the fowls and the eggs they lay.

Let us follow these solid lines and see the trend of the curve from August through to the following November. You notice the amount of feed consumed is falling until it reaches November, then it goes up and up until it reaches the highest point in March, April and May, when it begins to come down. In June it takes a little upward jump and then falls lower until the following September and October, when it again goes up. You will find the line of body weights follows the same general trend. Whenever there is decrease in amount of food consumed, very soon after there will be a decrease in weights; an increase in food consumed being followed by increase in weight. The highest point in food consumption is about coincident with the highest point in body weights except as it is interfered with by egg production.

Following the fluctuation of the curve representing egg production, we see that a decline in food consumed and decline in weight is followed by decline in production, and, as the foods consumed and the weight increases, egg production usually increases. Thus, we see that the curves representing food consumed, body weight, and eggs produced, are nearly perfectly correlated.

Here is the significance of the relationship between amount of food consumed, the body weight and the eggs produced. Hens laying must have all the food of the right kind that they can consume. They will not lay unless they do have sufficient food to produce this condition of surplus fat in the body. The fact should be emphasized that, as a general rule, farmers make the mistake of underfeeding rather than overfeeding. In one meeting where I was emphasizing the need of providing plenty of feed for the hens instead of assuming that they can pick up their own living, an old man arose and said, "Not for me! My hens have not been laying a dozen eggs a day for the past three months and

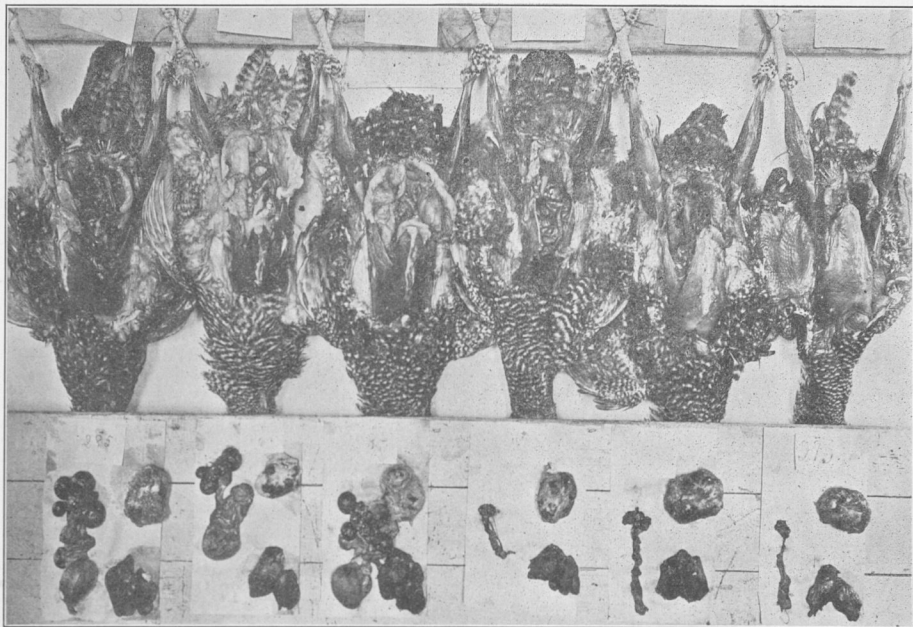


Fig. 5—Three fat hens, three poor hens, and the respective ovarian condition in relation to egg production.



I don't propose to give them any more feed until they lay more eggs." The trouble with this man was that he was three weeks "behind the procession." There must be first an increase in feed, and, second, an increase in weight or there will be no increase in eggs.

The first law of nature is self-preservation. The hen will take care of herself before she will take care of us. She will increase her own weight, put the surplus fat in her body and get ready to lay before she begins the process of manufacturing eggs. She does not prepare for one egg. If it were a question of laying simply one or two eggs, it would be a different matter, but when a hen responds to nature's call to perpetuate her kind, she follows the law of animal kind to first put her own body into a condition to nourish her family. In accordance with the laws of reproduction she fortifies her body by storing up energy and prepares to make a whole litter of eggs. When once ready to lay, a hen may lay several eggs, even though after beginning to lay she may not be properly fed. She will stand abuse and privation for many days in order to make the litter of eggs complete, even though she must give from her own body to do it. At the end of that time, however, she will quit and one cannot get her back to laying again until she has stored up surplus egg making material.

The point I am trying to make clear is that, if we are going to make money out of hens, we must do so by maintaining them in perfect health. This means to give them sufficient food of the right kind with which to manufacture eggs. This principle is true in the case of any productive animal, such as the cow, and we may be sure that if we will give the hens the same intelligent care and feeding that we give to other animals they will reward us in like proportion.

The problem of the successful feeding of poultry in large numbers for profit involves a good many considerations. Ordinarily a person thinks of but one, namely, the number of eggs which he can persuade his fowls to lay in a given time. This is but one and, though one of the important factors, it is not necessarily the most important.

The most important consideration in the successful feeding of poultry, first, above everything else, is the maintenance of the normal health of the hen. We can feed rations which will stimulate egg production beyond the normal, and make us pay the penalty, not only in this generation, but, worse still, in the next generation. The most fundamental principle of successful poultry husbandry is stability. The ability to continue in the business depends upon success in hatching and rearing of chicks. This is the hardest part of poultry keeping. Success depends upon the ability to rear healthy stock which will lay fertile and hatchable eggs. More people have gone out of the poultry business because of their inability to hatch and rear chickens than from any other cause. One of the remedies is to keep healthy parent stock. The method of feeding has much to do with the health as well as production and hatching.

In deciding upon a ration we must find what quantity can be fed our stock to insure perfect health. There are a number of mistakes which can be made in feeding as regards the health of the fowl, and one

is in feeding rations too concentrated, too rich in nitrogen, the elements that go into the compound known as protein. We have the nitrogenous group of substances which go primarily to build up the muscular tissue of the animal, in the making of part of the yolk and all of the white of the egg. We have a class of foods exceedingly rich in this particular element, so much so that they are decidedly abnormal, as we find them on the market. They are not necessarily abnormal as nature left them. I refer to cottonseed meal, pea meal, and flaxseed or linseed meal, peanuts, etc. These are the richest protein foods aside from meat. The linseed meal will contain 28 or 29 per cent. protein; cottonseed meal, 37 to 40 per cent. and sometimes more; pea meal, 25 or more per cent.; meat scraps, 50 per cent. We have compositions as high as 60 per cent. In contrast to that we have corn meal, which has less than 10 per cent. protein. In other words, there is in 100 pounds of these protein-rich feeds in the neighborhood of three to five times as much protein as we get in 100 pounds of corn meal, and they are many times as concentrated. The effect of feeding too largely on that kind of feed is that, not having enough of starchy matter and fat material to properly balance the ration, the fowl's body is unduly taxed in an effort to adjust itself to an unnatural condition and the first evidence is excessive thirst, the hens drinking much more water when they are fed on this rich, nitrogenous, concentrated product. The second effect is that the fowl's kidney and liver, in the attempt to throw off this excessive amount of nitrogen, are overtaxed and the digestive tract breaks down and the fowl fails to respond even to what ought to be the best feeds we have. It is just as if a person would undertake to live entirely, or nearly so, on lean meat or upon a legume like beans, which would have about the same composition as that of cottonseed meal or oil meal.

What is the remedy? We should not drop out the pea meal or cottonseed meal, or oil meal. They all have value and should be fed in proper proportion, if they can be purchased economically; but they should be fed in connection with foods lacking in nitrogen or protein, but rich in carbohydrate material.

The second mistake as regards health would be the feeding of corn exclusively. The person who feeds entirely or very largely on so good a food as corn, or its second cousins, milo maize and kafir corn and sorghum, will be making as serious a mistake in the opposite direction as the one who feeds excessively on linseed, cottonseed or pea meal, because they have at least a third and sometimes one-half more starch and fat as do those meals, as we get them on the market, and as I have already said, have less than one-third as much protein. They also lack mineral matter. Everyone recognizes the fact that corn is relished by fowls beyond almost any other food. They like other things when properly presented; so the thing to do is to mix them together in order to avoid the evils of feeding either one alone. We will get the better results, because we will have a healthy hen to use the materials successfully. Any person who feeds an unbalanced ration in either extreme will find that the animal will fail to give effective results because the

machine is inefficient; because the machine cannot work. But just as soon as we balance the ration and the machine functions properly we should get satisfactory results. Without it, we do not get eggs and are likely to get the hen out of condition and have weak chickens.

Another thing affecting the health of the hen is our failure to appreciate the importance of mineral matter. By mineral matter we mean the ash of the plant, the material which goes to make up the bone of the animal and the egg shells. Some foods are very deficient in mineral matter, while others are very rich. Alfalfa is rich in mineral matter, while corn is deficient. But putting the ordinary grains and mill feeds together does not give enough mineral matter to supply a flock of fowls in heavy laying with mineral matter, and, unless we make use of oyster shells or something of that kind, the hens cannot make the best use of the food supplied, because the bones will weaken and the egg shells will be soft. Fowls, first of all, maintain the body, unless they have started to lay. If the animal has started to reproduce, it may seriously sacrifice its body for the sake of making a perfect offspring, so that when a hen starts to make an egg she will attempt to make that egg perfect, even if by doing so it weakens her own body. We fed some hens for eleven months without mineral matter as an experiment. They ate nearly every egg they laid and the bones became so soft that they would break under a stress of eight pounds less weight than it takes to break them under ordinary conditions. One hen's bones were so soft that you could wind them around your finger. The bones were pliable. So you will see that one of the simplest and cheapest things to do and one of the things absolutely necessary to do to get good egg production and healthy chickens is to feed bone, which may be purchased at \$25 a ton, or oyster shells at \$8 or \$10, or less, or, better still, to feed both of these.

The next mistake frequently made with regard to the ration is the failure to supply green food. Hens are very particular about their feed and they are not satisfied to eat meat or grain alone, but thrive best when they have an opportunity to get some of all these things, together with green stuff. Green feed probably is the cheapest and the most desirable and one of the most important feeds that we can possibly give our hens. For you here in the South, who can supply green feed the year around and not have to can it, or buy it, or cold storage it, but just let the hens go out and get it, there is no excuse for not giving the hens all the green feed they want. It may not save you a penny on the feed bill. It would be surprising if your hens did not cost you more to feed with constant access to alfalfa, burr clover or rape or beets or other things which you can grow in succession during the year, than if they did not have these green feeds. But the important thing is that their health will be vastly better and egg production greater. It is impossible to maintain good health in fowls on a highly concentrated ration if one does not add plenty of green, succulent food. It is a medicine to the hen or to any animal. So green feed ought to be supplied the year around as the climate, soil and possible crops will permit.

So far as health is concerned, we have now considered the grain feeds,

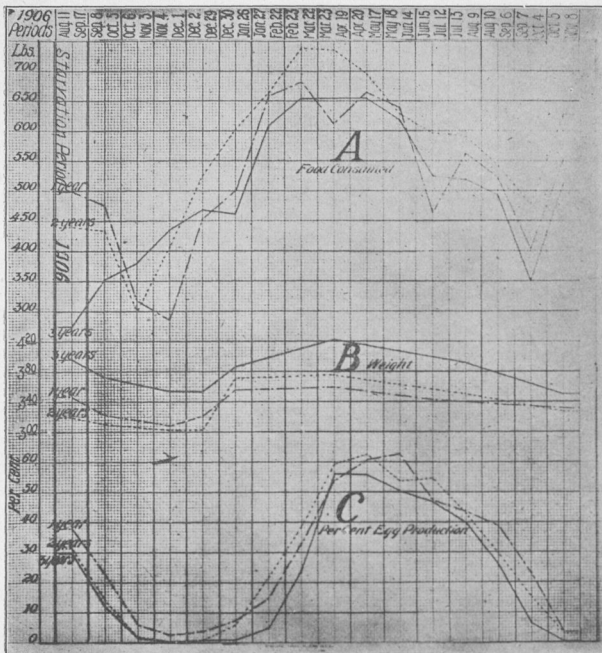


Fig. 6.—Plotted curves showing the relation of food consumed to time of year.

the mineral feeds and the green feeds, and we ought not to overlook the meat feeds as having a bearing upon health conditions. It is a disputed point as to whether protein as found in meat is worth more than protein found in vegetables; but whether this be true or not, in feeding hens we know from practice that the rations which give us the largest net results in a period of years are the rations that contain meat in some form, and this is very important for the health of the birds.

There is danger connected with the feeding of meats. I am speaking now of the danger which may come from using too narrow a ration. Many persons have made this mistake. Beef scrap, blood meal and meat meal, as found on the market, are the most concentrated kinds of meat foods known for feeding fowls.

As compared to cottonseed meal, linseed and pea meal, beef scraps analyzing 50 to 60 per cent. protein contains 20 to 40 per cent. more protein than these meals. Therefore, a person who uses meat feeds freely must feed them with starchy feeds like corn, kafir corn, sorghum, etc. In our country we find that high grade beef scrap, selling at \$50 to \$60 per ton, is one of the cheapest feeds we can put into the rations because it is so rich in protein. The hens must have a rich protein ration, if we are to get the largest net returns in egg production.

We have been discussing the health of the fowl as affected by feeding up to this time. The next point in feeding for egg production is the amount of feed to give. We want to get the largest possible number of eggs. That means we must induce the hen to lay normally. She must lay many eggs if she is to make money for us. So we must feed a ration the year around which shall be of such a nature that the hen will eat freely and yet not suffer the consequences. When we do that the hen would rather lay than not. Do not think for a minute that when you are providing a ration which will keep the hen healthy and cause her to produce an egg every day or every other day, that you are imposing on her. The happiest hen in the world is the singing, cackling, laying hen, and it is mighty good business to keep her happy and let her lay. That means that the ration must be made up, as I have said, from the grains available, with green feed and meats and mineral matter, and fed with regularity. And we must feed in such a way that the hens will be certain to have at all times all they want to eat and come hungry at least once a day for their rations.

A ration to stimulate hens to lay many eggs must be rich in these protein nutrients which make the egg. They stimulate the hen into production. I have seen flocks of hens laying scarcely any eggs, though fed as good a food as corn and materials of that sort, but lacking meat or any of the rich protein foods. And I have seen these added to the ration and just by their introduction into the ration in liberal amount, the egg production has increased rapidly until the hens were laying normally and splendidly. We must realize that the little hen which manufactures such an immense amount of product, and producing an egg a day or an egg every other day, must have on hand ready to be digested and used, such materials as are necessary in this manufacture. If the hopper runs dry and she fails for a little time to secure all these materials necessary, egg production will lessen or stop. If the lack of food is but for a few days, she will draw upon her own body for these necessary elements.

The next factor is the quality of our products. We want to produce eggs which have quality. This means that we must feed wholesome food which makes a well flavored product. We can feed certain things which affect the flavor, the density of the albumen, and in a slight degree the composition of the egg.

It is a common practice in our country, and I presume it is here also, to throw out to the hens stuff that we would not think of feeding to any other kinds of domestic animals, believing that the hen is a natural



scavenger, and that she has the power to eliminate from her system those poisons which affect other animals. The fact that she is just a little thing also enters into the question, as the loss is not so much if one bird dies. However, there is a little mould known by the name of "aspergillus," which lives on musty grains and musty straw. If these are used in a warm, damp place by hens or little chickens, they are almost certain to kill them. Chickens have died by the millions from no other cause than the fact that the straw and grain were mouldy and the spores were taken into the system, causing death.

The same trouble may be caused by cracked corn becoming heated or mouldy. One of my personal friends bought a carload of corn meal because he had an opportunity to buy it cheap. It happened to be heated, some of the lumps being so hard that it was necessary to use a hammer to break them. Within a short time, as a result, several thousand young chickens and hens were affected.

Take cottonseed meal, for example. A clean, bright yellow product is a very satisfactory food in limited quantities when in good condition. When we get a dark brown cottonseed meal, which has gathered dampness and heated, we have a dangerous product. It is no more dangerous, perhaps, than linseed or other rich protein meal in the same condition, but the fact that they will decompose readily and these moulds be likely to grow makes any feed in that condition unwholesome.

We need now to consider the cost of our ration. The fact is, in the feeding of our fowls, that we must give them rations that, other things being equal, will give us eggs at the most economical cost. I have a lantern slide (Fig. 7) which shows the amounts of the different kinds of feed fed to various flocks of fowls. In one instance the eggs were produced for 11 cents, and in another for 14 cents per dozen, a difference which, with hens laying from ten to twelve dozen of eggs per year, is a matter of considerable importance. The time has come when we must figure as carefully on the cost of a dozen eggs as we would in the production of a pound of pork, a quart of milk, or a bale of cotton. It is primarily a question of efficiency, and the person who feeds an excess of rich nitrogenous food is feeding an expensive ration.

Our rations must depend primarily as to cost on the protein we buy and if a man feeds a ration excessively rich in protein it is likely to be expensive. The point is to find a ration which will give results in egg production, quantity and quality both considered, which will cost as little as possible and still give us desired results. If the ration is too narrow it hurts the bird and is too expensive; if it is too wide, it may be cheap, but too fattening, too starchy, and lacking in egg and muscle making material. On that account we must have a ration containing all the elements needed for best results, as we have considered them here, and doing it as economically as possible. We will go into that more in detail during an extra period.

The next factor is the availability of our ration for home consumption. Whether we live in the North, South, East or West, the practical point for farmers to decide is how to feed our live stock on the largest

possible amount of home grown stuff. This idea of sending away off somewhere for a large part of our food to feed stock is all wrong. The best plan is to grow on the land, in so far as it is possible to do so, the plants which we need to feed our stock and families and then let the stock pay a profit for the food which they eat. Generally the highest price we can get for our products grown on the farm is by feeding them to the right kind of stock and allowing them to manufacture these feeds into high-priced, concentrated products. Sometimes the stock is of such a nature that we may not make a profit in feeding our products. If we do not make a profit by feeding in that way, we had better sell them at cash price. But there is another point which was brought out by one of the county demonstration agents here last night. We have realized for many years in the North that we must conserve the fertility of our soil by growing crops and feeding it on the land to build it up. You can grow right here in the South two of the greatest classes of human food products and two of the greatest products to feed to domestic animals, clovers and other soil building plants, such as the peanuts, alfalfa, cowpeas and the vetches that in many parts of the State grow naturally. These plants take the nitrogen out of the air and put it into the soil, so that only a small part is taken off to feed the stock. When we cut alfalfa and feed it to the stock we know how valuable the manure is, yet there is more manurial value in the stubble and roots than there is in the part we take off. Corn is the greatest carbon gatherer grown. The carbon is taken out of the sunshine, out of the air, and stored up in that king of all food plants, King Corn. The thing to do is to try to grow on the farm all the things necessary for your own balanced ration.

Let us now consider some of the special kinds of feeds. We will first speak of the grains.

The best grain, all things considered, if we could feed but one, probably would be wheat. We ran several experiments, one for two years, with two flocks of fowls, putting before them in hoppers all the kinds of feed we could get in the market *so that they could pick out just what they preferred to eat*, and we found that they eat more wheat than any other grain. Corn came second, peas next, while oats came about fourth. Wheat generally seems to be our best grain. It is too expensive to feed exclusively, therefore we must mix it with other less expensive grains.

Corn, because of its fine flavor and cheapness, must be considered as next in importance, and when we count cost as well as quality, probably corn ranks as the first grain in the South. The danger in feeding corn comes from its tendency to fatten, if fed exclusively. Of course I am a little off my own territory in speaking in connection with this subject, but I doubt the advisability of feeding oats to any extent here. In some parts of New York State we probably grow as fine oats as can be grown in the country. This is in the northern part, where there is high altitude and it gets very cold. Farther south, even in our own State, we do not get as heavy oats. In the northern part of the State we get oats weighing 40 pounds to the bushel, really seed oats, right out of the fields. In other parts of the State and farther south, we will have oats

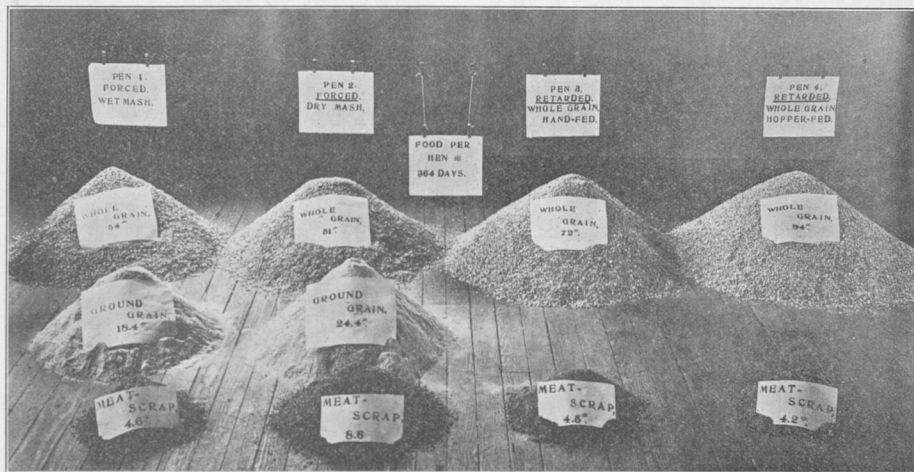


Fig. 7—Amounts of different kinds of feed fed to various flocks of fowls.

weighing but 30 pounds or less to the bushel. The oat shuck in normal oats makes up at least one-third of the entire weight of oats, and the oat shuck has no more value as food than straw. The chemical composition shows it to have even less value. If you will watch a hen eat you will find she knows the difference between heavy and light oats. She will pick out the heavy grains and flip out the light oats for bedding. It is expensive bedding and it is not profitable to use oats unless one can secure heavy grain. Generally it is really less expensive to buy the other grain without shucks. Then there is very little waste.

The bean, for some reason which we are not able to explain, has not proven to be a very satisfactory poultry feed, except when cooked. I cannot speak with authority concerning the many varieties of so-called cowpeas, which are really beans, because I have not fed them; but they are worthy of trial because they will add one more to the legume crop and to the possible available food products for poultry. In the North we have the "Canada field pea," which I judge you cannot grow here to advantage.

Coming now to the ground feeds which we may buy, there is a standard one which we can always feed liberally because the hens cannot eat too much of it. This is wheat bran. If it is of fine quality, it is a safe, wholesome food, full of protein and rich in phosphorus. And if we can get the right kind of unadulterated high grade flour middlings (shorts), full of gluten, to add to the bran, it materially adds to the value of the feed. To this you can add corn meal and cottonseed meal and meat scraps to make a good ground mash.

I have left out many of these things from which certain parts have been removed, such as hominy, the gluten feeds, brewers' grains, etc., which are fed successfully to cattle, but are not as a rule satisfactory for hens. This is because of the difficult problem of feeding hens without disturbing their production. It is vastly more difficult than with cattle. We must have eggs when the prices are high. If we have a ration which will give us eggs when they are high in price, that same ration will give us eggs when they are low in price. But we must have a ration which will not be taking chances on interfering with egg production, as we would be doing by feeding many of the so-called "by-products."

There is no question about the desirability of feeding meats. The best meat to feed chickens, with all due respect to our friend the bob-tailed rabbit, is skimmed milk,—and sour skimmed milk is better than sweet. There is no meat food which can compare with it. Wherever skimmed milk can be secured, it is the best thing to feed to young turkeys or chickens. You should get two or three times the feeding value from it than is ordinarily obtained from its sale at 20 cents a hundred.

Professor Atwood of West Virginia added to his ration all the sour milk his hens would drink, and he produced more eggs because the hens were more healthy. He received enough more to make it worth \$1.00 per hundred to feed. It is not to be inferred that it would pay to buy skimmed milk at \$1.00 per hundred to feed, but, taking the skimmed

milk at the ordinary price of 15 to 20 cents per hundred, we can get a big profit by feeding it to poultry. It may be the lactic acid in the sour milk affecting the healthfulness of the digestive system and killing off the bacteria within the digestive tract that gives the most valuable results. It is palatable and cooling and the most desirable form of protein we can secure.

If you cannot feed skimmed milk, the next best available meat feed would be fresh meat. Jack-rabbits are desirable, but the hens would rather have them cooked than raw, and cooked meat is infinitely safer. Whenever one feeds raw meat, especially in hot countries, he runs a great risk of ptomaine poisoning, because the least bit of taint may result in poisoning and lead to certain forms of muscular contraction known as "limberneck" in fowls. This danger can be avoided if we feed the meat boiled. It will keep better and the hens will like it better.

If we cannot have any of those things we must resort to one of the commercial articles, and then we want to get a high grade beef scrap. I do not know what the laws of this State are, but if the purchase of meat scrap is not safeguarded by State supervision, it ought to be.

There is also the question of wholesomeness. It is never profitable to feed to any kind of an animal beef scrap which is nothing more than fertilizer, and you would want to get it on your land pretty quick at that. I have seen men try to feed beef scrap which was so offensive that the hens would not eat it. The hens had sense enough for that. Such meat scrap is dangerous.

We must have nice, clean, wholesome food. When you take beef scrap in your hand and hold it a few moments or pour scalding water on it, if there is any offensive odor, do not feed it. A good grade of beef scrap ought not to have an offensive odor. The hens ought to eat it greedily when it is fed by itself.

The best green feeds are those which you can grow seasonably through the year and are of a different kind nearly every month. Generally the legumes, such as clover or alfalfa, are best because of their richness in protein and mineral matter. Then come the succulent things of the best type—Swiss chard and dwarf Essex rape—which is of the cabbage family. These grow very freely and may be cut many times in the season. We have cut rape five times a season in our State, and I suppose you can cut many more times. It is merely a question of leaving the crown uninjured when cutting and cultivating, and the hens eat it greedily.



## CHAPTER II

### BREEDING FOR CONSTITUTIONAL VIGOR.

BY J. E. RICE,

Professor of Poultry Husbandry, Cornell University, Ithaca, N. Y.

We find in the poultry business that we have efficient and inefficient machines in the case of our fowls. Probably the greatest loss we suffer as poultrymen is in keeping cull stock. In other words, if one will go into the flocks of this or any other State he will have no difficulty in picking out a large percentage of birds which are losing money for their owner, and also finding in those same flocks a few birds, sometimes many, which are paying a splendid profit. It becomes necessary for the grower to see if he can by one of the simplest methods select out the profitable from the unprofitable individuals in his flocks. This is more difficult in the case of poultry than it is with larger animals. It is now becoming very common for the dairyman to select his best cows by means of milk and butter records and to breed only from the best, gradually cutting out the poorest individuals, in order to bring up the general average of his entire herd. In a measure this can be done also with hogs, by watching their growth, observing the number of pigs in a litter, etc., and it may also be done with sheep by noting the number and quality of the lambs and other characteristics. Thus man has been able to bring up the average of practically all kinds of farm live stock.

In the effort to apply these principles to poultry, experiments have gone far enough in selecting fowls for vigor and productive power to enable us to feel certain that we have discovered characteristics which we can apply with reasonable accuracy to the selection of fowls for vigor and productiveness. They will apply at least to vigor, and that in a measure will indicate one of the factors in the productive power of individuals in the flocks. Therefore, we have come to believe that the cornerstone of success in poultry farming is to follow a policy of rigid selection for constitutional vigor, vitality, quick, healthy growth and long life. There are many persons who can go through a flock of fowls and pick out almost all the individuals that are not laying or of low vitality at that particular time and by this process of elimination get rid of the idle ones and keep only the best ones.

Improvement and profit come in two general directions; one by increasing the efficiency, the inherited tendency of individuals to produce a larger amount of eggs, more fertile eggs and more vigorous chicks; the other by simply eliminating the unprofitable individuals. We are making strenuous efforts to breed hens to lay more eggs, to get hens which inherit the tendency to lay 150 to 200, instead of 50 to 75, by selecting and breeding from the higher producing females and the better males. The law of "like begetting like" undoubtedly, in the

main, is sound and this process should raise the average of the general flock by increasing the power of the individuals to lay. The other method is by eliminating the low producers to raise the average output. We should do both. A little time, therefore, to try and point out some of those characters which we ought to be able to recognize when we see them, and then put the principles into practice. Next year, if you do this and come to the College, you will stand here and give eloquent testimony to the fact that having seen the difference between the vigorous and weak fowls you have sold off the unprofitable ones, that you have made more money with fewer fowls than ever before, and that you have had better results in regard to fertility and hatching power of the eggs.

Fowls may be inefficient for a number of reasons. The first would be an inherited tendency to weakness. Chickens are born weak or strong. There is scarcely a litter of pigs produced which does not have one or two which cannot hustle with the others, and every one of you practical men know that usually there are one or two individuals in those litters which are far and away better than the others, and, because of this fact, they will have more than their share of the feed trough most of the time. It is born in them. It is the same way with chickens. We scarcely find an incubator hatch of 100 chicks or more, or a litter of chicks with the hen, where there are not several which grow faster, lay earlier, eat more food and live longer. It is for us to pick out and keep those individuals, birds with this tendency to high vitality, and eliminate those showing slow growth and low vitality.

The second condition of weakness is acquired. You may have a flock of chickens, all of which appear to be of equal strength, but if they are reared under unfavorable conditions, if they suffer from cold, which might be true in our country in many instances, or from heat, which might be the case in this climate, or if not fed on the right rations, or if hatched from incubators improperly handled, or if any other conditions obtained which cause those birds to lose their vitality, they are no longer profitable individuals.

So we have the two great causes of weakness, one of inheritance, the other acquired, and generally we are to blame for both, depending upon how we handle the breeding stock and how we handle the stock being reared.

What, then, are some of the characters which enable us to select these individuals according to their vigor? They are many and probably not one of them taken singly would be absolutely infallible, but, taking them together, remembering the factors and principles involved, a person can get a composite idea of the characters indicating high and low vitality and with almost unmistakable accuracy he will pick out the high from the low.

Before taking up a demonstration of these characters we should consider the effect of selection and what it means. We published in several bulletins from Cornell University the results of experiments covering four or five years in breeding and selecting birds for high and low

vitality. There are pictures showing the birds and the results. The experiment was started by taking a flock of pullets hatched and reared at the same time and in the same manner. The birds were of the same general breeding. From this flock of birds twenty-five pullets were picked out which we thought were the finest type of robustness and vigor, having bodies well developed, and birds in apparently excellent condition; and we picked from the same flock birds which, because of inherited weakness or acquired weakness, did not grow quite so robust, had shanks a little lighter, bodies not so deep, combs not so well developed, etc. We picked out those which lacked a little in stamina and robustness. There was not a sick bird in the lot, not a bird which most farmers or poultrymen would not have been glad to put in their flocks. We kept an exact account of the eggs laid, feed consumed, fertility and hatching power of the eggs for a period of years. Then we took the offspring of these birds, kept a record in the same way, and kept that up for three generations. The results are now in bulletin form. At the end of the first year we found those pullets which had been selected in October or early in November, on the basis of high vitality, had laid eleven and a fraction eggs a piece more the first year than their sisters did. Then, taking the chickens that came from these two flocks, we found they laid in much the same way as their parents had. The pullets from the high vitality flock of hens laid a dozen eggs more than their sisters did on the same ration. In other words, we had picked out the efficient from the inefficient producers and mated them with males of similar characteristics, with the result that the offspring had inherited the strength or weakness of their parents, and here again we find in evidence the law of "like begetting like."

Hence, as a basis for success in poultry husbandry, before we put expensive feed into inefficient hens we might better find out whether they are the kind which are going to pay. Just to illustrate how it works in a practical way: A farmer, near the College, although very much in favor of progressive farming and interested in the work of the College, a man who was very up to date in his methods, had great misgivings as to whether there was any difference in the vitality of chickens. He could and did recognize in the breeding of cows, horses, and hogs, the necessity of breeding in accordance with performance and vigor; but a hen was a hen to him. As he looked out over his flock of 1200 or more he could not conceive that it was possible for a person to pick out the ones which were laying from those which were not. I told him that the "proof of the pudding ought to be in the eating," and if our theories would not work in practice they certainly were not true in principle. A man who has a theory which he cannot put into practice is on the wrong track. Any teaching that cannot be put into actual successful practice is not sound. He agreed to give our theories and teaching a trial. One of our men then picked out the unproductive hens and put them in another pen to note results. He removed about two hundred birds. The next day or two after that the farmer came to town and said, "The hens that were left were laying more eggs than he had been getting before the others were removed. How can you

account for that?" We were ready to expect that they would not drop off very much, but we did not expect them to lay more. It was just before the molting season, in very warm weather; the pasturage was perhaps a little low, the hens presumably suffering from crowding, and there were a lot of unproductive hens. This young man, because he knew by experience and observation how to distinguish the layers from those which were idle, weeded out those idle birds and put them off in a pen by themselves. He thus relieved the congestion elsewhere, and it is probable that the feeder shoveled out as much feed for the flocks as he gave before the two hundred birds were removed, so those remaining had more to eat.

What is true with regard to the selection of hens is just as true in regard to the importance of selecting the males for the breeding flock. This selection ought to be carried on throughout the entire cycle of the life of the domestic fowls, and one period in that cycle is as important as another period.

The first thing to do is to pick out eggs for hatching according to the motto, "Every egg a good one." That means that every egg must be of the right size and shape, and, although it might not involve the question of vigor, there would be other factors, such as the color of the egg. We should use only those eggs for hatching which promise the best results and which will help to give us even quality in egg production. A person who eliminates the eggs with weak, spotted shells, showing faulty shell construction, and simply takes the perfect type of shell, has made the first good move in selection for vitality. The size of the egg from any given variety of poultry is a very exact measure of what the size of the chicken is going to be. If a poultryman will take any breed, the Leghorn, or the Plymouth Rock, or the Wyandotte, and will grade the eggs into three classes, the small, medium and large, i. e., one ounce and a half for the small, about two ounces for the medium, and two and a half for the large, and if he will incubate all in the same incubator and just before they hatch separate them into bags or trays so the chicks will not get mixed, and then weigh the chicks, he will find that the weight of the young chicks on the day they are hatched will be in practically an exact proportion to the weight of the eggs from which they came. He will also find, if he weighs those chickens in the fall, after they have run together under the same conditions, having leg banded them so he knows which eggs they came from, that they will still show weights proportionate to the eggs from which they are hatched. Generally the bird of high vitality makes the egg of good measure, full of meat, compared with the egg produced by the hen of low vitality.

When one tests eggs at the end of the first seven days, by looking at the egg through the tester in a dark room, he can pick out the chicks of high vitality from those of low vitality by the heart beats of the young embryo chicks.

We do not need to wait for a chick to get out of a shell to tell its constitutional vigor. There is a difference at the end of seven days, indicating slowness of development on the part of the weak chick, which



will mean two or three days delay as compared to those in the eggs of high vitality, and they will mostly die at the end of a week or two.

The next test for vitality comes when the chickens hatch. With almost any eggs, selected as carefully as we may, you will find little chicks that are weak and chicks that are strong and you can tell them at a glance. We had with us for a number of years a Miss Nixon, who had remarkable success in rearing chicks and she could tell with unmistakable accuracy when a flock of chicks came to her to be put into the brooder whether they came from high or low vitality eggs. We purposely put in the machine eggs of low vitality, and the minute she saw them she would tell us by their appearance when a day old whether they would be likely to live or not.

Whenever chicks hatch from the incubator one must "screw up his courage" and kill the unfortunate chicks which are weak, keeping only the chickens which are strong. Unquestionably one may, with great care, rear some of the weak ones, but it is a mistake to do this. The mortality will be such that it may take all profits from the others. You will find one thing is certain: If you have one or two little, struggling chicks in a flock of 100 or so, people who see those chicks will notice them first and remember longer and say more about them than they will in regard to all of your good stock. Such chickens ought to be killed instantly. If they are not disposed of the danger is not simply the loss of the weak chickens during the rearing period, but the greatest danger is that many of these born weak may appear to overcome it and get into the laying or breeding flocks. Yet if you would keep a record of those hens for three or four years, you would find that they are the birds which generally die early and are poor layers. What we want is to develop a kind of ruggedness on the part of the chicks that will cause them to live long. One of the best things we can say about any chicken is that it has a tendency to longevity, that it is born with a long life ahead of it. The chicken which is born strong will overcome disease troubles that a weak chicken cannot withstand.

Additional selection should come every week right along during the summer and forever afterwards. Whenever we see a chick, especially a slow feathering kind, with the long wing feather drooping to the ground, or with bowel trouble, or with the indication of roup, the chance is that it is one of a weak lot which ought to have been killed and burned. In case of some which may not have disease, but fail to grow rapidly, they may be put in a brooder by themselves, and because of the fact that they do not have to rustle with stronger ones, if given a sour milk fattening ration, may be brought to three-quarters of a pound or a pound and sold. You may put a little dab of red paint on white chickens or white paint on colored chickens to distinguish these so as to prevent any possibility of getting them into the flocks. (Fig. 8.) We must always select for the vigorous chicken.

In the fall of the year, when we come to put the flocks in the winter quarters, we must again make selection. A person ought to pick out all the undesirable birds. Sometimes these birds which are under their



normal size are also vigorous and healthy, but we want to maintain a reasonable standard of size as well as vigor.

We should put the birds, according to their ages, in different pens, so that we will know the age of every individual. It is unfortunate that as a rule throughout the United States no system of marking prevails by which poultrymen may know the ages of their birds. In some flocks we still find roosters that look as if they may have crowed for Andrew Jackson. Fowls may live for twelve years or more, but as the years go by the increase in mortality is greater. Hence, for this and other reasons, we do not want the birds on farms mixed up in such a way that we cannot tell the ages. There are ways of punching holes in the web of the foot, leg banding, etc., by which we can know definitely one year's flock from those of other years. A person can not distinguish with absolute accuracy in the fall of the year, after the

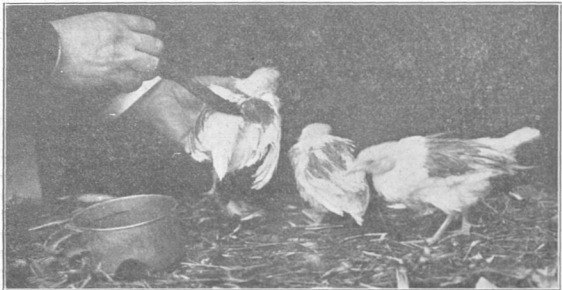


Fig. 8—Placing a little red paint on white chickens as a distinguishing mark.

birds which are one or two years old have molted, those birds from the very early hatched, healthy pullets. I know we have been mistaken many times and have had to verify our selection by looking up the records of the leg bands on the birds. So it is very desirable to have the birds marked in some manner.

We now come to the point of selecting our breeders. The time of year for selecting the breeders is not in the spring, when most of the fowls used for that purpose are generally selected. Of all the seasons of the year, this is the one when such selection should not be made. This is because in the spring of the year every hen will be laying, if she is going to lay. When hens are in laying condition it is a pretty good judge who can tell with absolute accuracy the difference between a high and a low producer. This is because the hen's body shape changes and will show up better at that time; her comb will be large and red; her actions will be more lively; her appetite will be good and she will

have practically all the characters by which we pick the high vitality birds.

When she begins to grow dormant again these characteristics will begin to change and gradually we can eliminate the poorer ones. In the month of March, April and May, in this part of the country, your birds will probably be giving their highest production. We have trap nest records of nearly a thousand birds each year for many years past, and these records show that the hens which lay the fewest eggs in the year will lay them in the spring; and the hens which lay from 150 to 175 or 200 eggs per year will lay not only as many as the other in the spring, but will also lay during the unfavorable season when the poor hens do not. The poor producing hen, therefore, adds insult to injury by not only laying the fewest eggs but by laying them when they are cheapest.

So the person who breeds for high egg production must breed from the birds which lay in the season of high prices. When you breed from those you will be pretty sure to be breeding from the hens of the highest production; and if you select your breeders during the spring of the year you are pretty sure to select some of the birds which you have been boarding for the sake of their society and have been supported by the high producing birds.

With that statement we will proceed to a study of some of the characteristics by which we may select the high producers without the aid of trap nests. We will speak mainly of the cockerels now, but the same general factors will be true with the hens. However, the characteristics are more easily seen with the cockerels than with the pullets; hence I am using the cockerels as an illustration. One of the characteristics would be the actions of the bird. Health always manifests itself in action. Any animal out of condition physically will, according to its race or breed or variety, show it in some way. It will assume a somewhat different position. One of the symptoms of a weak bird is inactivity. The birds which are vigorous are up and doing; the birds which are weak are generally inactive. In order to determine this point, for example, we may watch the birds on the perches and observe them when they go to roost at night and when they come off in the morning. In this method we have a very easy way of eliminating weakness. The birds of low vitality will go to roost early and get up late, and will frequently be found on the roost during the daytime. Birds of high vitality are off the roost early, for good reasons. They have digested all they have eaten the night before and are hungry and anxious to get out in the cool of the morning to hunt for something to eat. They will also work late at night before going into the houses to roost. I have seen the highest producing hens coming in so late at night that they were not able to find their places on the roost. They would stay out as long as they could see to forage.

Then notice when you are feeding them the way they eat it. Generally the hens of low vitality will be squatting or moping around on the floor. They are not active nor are they hungry. The high vitality hens are the ones which go right after the feed and water. Hens drink

water in proportion to the amount they eat and in proportion to their egg production. The observation of these little things will help us greatly in selecting our vigorous, high producing hens. By quietly observing the birds one can learn a great deal. He will be able to recognize birds of high, medium and low vitality in almost any flock.

In the cackling and singing of the hens and the crowing of the male birds, we find indication of high vitality. We should seldom, if ever, select a male for the breeding pens that is not a loud, lusty, frequent crower. That is one of the most reliable characteristics indicating vigor. I might mention an interesting instance along that line. Several years ago a breeder of fighting birds told me that in England it was customary to precede a fighting bout with a crowing contest. The birds which crowed the longest and more frequently were the ones selected as the most likely to stand up under the trials of heavy, physical endurance. I mention this in connection with an occupation which is past and which we hope will stay that way in this country. The crowing of the rooster is a physical expression of good health. The scrapping or fighting tendency of the male birds does not necessarily indicate that the pullets from these birds will be heavy egg producers except as they will have a tendency to better health and better vigor; but the crowing of the male does indicate a physical condition which must be taken into consideration if we will have birds of high productive capacity.

The birds can also be judged from the standpoint of their appetites and by the conditions of their crops as we find them on the perches, as to whether we find their crops full or empty. This may be learned by picking up the birds after they have gone to roost and noting the fullness of the crops. In the case of the bird of low vitality, it does not matter how much food may be available or how appetizing it may be, that bird will not eat enough to fill its crop. If you have a bird of high production, one full of life and vitality, in nearly all instances the bird will go to roost with its crop full.

The temperature of the bird is also an indication of condition, and one of the ways to learn the health of a fowl is by feeling of the shanks. A bird of high vitality, of strong constitution, has a high, normal temperature, 105 to 106 degrees. This is seen in the healthy condition of the blood. The shanks and the body will be warm. Chickens which have any disease, or which are low in vitality, usually have cold feet and cold shanks.

We can also tell a great deal by the color, appearance and growth of the plumage. Birds low in vitality will feather very slowly and carry their feathers drooped. Chickens of high vitality, say, about three to six weeks old, depending on the breed, will carry their wing feathers up against their bodies, folded closely, in shape something like a person's hand. They hold the wings right up tight, and the body feathers hug close and smooth. The down on the top of the head in young chicks lies down flat and hard, and their tail feathers are carried normally in an erect position. Whenever a little chick shows weakness the feathers will droop. Whenever you see a chicken with wing and tail feathers

drooping you may know something is wrong with its health. When you call little chickens and they come on the run, jumping and active, with the wings flapping and the tail feathers erect, you will know that all is well with them.

The same is true with older birds. In looking over a lot of cockerels you may see some with the tail feathers to one side or drooping, and you may make up your mind that those generally are the weaker birds in that flock. Why is it?

Birds having good health grow good plumage because they have lots of vitality, good healthy blood and well nourished bodies which chicks of low vitality do not have. Courage on the part of the male indicates health and vitality, because, generally speaking, courage is associated with ability to carry out whatever is undertaken. A timid bird will

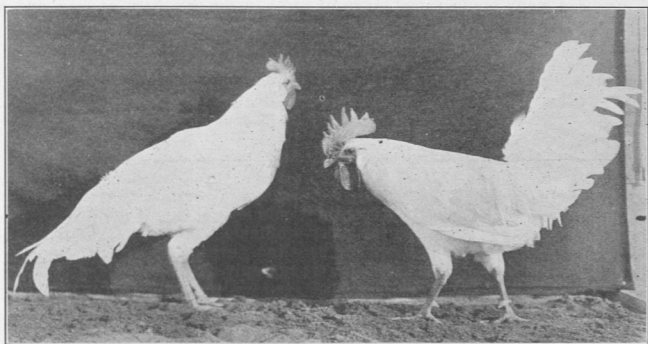


Fig. 9—A constitutionally strong and a constitutionally weak male.

more often fail to accomplish what he may set out to do and lose confidence in himself, so we should always pick out the males which have courage. One method of selection is to put the males together and note which are assertive and able to command. (Fig. 9.)

Out of one hundred or more males I recently selected out the least desirable until only five were left, then I studied these for weeks until I selected two out of that five which were better than the others. These were the two finest birds from a flock of over one hundred which had been reared, and it has been impossible to decide as yet which is the better of those two. Just think what it will mean to the breeding flock if a person is breeding from the two best males, selected from one hundred brothers of the same general breeding. The superior quality is going to be impressed upon the chickens, just as will be the case in the selection of the finest females that lay the most eggs of the best quality.

When a male shows fear he loses the power to control the muscles of the tail. On the back of the fowl, near the little oil gland, is the rump. The tail feathers are carried there. Whenever a bird shows physical weakness the muscles that hold the rump erect weaken and the tail feathers droop. (Fig. 9.) Fear will produce this effect.

The condition of the oil gland indicates a fowl's health. Oil is stored up energy. If there is no oil in the gland the bird is in poor condition. The plumage of the chicken will show this. The drooping of the tail is due literally to loss of nerve. It is a question of the nerve that governs the muscles failing to hold up the rump that supports the tail. It is a physical manifestation of fright. Actors who study manifestations of human emotions understand this. They know that fear in the human race is always associated with a relaxation of the muscles in the knees and in other parts of the body, resulting in a cowering attitude. We have many photographs taken of birds in the condition of fear, and most of them show this drooping of the tail. You can notice the same thing with a bunch of little chickens. Suppose a lot of little chickens were on the other end of this table and I should rap, imitating the call of the hen. That would bring all the little chicks running to get something to eat. Then if I should give the call of the hen hawk they would go rushing in the other direction and many would drop right there and hide.

In the case of low vitality there is muscular weakness and consequent inability to stand up under fright.

Question: At what age should we dispose of laying hens?

Prof. Rice: Ordinarily a person would expect the first year of a fowl's productive life to be the most profitable, but I think we should keep the birds for many years for breeding purposes if we have exceptionally good ones. This is because we not only secure the added benefit of more progeny from our best birds, but we also add the quality of longevity. The very fact that a bird is able to stand up under heavy production for a number of years shows an inherited tendency to long life. It is a serious mistake to kill either male or female if they have exceptional quality. We should use these as breeders as long as they prove strong producers. When breeding from pullets we have been doing what in effect the dairyman would have done if he had kept only heifers to breed from. The wise dairyman, on the contrary, builds up his herd by picking out the exceptional individuals and breeding from them as long as they prove profitable.

The most important factor of all has to do with the shape of the birds. The shape of the body of a bird of high vitality nearly fills a parallelogram. (Fig. 10.) The shape of the body of a bird of low vitality has a tendency to fill a triangle. (Fig. 10.) This is true of a chick or old fowl.

The same thing is true with regard to the shape of the birds when viewed from the front or rear. A bird of high vitality, viewed from the rear, has a tendency to fill a parallelogram because its keel is better fleshed and it has a full abdomen. Its vital organs fill the abdomen and give it a large egg producing capacity, a capacity for digesting a



large quantity of food. This kind of a bird also has a well developed breast and full crop that nearly fills out the parallelogram. A bird of low vitality generally has a shorter keel, a "tucked up" abdomen, and is hollow breasted.

The bird of high vitality has the keel well covered with meat. If a fowl is sick the loss of flesh shows first on the keel. The bird of low vitality will always have a thin keel. If a bird is healthy and has been well fed, one can carve the white meat off in large slices. (Fig. 11.)

A bird of high vitality generally has short jointed, heavily meated legs, the joints round and full as compared with the bird of low vitality, which is more likely to have thinner shanks. Viewed from the side, the bird of high vitality would have its thigh bones wide apart, while the bird of low vitality would have its legs set more closely together. The width between the legs is fixed by the width between the sides of the body,

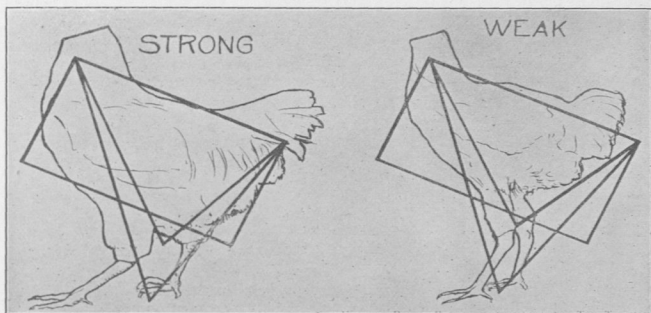


Fig. 10—The way in which birds of high and low vitality fill a parallelogram and the two triangles. This clearly brings out the points of weakness in development of keel, breast and abdomen in the low vitality bird.

and a wide, well developed digestive capacity will throw the legs wide apart. With low vitality we have the long, lean, lank appearance. Sometimes the chicken is knock-kneed so that the hocks interfere.

The neck of the bird of high vitality usually is thick in proportion to its length, as compared to the tendency to a long, thin neck of the bird of weak vitality. This is one of the best indications, because we nearly always find the short, thick neck associated with the blocky body, and with this tendency of body and neck comes the tendency to a well rounded, well developed comb. Indeed, all of the face appendages are in general harmony, showing a tendency to small wattles, comb and ear lobes. In the high vitality bird we have the larger comb, wattles and ear lobes.

The bird of high vitality has a bright, expressive, clear eye, with the eyelids wide open, which gives a round appearance to the eye. The

bird of low vitality has a sleepy or dopy appearance, the eyelids not being held wide open and thus giving a snake-eyed appearance. Whenever the bird is weak the muscular tissues are not well developed and the eyelids do not have the power to stay open and the eye sinks back into the head. If the bird is well and vigorous the eye looks round and bright. If you will notice a bunch of vigorous young chicks you will see that their eyes stand out like shoe buttons. A bunch of little chicks two or three weeks old, if of high vitality, are alert and stand erect. When seen in a large flock they seem to be "all eyes." They are bright, active and intelligent.

In the case of the bird of high vitality there is a tendency of the wing to stay up close to the body; while the bird of low vitality has a tendency to a drooping of the wing feathers. In the case of a bird of high

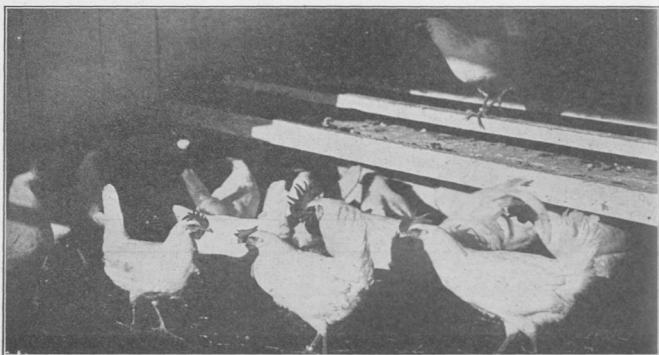


Fig. 11—A flock of fowls selected from a general flock of pullets of similar age, having the same breeding and care, but which were chosen because of their low vitality.

vitality the feathers of the tail are carried in the natural, upright position characteristic of the breed.

The size of the feathers and their condition will also indicate vitality. In the low vitality bird the rump has a tendency to weakness, causing the tail feathers to droop. The feathers are smaller in size and are not in good condition. In almost all instances these characteristics are maintained. (Fig. 12.)

A good, strong, well developed body and heavy shanks will also have toes and toe nails in the same proportion. A bird of low vitality will be likely to have thin toes and toe nails. The explanation is that the strong, active hens wear their toe nails out scratching in the litter or soil, while the birds of low vitality stand around idle and let their toe nails grow. In the case of young chickens, if they grow at all, they

will grow beaks and toe nails. The beaks grow as long as that of a crow. The toe nails are long and thin. The body is extremely small and out of proportion. Nature apparently has determined that, if a little chicken is to grow at all, it needs beak, toes and wing feathers to help it get away from enemies and get a living.

In the case of males having single combs, the normal tendency in a specimen of low vitality is for the comb to lop over. You may have a flock of birds every one having good, straight combs, all running at large and in perfect health. If you keep them closely confined you will find in those which have a lower vitality a tendency for the comb to lop over. The tail also has a tendency to droop to one side. You may take such a bird out of the flock and put it in fine physical condition and the tail and comb are likely to come up straight. Other things being equal, the larger size and weight would indicate constitutional



Fig. 12—Selected from the same general flock as those in Figure 11, but selected with regard to high vitality.

vigor. Things are not, however, always equal, and frequently we find a bird weighing more than another, yet having lower vitality. Size does not always mean vitality. Sometimes a bird of greatest vitality throws his energy so much into motion that he fails to grow large. He grows hard, nervy and strong, but not big. He, nevertheless, has endurance and vitality. However, size is always a thing in favor of the bird if other conditions are equal.

What we want to do always is to maintain a generally harmonious development of the bird. We want it well filled out in front and rear. This sort of a bird will give us a machine which will manufacture feed into eggs or flesh. When you see a little baby chick which just fills that parallelogram, you can hardly hold the little rascal. He will fill your hand and will slip through your fingers if you are not watching. You may take another chick of the same variety that is hollow breasted

and "tucked up" in the rear and he will be weak and soft. He will stand around peeping instead of eating and you will never be able to get anything out of him.

Question: Is it well to use the eggs from pullets for hatching?

Prof. Rice: No, it is not. I think it is perfectly sound doctrine to say that we should breed from hens rather than from pullets. The hens do not lay so many eggs before the breeding season and they have a tendency to lay bigger eggs which produce bigger chicks. Also, after we have kept the birds a year or two we have a chance to observe whether or not they break down in health and, therefore, will have birds with a tendency to longevity.

Question: At what age should we begin to sell off the hens?

Prof. Rice: The matter of selling should be regulated by the condition of the hens and the market. The unproductive hens should be culled out and sold as we find them. In the matter of selling off the layers from the flocks, I think every fall a man ought to sell off probably one-half to two-thirds of his hens and simply keep the choicest birds on the basis of vitality and whether or not they are laying late. As a general proposition, we cannot afford to keep hens for the eggs they lay, outside of those to be used for breeding purposes, after they are two or three years old. Much depends upon the breed. Leghorns may be kept longer, as a general rule, than the heavier breeds.

In connection with the question of constitutional vigor and also as having an important bearing on the marketing question, Table I shows what takes place in keeping eggs for hatching. This is only one of several experiments that we have tried and we have had as high as 1800 eggs in some tests. Therefore it is not mere guess work or mere accident, but the results of careful experimental work.

TABLE I.

## TEMPERATURE OF EGGS KEPT FOR HATCHING.

Kept 14 Days in Egg Cases, Clean, Unwashed, Turned Daily.

No. of eggs.....	Living room			Cold storage			Furnace room		
	Max. Min.			Max. Min.			Max. Min.		
Average Temp. kept in.....	65	75	53	50	54	45	80	95	57
Per cent. fertile.....	88			90			24.4		
No. dead germs.....	18			4			12		
No. pipped.....	0			2			0		
No. chicks.....	19			31			0		
Per cent hatch of total eggs...	52			76			0		

TABLE II.

## TIME TO KEEP EGGS FOR HATCHING.

All Eggs Kept on End in Egg Cases, Unwashed, Clean, Turned Daily.

No. of eggs.....	50	50	50	50	50	50
No. of days kept.....	35	28	21	14	7	1
Per cent. fertile.....	8	19	52	78	80	86
No. of dead germs.....	1	4	8	8	6	0
No. pipped.....	0	0	4	5	3	3
No. of chicks.....	3	0	6	16	17	37
Per cent. hatch of total eggs.....	6	0	12	32	36	74

We found later, upon breaking the eggs tested out as infertile that we could see dead germs which had not appeared in candling. We also found that we would increase our count of the number of dead germs by about 50 per cent. whenever we examined by breaking the eggs that had been tested out as infertile.

Table II shows the results of an experiment to observe the effects of time in keeping eggs for hatching. In this particular experiment the eggs were all kept exactly alike and all were kept in a living room at an average temperature of 65 degrees, which is five degrees lower than that of the ordinary living room and a little below the temperature which is necessary to start incubation. Great care was taken to get all the eggs from the same flocks so the conditions would remain the same. The figures there speak for themselves.

It is perfectly clear that there is loss in fertility continually (as shown by candling the eggs) and in hatching power, after the first few days, and that the sooner the eggs can be put in the incubator or under the hen the better, and that usually they should not be kept for more than a week or two at most, even when kept cool. Also we learn that the eggs should be kept in a temperature as low as 40 to 50 degrees to secure the best results.

Fig. 13 shows chickens that are suffering from what is known as white diarrhoea. This is probably one of the most disastrous diseases known to poultry. It has been the cause of more persons failing in the poultry business than perhaps any other one disease. The humiliating thing is that persons otherwise well qualified in the matter of keeping birds successfully have failed in the business because they could not hatch and rear chickens, and it was through no fault of theirs so far as the general handling of the birds, breeding, etc., was concerned. It was simply a failure to understand the cause of the disease and how to overcome it. In many instances I have known persons in our country to lose nearly all of the chickens they hatched. I have known a man who hatched two or three thousand a year to not rear a hundred because this disease so thoroughly permeated his flocks.

Dr. Rettger, of Storrs College, Connecticut, discovered several years ago bacteria called *Bacterium pullorum*, but he did not at that time recognize it as the cause of this disease. Eight or nine years later,



when the disease had become very serious throughout the country, he then connected his original discovery with the actual disease and has spent three or four years of valuable service in unraveling the life history of the bacterium. He discovered this disease in the blood of the parent stock, and showed that the bacterium lives in the body of the fowl, and that it is localized primarily in the ovary of the bird. When a hen gets into heavy laying there is a great strain on this particular organ, which becomes weakened and this apparently assists in localizing the disease germs in that particular part. So that whenever a fowl develops the egg yolk some of these bacteria may be deposited with it. Sometimes this happens with all the yolks developed and sometimes with only occasional ones. Fig. 14 shows this condition. The yolk with its diseased germ passes along, receives its covering of albumen, is covered with the shell, and the egg is laid. We therefore see how the hen may transmit through the egg to the chick this disease which has proved so fatal. A large proportion of the eggs which contain these

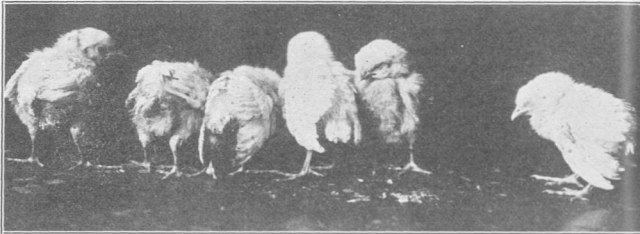


Fig. 13—A flock of chickens affected with White Diarrhoea.

germs never hatch. The chicks die in the shell. Frequently this failure to hatch has been laid to the incubator and to all sorts of possible conditions, but frequently it is due to the action of these bacteria in the body of the chick. If the chick hatches, as many do, it usually dies before it is two weeks old. The disease usually begins to manifest itself by the end of the first week, is at its worst about the tenth day, and frequently takes off practically the entire flock. Usually a few chickens will live and carry the disease in their bodies, though apparently they have overcome it so far as physical appearances are concerned. Nevertheless, they do carry the disease in their ovaries and transmit it to the next generation.

One method of extermination is to discard the hens which carry this disease and not breed from them. The first method of attack was to trap nest the hens, incubate the eggs, then throw out of the flock the ones whose eggs showed that they contained the bacteria; but inasmuch as some hens carried the disease and only occasionally laid an egg having it, it was impossible to detect all the hens carrying the disease. So that

method was abandoned. The method now employed to discover the hens having this disease was originated by Dr. L. M. Jones of Cornell and proven by Dr. Rettger and Dr. Gage. A little blood is taken from the fowl and put through an agglutination test which shows whether the hen has the disease.

The first practical thing to do is to select rigidly only the finest birds which you want for breeding and have those birds tested if there is any suspicion of the disease. This is unnecessary if the chickens are doing well. It is only necessary if there is any evidence of the diseased chicks. Under those circumstances you may be reasonably certain you have the disease in the first flock.

Dr. Rettger is quoted as having made the startling statement that in his search to get absolutely pure stock, free from the disease, he found

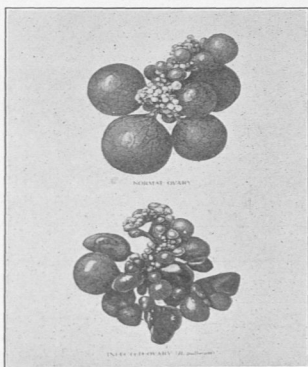


Fig. 14—Two ovaries.—The top one is healthy, the lower one is infected with White Diarrhoea.

two flocks that did not show evidence of white diarrhoea. Many persons have had diseased flocks of pure bred birds and have innocently sent the disease all over the country, whereas, persons having good stock and not having brought in new birds from outside have avoided the disease for many years. Persons who are in the habit of getting in new blood every year have generally brought the disease into their flocks in this way.

Whenever you kill a fowl and discover rather irregular shaped ova or a greenish yellow substance in the ova, a substance of a gangrenous nature and appearance, you are pretty sure to be right in concluding that the hen carries the bacillus of white diarrhoea or some other trouble that should call for a special examination.

Dr. Rettger also discovered what practically all of us have understood for some time but could never explain, that sour milk, the "clabber" you speak of, carrying lactic acid, when fed to chickens so stimulates them in their growth as to appear to overcome the disease or kill the bacteria. Whether it kills the bacteria with which it comes in contact in the digestive tract, or whether it is merely a stimulating and effective food, we do not know; but we do know that apparently the chickens fed with sour milk or sweet skimmed milk will overcome the external evidence of this disease as indicated in Fig. 13.

The remedy must be in the nature of careful selection and the feeding of sour milk to make the chicks strong. After all the various rules for selection have been applied, then test out by blood examination the remaining ones to make sure that none of the hens carry the disease. The State of Connecticut has agreed to make that test at a cost of five

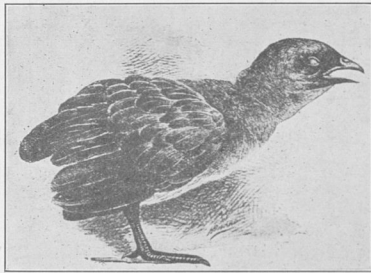


Fig. 15—Chicken affected with gapes.

cents per hen, and a State could not do a better thing for the poultry people of the country than to do this. The reason it has not been done heretofore is because the importance of the work has never been realized but the day is coming when it must be done everywhere.

You may be more or less familiar with the troublesome disease (Fig. 15) known as gapes. This disease is due to a parasite which lives in the soil part of the time and which is frequently found inside of angle-worms. Chickens living on infected ground pick up the soil and get these parasites in the throat where they fill the air passage, and unless relieved the chick will strangle to death. Fig. 15 shows a bird suffering with the disease and here are pictures of these gape worms. (Fig. 16.) Sometimes these worms are half or three-quarters of an inch in length. Fig. 16 shows the sucker-like disk with which it adheres to the throat and the male adhering here. If not removed they grow large and suffocate the chicken.

Just as soon as the disease is discovered the chicken should be killed

and burned and then rear chickens each year on new ground until the disease is stamped out. The great danger from this disease is in rearing chickens constantly on exactly the same place. In my State I have known instances where the coops have stood in exactly the same place year after year.

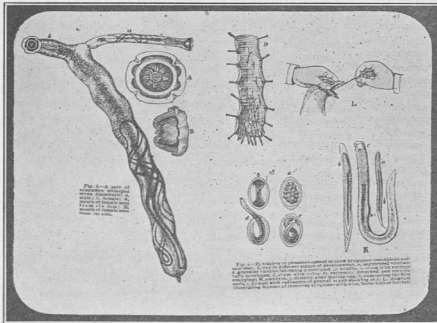


Fig. 16—Method of removing gape worm and treatment for same. It also shows enlargement of the worm.

### CHAPTER III

#### BREEDING FOR EGG PRODUCTION.

BY JAMES E. RICE,

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We must consider a number of factors in breeding for egg production, not the least of which is the number of eggs the hen will lay; but the real test of value of the hens for egg production is not based alone on the number of eggs laid. Several factors enter into consideration. First, it is based on the number of eggs produced per year; second, on the quality of eggs laid; third, the time of the year in which the eggs are laid; fourth, the cost of producing the eggs, and, fifth, the effect upon the health of the fowl.

The most important factor to secure the above results is the matter of constitutional vigor of the stock. We must discard from our flock all eggs or young chicks or pullets or cockerels for breeding stock which have any indication of weakness. It is only the strong that will pay, and only the strong upon which we can base a solid foundation for breeding for production.

It will pay well to breed only from pure bred poultry. Start with a foundation of stock or eggs from flocks which have been carefully and intelligently bred for vigor and egg production for a period of years. It is utter folly for a person to undertake to get satisfactory results in breeding for exhibition qualities or for eggs unless he starts where the other fellow left off. It is passing strange that persons will be willing to start with mongrel fowls when they could begin, with comparatively small original cost, with some good, pure bred fowls that someone else has taken years to bring up to high quality.

Therefore, start with pure bred poultry of some kind, for the following reasons: First, the fowls are more reliable in breeding; they are more prepotent, as we say; more likely to transmit their qualities, whatever these may be, good or bad, to their offspring, than are mongrels. By mongrels we mean ordinary fowls with no particular breeding back of them, or made up of a large number of pure breeds. A combination or cross of two or more pure breeds, no matter how good each may be, will not give as good results as a straight pure breed, because when a person has developed within a strain or variety certain characteristics of shape, size or color of eggs, or high egg production, or other characters, he knows, with a reasonable degree of certainty, that with this foundation these qualities will be more likely to be transmitted to the offspring.

In starting with some pure breed one does not need to be limited in choice to any one particular breed. There is more in the man or woman handling the breed than in the breed itself. Many persons are doing



equally well with one or another of many of the modern breeds, but you should only get *one* of them. I advise this not only for the sake of better egg producing qualities, but for other reasons. Wherever you have a lot of mongrels or a combination of various breeds, one year with another, the birds will not lay as many eggs as will those of any one good pure breed or variety. A flock of some one variety of pure bred stock will lay more eggs than the ordinary so-called "barnyard fowls," which have grown up without any particular parentage. It is a well known breeding principle that when varieties or breeds are mixed there is a clashing of characters and a tendency to revert to original types. The chances are that you will get a flock that will not lay as well as either line of parent stock. Take the White Leghorn and Black Minorca, or the White and Brown Leghorn; both are fine types of non-broody egg producers, but if you mix them their offspring will be more broody, will lay fewer eggs of less uniformity in size, color or shape. There will be a tendency to hark back to original type of fowls. The same thing is true if we mix the meat types, and there will be a reversion as to quality of meat.

The next factor is that the first cost for starting with pure bred stock is but little more. It will cost but a very few dollars more to begin in a small way with eggs from good pure bred stock, or with a trio or pen of good pure bred birds than with stock of no particular breeding. In almost any community good eggs for a start can be secured in this way at a low cost. If these eggs are hatched and the chickens carefully reared and brought to maturity early, the next spring you can waive the usual rule and keep a few of the pullets and the most vigorous cockerel for breeding. While, as a rule, it is better to not breed from pullets and cockerels, I think it permissible in such a case for the first year, providing always that none but vigorous, good sized, healthy individuals are used. This would give eggs enough for hatching purposes that spring and by the next year you could have on your place a flock of some good pure bred variety.

It costs no more to keep good pure bred birds than it does to keep mongrels, except in so far as they lay more eggs and grow more meat, which will require more feed, for which they will pay a better profit. But, taking size into consideration, if all are of the same size and lay the same number of eggs, it will cost no more to keep a pure bred flock of one variety than to keep a mongrel flock, and there will be less profit from the latter. Since this is true, why should we not start with something of better quality so long as we can handle it with exactly the same expense and with very little more original cost for stock?

The next factor is that we will get better results in feeding a flock of pure bred birds of one variety. This is due to the fact that pure bred birds are more uniform in type. In a measure, every bird is like every other bird in the flock. They are all Wyandottes, Rhode Island Reds, Plymouth Rocks, or Leghorns. But when you have mongrels, such as a flock we saw and photographed the other day not far from the College, where we counted seven varieties of individuals showing their external

characteristics (and doubtless there were other kinds which did not show in the feathers, but were in the blood). We do not get equal results in feeding mongrels. In a mixed flock you may have the Leghorn type of birds and their opposites, the heavy Asiatic types, which have a slow action and phlegmatic disposition; or you may have general purpose types, which are more active than the sprightly nervous Mediterranean. All good poultrymen who have compared pure bred and mongrels agree that you cannot get as satisfactory results in feeding a flock of common stock as you can from a flock all of one breed or variety.

In feeding fowls we must feed them as a flock, not as individuals, as would be the case in feeding dairy cows; hence, the importance of uniformity. In the mongrel flock you will have big and little birds and those of different characteristics, old and young birds, and birds that are active and birds that are phlegmatic, birds that are laying, birds that are not laying, those that are getting ready to lay, and those that have ceased to lay. We will find that they do not make the same use of the feed; they will get fat easier at one period than at another; some types will fatten more quickly on the same ration, and we cannot get as satisfactory results in feeding these various types as we can get if we have flocks that are all of the same variety and of essentially the same age and kept under similar general conditions.

Then we have the question of hatching the eggs from birds of varying characteristics. Anyone who has run incubators for several years knows that there is a difference in results between a tray of eggs all of one variety or a tray of eggs of more than one variety or many varieties. Where all the eggs in the machine are Leghorn or all Wyandottes or all Plymouth Rocks, we will get better results than where they are mixed. If the eggs are from the same variety, there is more likely to be uniform hatching of a large number of chicks at the same time. For instance, Leghorn eggs do not require within several hours as much time to hatch as do Wyandotte eggs or Plymouth Rock eggs; and these hatch in considerably less time than do the Asiatics. Where the eggs are of the same size, same texture of shell, the same rate of growth of the embryo, they will all hatch out at nearly the same time, very much like popcorn in a popper. When eggs of several different breeds are incubated together, the chickens late in hatching in an incubator do not have the same chance as those which come out of the shell earlier; so a given number of chicks will not do so well where there is much difference in time in the hatching as if the conditions are right for all of them to pop out at the same time. We can get this result only by having eggs of one variety of some pure breed.

Then, again, pure bred birds are most attractive in appearance. A person is to be pitied who has not enough pride and sense of appreciation to prefer to look upon a flock of good, uniform, pure bred birds rather than the ordinary, nondescript flock of mongrels—a regular “crazy quilt of feathers.” There is little that is uplifting, little to inspire a person to give these birds good care. But if one has uniform quality in the flock, no matter whether the birds are white or red or spangled

or barred, so long as the quality is uniform, it will be more attractive. It is but human nature to give better attention to such a flock. If we have something that "looks good" and has quality, we are bound to take infinitely better care of it. A man who has birds of this kind will give them better care because he wants to show them to his friends. Did you ever know a person who had mongrel poultry to ask his friends to come out from town, or to get out of the wagon or automobile to go in and take a look at a flock of mongrels? If you have pure bred birds you do not have to invite visitors, for there is nothing except babies that will attract so many people as nice chickens. A man who has fine chickens that people are coming to see will be infinitely more likely to have the chicken house clean and to take better care of his poultry.

Generally, it is a mistake to send money away off to some distant place, to persons you do not know, for stock eggs, simply because a breeder advertises big headlines in some magazine. You can generally find on the next farm, or one not far away, essentially as good stock and many times much better for your purposes, and you have the opportunity of knowing before buying the condition of the stock. We believe in community co-operation and development. This means to get the best you can and help one another. When enough people in a community are handling good stock, it will bring money into that community instead of taking the money out of it. That makes for prosperity.

The next factor has to do with the size, color and quality of the eggs. As we have seen, we can never make any progress in breeding for egg quality until we have pure bred stock. Under the head of marketing I am going to show how many dollars difference it makes whether our eggs are uniformly white or brown, of good size, and even shape. A combination of sizes, shapes and colors in the eggs will make a difference of 50 to 75 cents net per year per hen in our State as compared to eggs lacking uniformity in color, size and shape. We must eventually come to breeding for standard eggs which are going to bring the highest prices. There is no reason why eggs for hatching produced in this State should not bring as much money as those from any other, provided they have equal uniformity of color, size, shape and freshness. When your eggs have all these qualities, you can send your eggs into any of the big markets, New York, Chicago, Philadelphia or Boston, and receive the best prices for them. You can put quality into those eggs by having pure bred poultry and taking proper care of it.

Unfortunately, there are many pure breeds which do not produce eggs of uniform color, but the eggs from any pure breed are more uniform than those from the average mongrel flock.

When deciding upon a variety to keep, we want to consider the kind of egg as to color, size and shape that we ought to produce to secure the most money in the markets where they are to be sold. We are most likely to get this quality by keeping a pure breed.

These, in the main, are the points of greatest consideration, though not all the points that ought to be considered in favor of keeping pure bred flocks.

Having picked out high vitality stock, having selected a pure breed what else can we do to help get more eggs which will sell for the highest price? The first thing is to get early hatched pullets that will lay early.

There is a principle of annual development that applies to all animals, which we can apply in selecting our high producing birds. The principle is the well known fact that an animal generally shows early in life those tendencies and characteristics that are likely to dominate it through life. The application of this principle to fowls is that the chicken is born with a tendency to lay many or few eggs and will show that tendency early in life. A high producer generally begins to lay when young. Hence, we should hatch as many chickens as possible at one time or nearly the same time, so that they will come to laying early in the fall. If there is more than one hatch, those of the same age must be marked so that they can be distinguishable from the others. You must know in the fall approximately the ages of the pullets. They mark those that lay the first eggs in the fall of the year. If early and late hatched chickens run together unmarked, you cannot tell with certainty the chickens which lay at the earliest ages. But the bulk of your hatching, in any event, should be done early. You should bring off your chicks at the time when you get the highest fertility and hatching power in the eggs and when the pullets will reach laying before unfavorable weather conditions overtake them.

A person need not necessarily trap nest his fowls in order to know which ones are your best layers, though trap nesting is the most reliable method if it can be done; but it is expensive. One can pick out the birds which are laying by observation after a little experience. Experiment station trap nest records, covering many years, have shown the value of selecting the early laying pullets as an indication of production.

Another thing one can do is to watch the fowls in the fall of the year and find out which hens continue to lay late. Then mark them for breeders. It will be found that nearly always the birds that began earliest to lay as pullets will continue laying latest in the fall of the year as hens. Why is this? It is simply that they have inherited the tendency to lay, started early, and stopped late.

Another way to select the heavy producers is to pick out the hens that molt late. Some persons are getting pretty good results in breeding for egg production and they depend mainly upon selecting out the late molting birds and marking them to keep for breeders. If you do this you will get practically every high producing bird in your flock, and in a few years you should noticeably increase the average egg production.

In our ignorance we have been going on the assumption that late molters should be discarded, and we had been killing off in the fall of the year the late molting hens for committing the crime of laying too many eggs, i. e., for doing just what we have been trying to breed our fowls to do, namely, to lay persistently, early and late. After all of the years of heavy producing we have killed these hens because of our ignorance. Our excuse has been that we wanted to get eggs in November and December, when prices were highest, and in our efforts to do



this we saved the birds that had molted early because they had their new coats of feathers and were already in the "new fall styles" and, theoretically, should begin laying. But we failed to recognize the fact that those hens molted early because they did not inherit the tendency to throw their energy into eggs and lay late and molt late.

We have learned by means of trap nest records that vigor alone will not give the highest production. We had a hen that was a perfect beauty, her shape, color, comb, everything indicated a perfect winner; but when we looked up her egg record we found that she was nothing but a "fashion plate." She had not laid a single egg. She had been traveling wholly upon her shape. Yet what would we have done with that bird if we had not known the results of our molting experiments? We would have kept her through the next year and made the other hens support her, and we would have killed the hens laying late and molting late in the fall of the year, the highest producers.

The thing to do next is to go out and study your hens. A person has no business handling poultry if he is not sufficiently interested to take pride and pleasure in watching them and getting acquainted with them whenever he has an opportunity. Therefore, watch your birds. Whenever you find a bird laying in the molting period, mark that bird and next spring breed from her. Then pick out the finest cockerel from her offspring and mate him with some vigorous late molting hens, which will be your highest producers. Also, select the most promising of her pullets and use them for breeders when they are a year and a half old. This method of selection should improve the egg producing quality of the flock.

Another important point is to breed from mature stock. Breed from hens rather than from pullets; breed from cocks rather than from cockerels. But we must go on the principle all the time of breeding from the very best individuals we have. The principle involved is to breed for longevity, to get birds that have a tendency to long life, to increase the period of profitable production instead of decreasing it. Thus we will have birds with an inherited tendency always to longer and longer lives. We know certain families of humans where the usual term of life is eighty to ninety years, or even one hundred years. And we know other families where it is usual for the members to die young. A similar condition is true with chickens. What we need to do at the present time is to breed our poultry with a tendency to live long, to get productive value for three or four years rather than for one or two. Today two years is considered the average profitable commercial life of a fowl. The man who breeds up a fine herd of cattle has them for ten or twelve years, and there has been a continued tendency towards increasing the profitable span of life in other animals. But when we come to poultry, what is the state of affairs? We have a flock one or two years and then dispose of them. This means that a man must, every year, hatch and rear as many chickens as he has matured fowls. He really should rear more; otherwise he cannot select rigidly for quality and maintain his flocks.



Question: Is there any foundation for the theory that the male is more likely to transmit high egg producing qualities than is the female?

Professor Rice: I know of no foundation in fact for the belief that the male any more than the female has the power of transmitting this quality. A theory has been advanced by some authorities that high producing hens transmit high fecundity only to the sons. Even if that were true, we cannot get that high producing male unless we have a high producing mother, and it all goes back to the breeding practice that is as old as animal creation, namely, mating the best to the best. Or, in breeding for egg production, the mating of two high producing individuals. I shall not believe it depends exclusively on one more than on the other sex until I can see the proof based upon many experiments with several breeds, covering many generations of birds.

Answering the question just raised in regard to inbreeding and line breeding, I will say that inbreeding, as it is generally understood, means the continued pouring together of the same blood lines by the mating of close relatives, as brother to sister, or parent and offspring, systematically or indiscriminately. It is sometimes not easy to point out where line breeding begins and inbreeding leaves off.

Line breeding is a systematic effort at breeding together closely related lines or families in such a way as to avoid as much as possible the breeding of very closely related individuals. This is done by picking out the choicest male and the choicest female, for example, mating them and marking the offspring, and from this offspring starting what we call two different lines, a male line and a female line, and thereafter selecting the females from the female line and the males from the male line, according to a well defined system of selection. It involves a complicated, expensive system of marking, pedigree hatching and record keeping.

As a matter of fact, it is not a practical thing to do in breeding large flocks of birds on the farm. It is the thing to do and should be done in breeding small flocks of carefully selected birds for definite qualities.

Answering the inquiry how to avoid the dangers of inbreeding without going into the details of line breeding, I will say that is where co-operation comes in to advantage. That is why we need to have many persons in a community breeding for egg production with the same variety, so that they may exchange stock. Generally speaking, persons may continue to breed for three or four generations without introducing new blood, providing always that careful selection is made of constitutionally strong individuals. The great trouble arising from inbreeding is that a person gets so enthusiastic in breeding for feathers or shape of comb or body that he has not the moral courage to kill an otherwise desirable bird which lacks constitutional vigor. Such men breed so entirely for feathers that they are liable to forget all about egg production, and we can commit the same error in breeding for egg production.

New blood should be introduced into the flock gradually. Secure the male or female, or the eggs, from some person you know, with whose

stock and methods you are familiar. In case of buying eggs, hatch them and then choose the most vigorous, desirable cockerel to mate to a few of your hens, and after you have had opportunity to note the quality of the offspring, if it is satisfactory, you can introduce the blood into the rest of your flock. Proceed in the same way with mature breeding stock. At all events, do not introduce the new blood generally into your flocks until you have had time to test it, otherwise you may injure your own stock, the results which it may have taken many years to secure. There is more money lost through indiscriminately getting in new blood every year than in almost any other way and great care should be used in this connection.

The point I want to emphasize is that if you must get new blood, either by purchasing eggs or mature stock, do it gradually. Experiment with a few chickens, mark these, watch the developments carefully, and, if satisfactory, introduce blood from these offspring into your other pens.

## CHAPTER IV

### RAISING CHICKENS.

BY JAMES E. RICE,

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This we consider is the most important and the most difficult part of poultry husbandry. This is the place where nearly everyone who fails "falls down." This is because we are dealing with so many little individuals. Unless our methods are right we are likely to get poor results. Danger of failure is also due to the fact that every year the poultryman must go through the process of rearing as many or more chickens as he has mature fowls on the farm. If he fails to succeed in raising enough early pullets to replace about one-half of the hens on his place, he will go into winter quarters with many birds not as efficient as they should be, or his houses will not be filled. All over the country men have failed in the hatching and rearing part of the business who have been fully competent to carry on the other lines of the work. The greatest limitation of the poultry business on the farm has been due to the difficulty of hatching and rearing chickens. Men can keep hens by the thousands so far as mere feeding, housing and handling are concerned, but when it comes to the details of hatching thousands of eggs and rearing thousands of chicks they find their limitations. This is due principally to the very small number of chickens that generally it has been thought must be reared in single flocks.

Within a few years many methods have been devised by which eggs can be incubated with greater efficiency and in vastly larger numbers than it was formerly thought possible. So, too, brooders have been invented by the use of which chicks may be reared in larger flocks of two or three hundred or possibly more, instead of the small flocks of twenty-five or fifty, as was formerly the custom.

This morning I will deal entirely with a system of rearing which has to do with flocks of two hundred and fifty to three hundred chicks, believing that in all cases where persons intend to make the poultry business a considerable part of their farming, they could well introduce some system by which chicks can be reared in large flocks. For farmers who keep a comparatively few fowls and have a few chicks coming off at a time throughout the season, they will frequently find it to be more satisfactory in the end if they will use some system of getting their eggs hatched at one or two, or, at most, three hatches, and then have a brooding system which will take large flocks of chickens, and let these be the only hatches of the season. The broods should be sufficiently far apart so that they may be given individual attention. By so doing, they can rear just as many chickens as by the old methods of small flocks in little kerosene heated brooders, and do it with infinitely less labor. On many farms the method of hatching with hens and brooding

with hens should still prevail, where no one has the time nor the inclination nor the skill to take care of a modern brooding system. In such case it would be better to have one of the general purpose breeds that have a reputation of being good mothers and let them do the hatching and rearing. We have among these varieties the Plymouth Rocks, the Wyandottes, the Rhode Island Reds, Orpingtons, etc. All these have the reputation, and I can vouch for the accuracy of it, of being splendid mothers when left to look after their own broods in their own way, with a little direction.

But the person who wants to hatch and rear every year two or three hundred pullets would find it advisable to have the one large flock and brooding system.

During the past few years a great many new inventions have been devised. Some of these are heated with fuel oil, others by kerosene, and still others by gasoline or coal.

The system which we devised at Cornell some twelve or more years ago is heated by gasoline and is, we think, essentially fireproof, and can be operated with less labor than any other system which has yet come to our attention. The coal heated brooder, however, can be heated with less cost for fuel, but requires greater care and attention in operating, and I think also requires as great skill. In the future we are going to look more and more to some of the coal burning types of brooders very largely because of the economy of fuel; and this is going to be especially true in those sections of the country where the temperatures are fairly uniform.

The great test of any brooding system is its ability to adjust itself and to be operated under widely changing temperatures, and we find the North is probably a good deal more severe in testing out the brooders than would be the case in the South, because our temperature runs so very low on one day and high on another, often changing thirty or forty degrees in twenty-four hours.

This brooder house (Fig. 17) is large enough to hold two hundred and fifty or three hundred young chickens, and all of the pullets in the flock, which would normally be reared to maturity, and will give them abundance of perch room. The house is eight feet square, having a shape that gives us the largest possible amount of workable space inside which we have been able to secure with the least cost for materials and with least weight.

We have made a number of types of houses, of which this is the latest and best. (Fig. 17.) You will notice that we have provided for air in the front through the window opening in the apex, and also a similar opening in the rear, so that we have an abundance of fresh air. We are able to do the work inside of these houses. In the very inclement weather, when storms come up and prevail for several days, the chickens are kept inside and the attendant can go inside to care for them. In the South it would be advisable to have the sides hinged to lift up for additional ventilation.

You will notice that these houses are placed fifty feet or so apart for



Fig. 17—Movable A-shaped colony house and method of coupling together for winter use. This type of house is too hot in the summer in Texas climate. The sides should be hinged to swing out and up. Too much glass in front for Texas climate.



Fig. 18—A row of colony houses at the Old Cornell University Poultry Plant. The plant has since been moved to a less congested location.



the first few weeks of the chickens' life, so that they may be given individual attention in what we call a nursery, in a nice, cool, shaded place in an orchard or field where the chickens can run out of the building when young. (Fig. 18.) Little chickens are quick to succumb to sunstroke, and many die from exposure to the sun that would survive if given proper protection. You will notice also that we have in Fig. 18 a woman to take care of the chickens; at least, we had for several years, and she was exceedingly successful in caring for them. Generally women are more successful than men in rearing chickens. They are more likely to look after little details and to keep things clean.

You will notice a chick enclosure (Fig. 19) to keep the young chicks from wandering too far away. They are educated and flocked first to

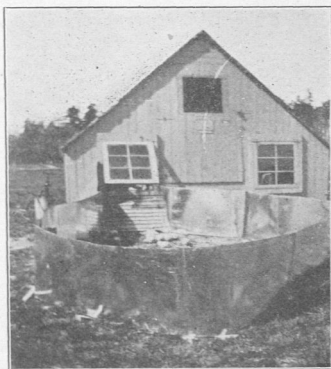


Fig. 19—Movable circular tin chick yard that automatically teaches the chicks the way to the house. It has been found very practical.

the brooder hover, then to the house, then to the yard, and later, when they are moved to the field, it is very easy to have the chickens come to their own houses with great regularity. These houses are kept right near the main buildings, where the baby chicks can be looked after properly at first and guarded against the invasion of crows, rats, or other enemies, where they can be fed without the attendant needing to go far to do the work. As soon as they are old enough, at five or six weeks, the houses, heaters, chickens, feeding appliances, and all, are moved right into the meadows, orchards or corn fields or anywhere it is desirable, on new ground, where the houses are scattered two or three hundred feet apart, and the chickens are given absolutely free range for the rest of the season. There they get insects, seeds and grass, and

are also able to pick up a great deal of waste grain which would otherwise be lost.

The picture shown in Fig. 20 was taken from the top of the barn looking over the plant. You see long rows of colony houses, extending back over the fields, covering fifteen acres. More than five thousand five hundred chickens are here in about thirty houses, and between each two houses you will notice a water barrel, an outdoor feed hopper, and a shelter from the sun. Inasmuch as this land has been occupied for a comparatively short length of time, and we have not yet had a chance to get fruit trees growing to provide shade, we furnish artificial shade by driving stakes and putting cross poles on them, covering this with wire and then putting over the top a layer of hay, so that it furnishes a large covered area under which the chickens can go and lie in the heat of the day.

In the morning, as soon as it is daylight, the attendant unlocks the



Fig. 20.—The chick rearing division of the Cornell University Poultry Department. Chicks are reared under free range conditions.

house and lets the chickens run out in the cool of the morning to forage as freely as they will, and then, during the middle of the day, they are found in the houses or under the shelters. At night they go foraging again and the last thing at dark, when the chickens have all gone into their own quarters, the attendant locks the houses. The point we emphasize is, that they shall have an opportunity to get out and forage early in the morning and at twilight when it is cool, and have shelter and feed provided near by so they do not need to go out in the hot sunlight. This precaution is of even greater importance in the South than in the North.

The chicks placed in one flock must be of one age and, in addition to that must be very carefully graded as to size and vigor. If you put some weak chicks in a flock of strong ones, the strong chicks will dominate the others and practically exterminate them. The weaker ones

must be culled out and killed or placed in a brooder by themselves where they may be carried to broiler age.

We use matched, first quality lumber for making these houses, placing the boards vertically so that every board serves as a stud or rafter. We have the plates, rafters and sills for a light frame and the boards are put on vertically. For our late hatches, where houses are to be used in summer, we use clapboards and no paper and leave a half inch space between the boards, putting in a little wedge so as to hold the clapboards in an open position. Those are put on horizontally. That enables the chickens to get a fine circulation of air right through the house without the wind driving on them.

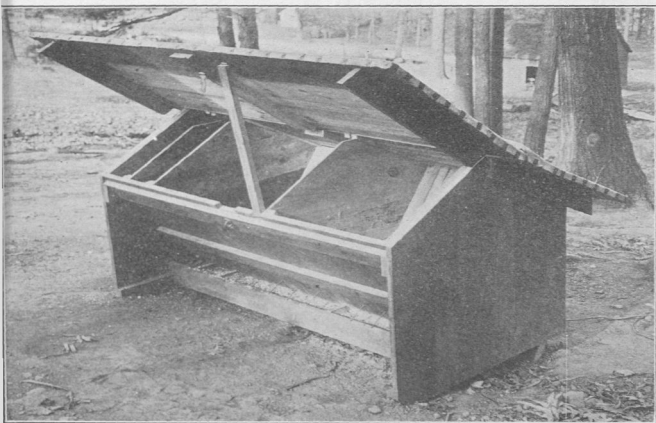


Fig. 21—An outdoor feed hopper. This hopper contains four compartments. Constructed for outdoor use.

Fig. 21 is an outdoor hopper which can be used indoors as well. Such a hopper can be placed in the partition so that the fowls can eat from either side. The roof is made so wide that it hangs over the sides far enough so that the rain cannot wet the feed. One side of the roof lifts up. The hopper is divided into compartments for the mash, oyster shell, charcoal, etc. You will remember that one of the earliest pictures showed a water barrel and feed hopper between each two houses so that chickens eight or ten weeks old will never be without these supplies. With this provision they will grow into strong, husky, vigorous chickens, if proper rations are fed.

One man drives around to these houses with a horse hitched to a low-

down wagon, carrying barrels of water and bags of feed to fill these hoppers. When he cleans out the houses he puts side boards on the wagon, throws the cleanings into the wagon and disinfects the houses. Every week every house is cleaned out and thoroughly disinfected. During the first week or two of the chicks' lives the houses are cleaned twice a week and fine cut straw placed in the houses for litter. It may seem to some persons that this is going to too much trouble in raising chickens, but it is all necessary and important if one is to succeed and desires to keep down cost.

## CHAPTER V

## CANDLING AND GRADING EGGS FOR MARKET.

By F. W. KAZMEIER,

Poultry Husbandman, Extension Department A. and M. College of Texas.

The general practice in Texas has been to market eggs without candling or grading. This haphazard method of marketing has caused abnormally low prices for fresh eggs in the summer and has caused egg retailers to prefer good cold storage eggs from Northern States to the native product. The low price of eggs during the summer is largely due to inferior quality and not entirely to overproduction, as so many farmers think.

## PRODUCE INFERTILE EGGS.

It has been proven that a fertile egg deteriorates at a temperature of 68 degrees or above. Under ordinary conditions on most farms it is

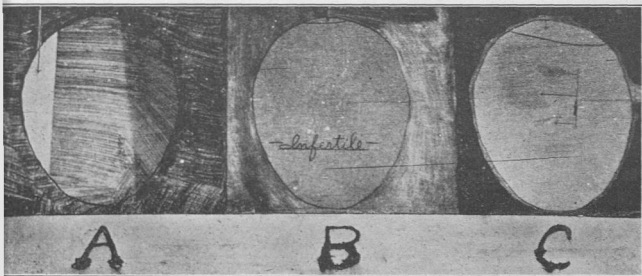


Fig. 22—(A) An extremely bad egg showing decay, a ruptured yolk and air cell. (B) A new laid egg, 24 hours old. Note small air space. (C) Spot rot and a large air space.

impossible to keep eggs at a temperature below 68 degrees. It is highly desirable, therefore, that roosters be kept apart from hens when eggs are not required for hatching purposes in order that all market eggs may be infertile. (Fig. 22.)

## PURE BRED STOCK.

Produce eggs of a uniform size and color. Practically all of the small breeds lay a white shelled egg and most of the large breeds lay a brown shelled egg. Texas markets make no demands in regard to color, but there is a demand for uniformity in size and color.



## CARE OF MARKET EGGS.

Market eggs should be gathered at least three times a day. Clean nests, yards, and houses should be provided to prevent dirty eggs. Dirty eggs sell for about five cents per dozen less than clean eggs of equal quality. Washed eggs do not keep as long nor sell for as much as clean unwashed eggs. Market eggs three times a week or oftener. Until you are ready to market, store in a cool and comparatively damp place. The dampness, however, should not be sufficient to cause the growth of molds. Do not tolerate setting hens on nests from which market eggs are obtained. Do not store eggs in the same place with kerosene, decaying vegetables, or other odor-causing substances. Endeavor to get the eggs to the consumer as soon after being laid as possible.

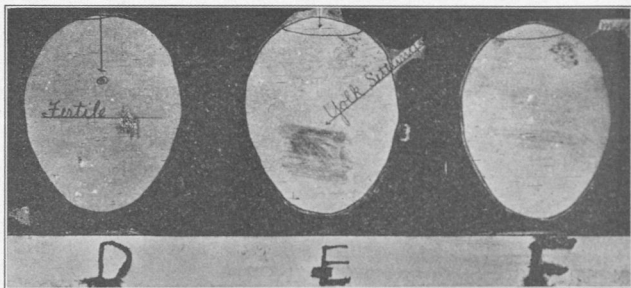


Fig. 23—(D) A fertile egg 6 hours old. Note the development of germ. (E) A stale shrunken egg. Note large air space and dark yolk setting. (F) Egg showing a mold spot.

## QUALITY.

Flavor, freshness and size are indicative of the quality of an egg. Feed nothing but pure and untainted foods. Market nothing but good sized eggs. Use the smaller ones at home.

The older the egg, the staler it is. In a perfectly fresh egg the air space is noticeable but very small. The egg shows increased evaporation, or size of air space, with age. The smaller the air space, the fresher the egg. The larger the air space the staler or older the egg. Storing eggs in very dry locations increases the evaporation. (Fig. 24.)

## CANDLING EGGS.

In order to candle eggs it is necessary to be equipped with a dark room and a strong light. Anybody at all handy with the saw and hammer can construct a good home-made tester. Build a rectangular box several inches larger and higher than your kerosene lamp. Cut a two-

inch hole in the top to allow the heat to escape. Cut a hole a trifle smaller than an egg in the side of the box and exactly opposite the flame. Line the opening with some soft cloth to act as a cushion for the eggs. Cut a few triangular notches in the bottom of the tester to prevent it from being air tight and causing the lamp to smoke. Place tester in a dark room. To test eggs, hold them between you and the strong light coming through opening of hole in the side of tester. Various kinds of testers, both kerosene and electric, may be purchased ready made.

Candle or test all eggs before marketing. Throw out all such as show blood spots, blood rings, ruptured yolk, grass yolks, and much evaporation. Evaporation shows in size of air space. (Fig. 23.) A blood spot shows a round dark spot, generally in the yolk. A blood ring indicates that the germ has started to develop, due to the egg having been kept at a warm temperature. Grass yolks generally appear dark

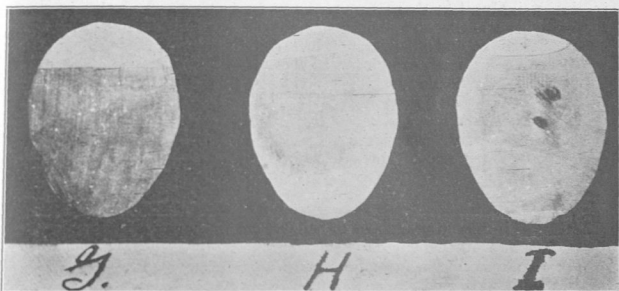


Fig. 24—(G) Egg about due to hatch, note large air space and blood veins leading to air space. (H) A heated egg—heavy float. (I) An egg showing black rot.

and heavy. A ruptured yolk shows the yellow more or less mixed with the white. (Fig. 22.)

#### GRADING EGGS.

In grading eggs we consider color, size, shape, quality, and condition of shell. There are three important grades of eggs as to color, white, brown, and mixed. In size we have the following: large, 27 ounces and above per dozen; medium, 21 to 27 ounces; small, 18 to 21 ounces; and culls, smaller than 18 ounces to the dozen. In quality we have the following: perfectly fresh, fresh, heated, stale, evaporated, watery, and rots.

In Texas, eggs generally are classified as follows: Fancy white, fancy brown, first white, first brown, seconds, checks, and rots.

Eggs to be classed as fancy white must all be pure chalk white in color, weigh to exceed 27 ounces per dozen, perfectly fresh, perfect in shell, perfectly clean, normal and uniform in shape.

The fancy browns are identical with the fancy whites except as to color. They should be a uniform rich brown.

Eggs to be classed as first white must all be pure chalk white in color, weigh 21 to 27 ounces per dozen, and possess all the other qualities of the fancy white.

First browns are identical with first whites except as to color, which should be brown.

Eggs to be classed as seconds may be smaller, weighing between 18 and 21 ounces per dozen, may be mixed in color and show some evaporation,—or, in other words, do not have to be perfectly fresh. They must, however, not show too much evaporation and be in every respect fit for food. Perfectly fresh washed eggs frequently are placed in this class. They should be clean and have a perfect shell.

Eggs to be classed as checks generally show quite a little evaporation, meaning that they are stale, but still fit for food. Eggs that are small in size, weighing less than 18 ounces per dozen, fresh eggs with imperfect (broken) shells and abnormally shaped eggs are included in this class. "Dirties" and all eggs not included in the previous classes but which are fit for food, are placed in this class.

Some markets do not include "dirties" with the checks, providing a special class (dirties) for the same.

Eggs classed at "rots" are unfit for food and should never be sent to market. Eggs with partly developed germs and those with interior mold growths are also included in this class.

#### PACKING.

Although it may appear hard to believe, yet it is true that appearance more than any other factor sells the product. Wealthy customers are willing to pay well for fancy wrapping paper, boxes, or cartons. For this reason it pays well to pack all poultry products in neat and attractive packages. It is a good idea to get up an original package and adhere to it.

#### PACKAGES.

For shipping to commission houses, hotels, retailers, country stores, or private families in large lots, use the 4, 6, 8, 12, 15, and 30 dozen egg shipping crates. Never pack more than one color, size or quality in one carton, and if possible, follow the same rule in packing a full crate.

For private or fancy trade with hotels, clubs, and associations, the oblong one-dozen size cartons with your name, brand or trade-mark printed on the same in large black or red letters are best. An appropriate picture improves the appearance of the carton.

To ship eggs by parcel post it is necessary to pack them in so-called parcel post egg shipping packages. At present a large number of different kinds of parcel post packages are manufactured. Such a package should permit quick packing, be cheap, strong, and light. When shipping eggs by parcel post consider cost of package, packing, breakage, and transportation charges. Unless the eggs are shipped to wealthy

consumers or a special trade the transportation charges are too high to make it profitable. The packages are rapidly being improved and it is hoped that the transportation charges will be lowered, making it profitable to ship eggs by parcel post to the ordinary market.

## MARKET POULTRY.

Have the birds well fattened before killing.

Starve twenty-four hours before killing to empty the crop.

Kill by bleeding in mouth and debraining. Bleed bird well and dry pick.

Do not pack until all of the animal heat has had time to escape.

Keep at a temperature below 50 degrees and do not allow to remain in the water too long.

Wash the head to remove all blood and wrap in special wrapping paper. Wash vent to remove all voidings.

Pick and pin-feather without tearing the skin.

When shipping dressed poultry always pack in ice. Use plenty of ice around the vent, crop, and head. In warm weather, the ordinary market pays better for live poultry.

Pack all birds according to size, kind, class, age, and quality.

Line box or barrel with wrapping paper.

Ship by shortest and quickest route.

## LIVE POULTRY.

Ship live poultry by express in light, high, and roomy coops. Do not overcrowd them. Coops constructed of slats or wire netting are the best. Endeavor to have fowls as fat and uniform in size, age, and color, as possible.

## CHAPTER VI

### CO-OPERATIVE MARKETING OF POULTRY PRODUCTS.

By F. W. KAZMEIER,

Poultry Husbandman, Extension Department A. and M. College of Texas.

As a general rule farmers devote too little time to the marketing of their products.

In the State of Texas, I find that eggs bought from farmers at 10 cents per dozen are invariably marketed by the retailers to the consumer at 20 cents or more per dozen. The cause of this can be summed up in the statement "lack of co-operation among the farmers."

Farmers in the vicinity of Denton, Texas, recently organized and marketed their eggs co-operatively. What happened? Inside of a week they received five cents a dozen above the highest market quotations for their eggs and could not supply the demand.

#### MARKETING POULTRY BY THE DOZEN.

In Texas, poultry buyers, dressers, and commission houses still practice the unbusinesslike and out-of-date method of buying poultry by the dozen. Market quotations quote live poultry at so much per dozen. This is entirely wrong and a poor way of doing business for the farmers.

All Texas poultry raisers are urged to market their fowls at so much per pound. Insist on market quotations per pound. Do not patronize the dealer buying at a lump price per dozen. The only time it is at all advisable for the farmer to break this rule is when marketing very small broilers, weighing less than a pound each.

Texas poultry raisers are urged to organize and market their products co-operatively. At present too large a share of the profits go into other than the farmers' pockets. By marketing their poultry products co-operatively, Texas farmers can increase their profits on poultry by more than \$1,000,000.

Co-operative marketing of poultry products is not a new and untried idea. It is being successfully practiced in every State in the Union, and is the only profitable way of marketing for the small farmer. The large poultry raisers can sometimes market their products to advantage without being organized, but the small poultry raisers are at the mercy of the poultry buyers and dealers. Co-operative marketing depends on various important factors. The members of the organization must be willing to stick together. They should agree to work for the welfare of the organization at all times. The organization must be composed of members who believe in producing quality and not alone quantity. The members should standardize their products and sell them under their trade name, backed with a sound and broad guarantee. The or-



ganization should make it a point to market economically and at a fair price.

The successful co-operative egg and poultry marketing associations in Texas and other States follow more or less the following general outline and advice, which has been patterned after a most successful organization of this kind, the plans of which were originated in the poultry department of Cornell University:

A group of farmers organized and established headquarters in the nearest central town or city with good railroad connections. A large room adjacent to the express office was rented. The room was equipped with an egg candling apparatus and a poultry killing outfit. A place for storing empty egg packages and boxes was provided. A man was engaged to give all of his time to gathering the eggs and poultry, candling, grading, and packing the eggs and killing and packing the poultry. Country routes were established, which this man traveled on certain days of the week, stopping at all farm houses and taking whatever eggs and poultry they had, leaving a properly filled out receipt for the same. An identification mark was attached to each customer's produce. The farmers were given the privilege of bringing the products themselves, thus saving the charges made for collection.

The egg gatherer keeps a record of every patron's eggs and poultry, and payment is made according to the number and quality of the patron's products. Payment is made according to a certain specified and adopted scale, specifying a certain price for a certain grade, which is, of course, influenced by the latest market quotations. If a patron sends in a dozen eggs and upon candling and grading it is found that one is rotten, three are too small and two not perfectly fresh, the patron gets paid accordingly. Payment is made every two weeks, but under some conditions it is advisable to make remittance every week. Each patron gets top market prices for his products, this being influenced by the quality and grading of the same. The organization thought it advisable to make a small charge for actual expenses incurred for gathering, cleaning, grading, candling, and packing the eggs; also for killing, picking, packing, and collecting the poultry. This is advisable because it gives all an equal and fair deal. Those that do not send dirty eggs are not charged for cleaning. Those that deliver the eggs are not charged for collecting.

At the co-operative association headquarters, the eggs are cleaned, candled, graded and packed in fancy cartons and sealed with the organization seal. The live poultry are killed, picked, cooled, wrapped, packed and disposed of similarly to the eggs. All products are sold for what they are. Nothing but the best quality is sold under the organization seal and guarantee. Special attention is paid to the quality of the products and appearance of package.

Some of the products are sold locally and others are sent by express or parcel post to markets where they net the most. In large poultry producing sections carload lot shipments can be made. Orders for delivery and collection are received at regular hours by telephone, telegraph, in writing, and in person.

The following is a list of the charges made:

*Eggs.*

Collecting, 2 cents per dozen.  
Cleaning, 1 cent per dozen.  
Candling, 1 cent per dozen.  
Packing, 1 cent per dozen.  
Cases, 1 cent per dozen.  
Express, 1 cent per dozen.  
Accounts and records,  $\frac{1}{2}$  cent per dozen.

*Poultry.*

Collecting, 1 cent per pound.  
Killing and picking, 10 cents each.  
Packing, 1 cent each.  
Packages, 3 cents per pair.  
Express, 80 cents per 100 pounds.  
Accounts and records,  $\frac{1}{2}$  cent per pound.

The work of such organizations has been very successful and encouraging. The opportunities for such organizations in Texas are almost unlimited and they will easily double the poultry raisers' profits.

CO-OPERATIVE MARKETING WITH CREAMERIES.

In some of the leading dairy and poultry States, eggs are being marketed co-operatively through creameries. This method of marketing has proved fairly successful. In Texas, however, there are too few creameries to look to them as a means of marketing poultry products.

Co-operative egg marketing associations in Texas will benefit Texas poultry raisers as much or more than the fruit exchanges have benefited California fruit growers.

## CHAPTER VII

## RATIONS FOR POULTRY.

(Adapted from Cornell University.)

## RATION FOR CHICK FEEDING.

*The Ration.*

Mixture No. 1: Eight pounds of rolled oats, 8 pounds bread crumbs, 2 pounds sifted beef scrap, 1 pound bone meal.

Mixture No. 2: Two pounds wheat (cracked), 2 pounds cracked milo or corn (fine), 1 pound pin head oatmeal, 1 pound millet.

Mixture No. 3: Three pounds wheat bran, 3\* pounds milo, kafir or meal, 3 pounds wheat, middling, shorts, 3 pounds beef scraps (sifted, best grade), 1 pound bone meal.

Mixture No. 4: Two pounds wheat (whole), 2 pounds kafir, milo or corn, 1 pound hulled oats.

Mixture No. 5: Three pounds kafir, milo or corn, 2 pounds wheat.

*The Method.*

One to five days: Mixture No. 1, moistened slightly with sour skimmed milk, fed five times a day; mixture No. 2, in shallow tray containing a little of No. 3 (dry) always before chicks. Shredded green food and fine grit and charcoal scattered over food.

Five days to two weeks: No. 2 in light litter twice a day; No. 3 moistened with sour skim milk, fed three times a day; No. 3 (dry) always available.

Two to four weeks: As above, except that moist mash is given twice a day.

Four to six weeks, or until chicks are on range: Reduce meals of moist mash to one a day; mixture No. 4 in litter twice a day; dry mash is always available

Six weeks to maturity: No. 3 and No. 5 hopper fed. One meal a day of moist mash if it is desired to hasten development.

Directions: Provide fine grit, charcoal, shell and bone from the start. Give grass range or plenty of green food. Fresh water. Feed only sweet, wholesome foods. Avoid damp and soiled litter. Disinfect the brooder frequently. Provide shade, fresh air and protection from the sun.

## RATION FOR LAYING HENS.

The following whole grain mixture is fed morning and afternoon in a straw litter:

Whole grain. Sixty pounds milo, kafir or corn; 60 pounds wheat, barley or heavy oats.

The following mash is fed dry in a hopper kept open during the afternoon only:

Sixty pounds milo, kafir or corn meal, 50 pounds wheat middlings (shorts), 30 pounds wheat bran, 15 pounds cottonseed meal, 35 pounds beef scrap, 1 pound salt.

The fowls should eat about one-half as much mash by weight as whole grain. It is a good idea to feed only a very little grain feed in the morning, and all they want late in the afternoon. This ration should be supplemented with some succulent green feed the fowls will eat. It is important that they have some form of green feed daily.

Grit and oyster shells are necessary, also cool and clean surroundings with plenty of fresh water.

## CHAPTER VIII

## HOT WEATHER—THE MALES—THE EGGS.

By F. W. KAZMEIER,

Poultry Husbandman, Extension Department A. and M. College of Texas.

When the breeding season is past the question comes up as to what to do with the male birds, cocks, cockerels or roosters. They must be separated because you cannot afford to produce fertile eggs, which rapidly deteriorate in a temperature of 68 degrees or above, and it is almost impossible to keep the eggs in a temperature below 68 degrees in this climate. Those that have a large number of males should build

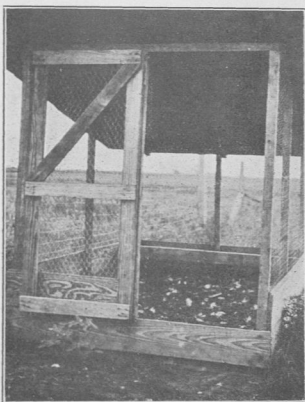


Fig. 25—A movable house, used for the housing of male birds out of breeding season.

a small coop for them in the orchard or wood lot and allow them to range in a large yard. It may be necessary to clip their wings to prevent them from flying over the fence.

No farmer in the State of Texas should sell fertile eggs for other purposes than hatching during late spring, summer and early fall. It is impossible to produce fertile eggs in summer and get them to market in condition fit for human consumption.

Fig. 25 shows a 6x8 feet movable coop on the A. and M. College



poultry farm used for the housing of the males out of the breeding season. This coop is located in a large yard with plenty of grass. On the farm this coop is best located in the orchard, wood lot or in the shade of trees. The construction of the coop is very simple. The floor and roof are built solid. A board one foot high keeps the litter inside. The remainder of the sides is covered with one-inch poultry netting. The door is in the front. This coop can be built larger or smaller, depending on the number of males to be housed. The males housed in one of these coops, located in an orchard or wood lot, where they can range in a good sized yard, will be in good condition by the breeding season.

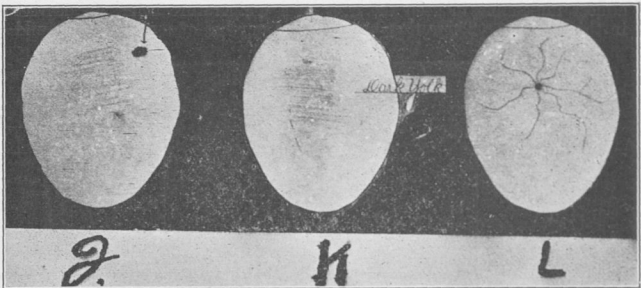


Fig. 26—(J) Egg showing a blood or meat spot. (K) A No. 1 cold storage egg; note size of air space; and dark yolk. (L) Showing a fertile egg 7th day of incubation.

## CHAPTER IX

## PREVENTION OF POULTRY DISEASES.

BY F. W. KAZMEIER,

Poultry Husbandman, Extension Department A. and M. College of Texas.

The success of poultry raising depends largely on being able to keep the birds thriving, vigorous, and healthy. They are machines which convert raw material into a finished product. In order to bring about this transformation most efficiently and economically the fowls must be kept in perfect health and in the pink of condition. One of the most serious obstacles in the poultry business is disease. Knowledge of the nature of the preventive and curing remedies is necessary to successfully check poultry diseases.

A healthy chick is lively, has clear eyes, a red comb, is quick and active in its movements, has a good appetite, and its organs perform their functions in a natural way.

To effect a cure, we must first understand the disease. Digestive troubles and disorders are frequently caused by the nature and amount of feed. The lack of such feed essentials as grit, oyster shell and water frequently cause indigestion and its long string of ailments. Exposure to dampness or drafts are other causes of indigestion.

In case the ailing individual happens to be a laying fowl, look for these ailments: rheumatism, bumblefoot and leg weakness.

If the general health is affected, as shown by paleness of comb, wattles and face or loss of weight, the cause can generally be attributed to internal or external parasites.

In treating poultry diseases, an ounce of prevention is worth more than a pound of cure. The ax, kerosene, and matches are the three best remedies for fowls with a contagious disease.

Locate the poultry house on a high, dry, well drained place. Gravel or sandy soil is to be preferred to heavy clay soils for poultry yards.

Plenty of green food not only aids digestion but helps materially in keeping the birds vigorous and healthy.

Lack of exercise is the greatest cause of bad habits and digestive troubles. Allow fowls free range and fence in garden and lawn. Fowls in confinement are much more subject to disease than fowls on free range.

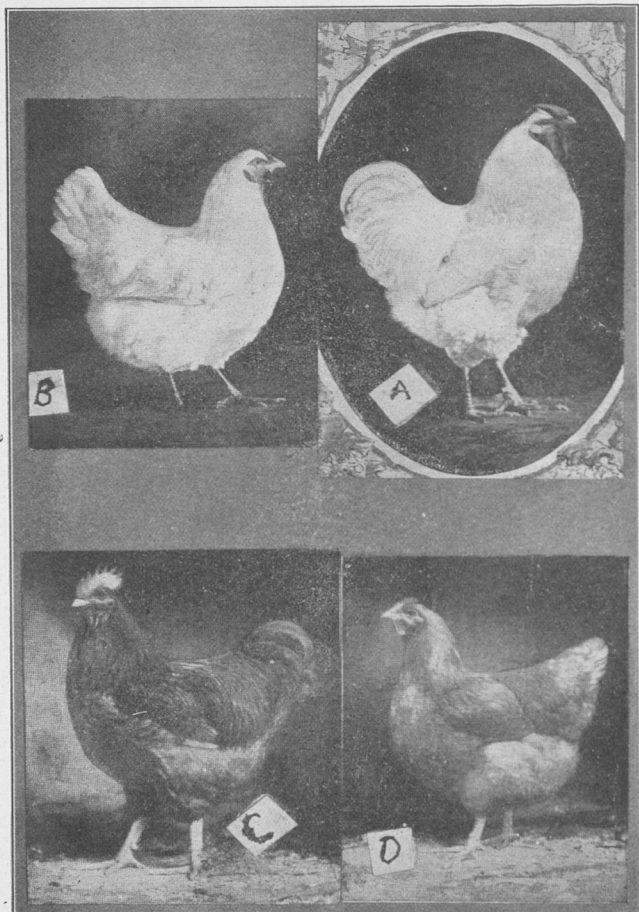
Lack of fresh air is frequently the cause of such diseases as colds, snuffles and mild forms of roup.

The most important factors in preventing poultry diseases are cleanliness and regular disinfection.

One of the best commercial disinfectants is a solution of 1 part water to 25 parts Zenoleum; Creolin, Kresol, or any other coal tar disinfectant. This should be applied with a fine mist sprayer and sprayed into every crack, corner and crevice. Success in preventing disease depends upon the regularity and thoroughness of the disinfection.

A good spraying mixture for red mites, blue bugs, and other similar poultry parasites is 3 pints kerosene or Beaumont oil and 1 pint of crude carbolic acid.

Charcoal is an excellent digestive trouble correcter.



Figs. 27, 28, 29 and 30—(A) A white Wyandotte male; (B) A white Wyandotte female; (C) A Buff Orpington male; (D) A Buff Orpington female.

## CHAPTER X

### TURKEYS ON THE FARM.

BY F. W. KAZMEIER,

Poultry Husbandman, Extension Department A, and M. College of Texas.

The State of Texas is well adapted to the growing of turkeys. In some parts of the State turkeys are kept in large flocks and herded like sheep. Turkeys in order to do well should be raised on fresh ground each year with plenty of land to roam over.

#### VARIETIES.

The most popular varieties are the Mammoth Bronze, Bourbon Red, and White Holland. The Bronze turkeys are the largest of all. The standard requirement for adult male is 36 pounds; for adult hen, 20 pounds. The Bourbon Red is a close second in size. Both are hardy and reasonably free from disease. The Bronze turkey is the wild turkey domesticated. The Bourbon Red turkey is supposed to have come from a cross of Bronze and mongrel buff stock. Some other varieties are the Slate and Buff, but neither is as extensively bred as the three first named varieties. The White Holland turkey is noted as a good layer and economical meat producer. White turkey feathers are worth more than colored turkey feathers.

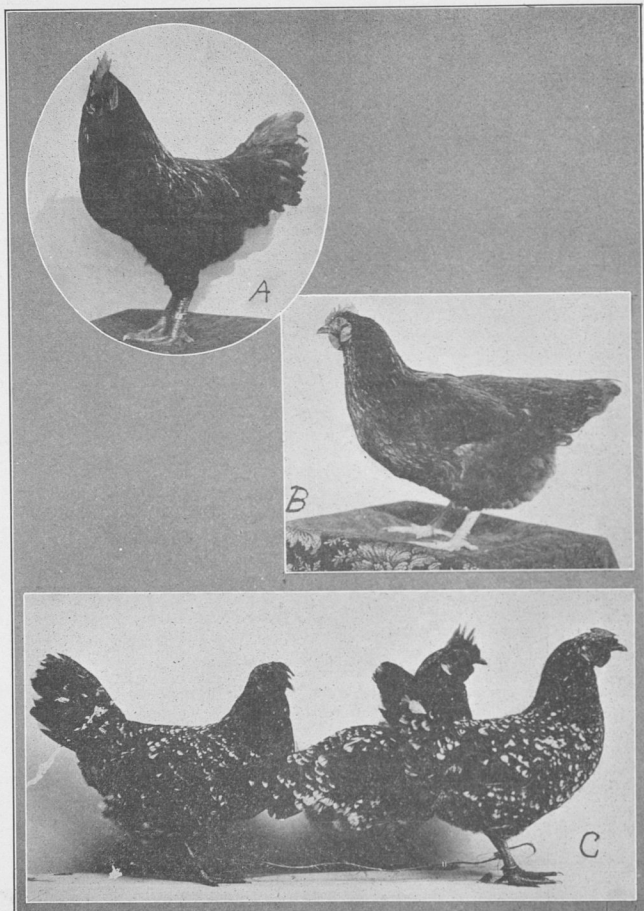
#### BREEDING.

Do not practice inbreeding. Make it a practice to select only healthy, vigorous and medium sized birds for breeders. Buy new toms of unrelated stock each year and mate with the most vigorous of your turkey hens. As a rule, young turkeys do not make as good breeders as two-year-old turkeys. Keep the best of your early hatched specimens for breeders, and sell the late hatched specimens. A good many make the serious mistake of doing just the reverse.

Allow your breeding stock free range. Turkeys can never be profitably kept in confinement. The poults from stock allowed unrestricted range are much stronger, easier to raise, and more profitable. Practically all of the most fatal turkey diseases are eliminated when they can be kept on fresh ground each year. Keeping turkeys year after year on the same ground generally proves fatal.

#### FEEDING BREEDING STOCK.

During the winter feed very lightly and the food should not be of too fattening a nature. Corn should not be fed extensively, because it is too fattening. Feed a mixture of equal parts oats, milo or kafir, and barley or wheat. Buckwheat will take the place of milo or kafir



Figs. 31, 32 and 33—(A) S. C. R. I. Red male.—Courtesy of Jas. Everett. (B) S. C. R. I. Red female.—Courtesy of Jas. Everett. (C) Mottled Anconas.—Courtesy L. L. Kellogg.



and is equally as good. In the morning their feed should be rather scant, but at night they should be fed enough to fill up their crops. Keep water, grit, oyster shell and charcoal accessible at all times. Whenever any of them appear to go off feed cut down the amount at once until they are all eager for feed at feeding time.

Several weeks before turkeys begin to lay they should be fed well to get them in good condition. They should not be excessively fat at breeding time, yet they must have some surplus fat.

As a rule turkeys are mated in the proportion of one male to eight or ten turkey hens. The toms should be fully matured and constitutionally strong. Where green food is not accessible, provide it. Keep your turkeys as near to natural condition as possible.

#### HOUSING.

Turkeys do not require expensive houses. In Texas, they do well roosting in trees. See Fig. 49. During wet weather, or a rainy night, it is advisable to drive them into a barn or some other protection, because they will not do well in damp surroundings. Keep them out of the rain and they will do well in most any other kind of weather. This is especially true in the case of poults.

In parts of the country where it is necessary to house turkeys on account of being troubled with two-legged and four-legged enemies, it is advisable to confine them in some shelter with a good roof and the sides and ends enclosed with hog fencing.

#### HATCHING.

Turkeys like to lay in secluded places, and just as soon as they find that you know the location of their nests they will hunt for another place to lay. Therefore it is advisable to gather the eggs when the turkeys are not around. For nests, we know of nothing better than common salt barrels with one end removed and laid on the side. Place a little brush over them to make them look more natural and secluded. Quite often even these salt barrels do not appeal to them; in such cases it is advisable to allow them to choose their own nests. It is a good practice to set the first hatch laid under a hen or in an incubator, instead of allowing the turkeys to hatch them. This will make them lay twice as many eggs. It is good practice to allow the turkey hen to hatch the last batch of eggs. The turkey hen as a rule is most satisfactory for the incubation of the eggs.

Early in the spring it is important that the eggs be gathered as soon after laying as possible to prevent their getting chilled. Turkeys lay early in the morning and prefer nests in low brush, tall weeds, near a stone fence or in a brush pile. Skunks and crows are great thieves of turkey eggs.

Setting turkey hens should be left alone as much as possible. They will not stand for too much fussing. At hatching time allow the poults to run with the mother hens. When common hens are used to hatch

turkey eggs, it is good practice to set several at the same time and give the poults to a turkey hen that has just become broody.

#### REARING.

For the first few days feed young turkeys often and little at a time of rolled oats or pin head oatmeal and sour milk (clabber).

When large enough, feed the hard grains, corn, kafir or milo, the

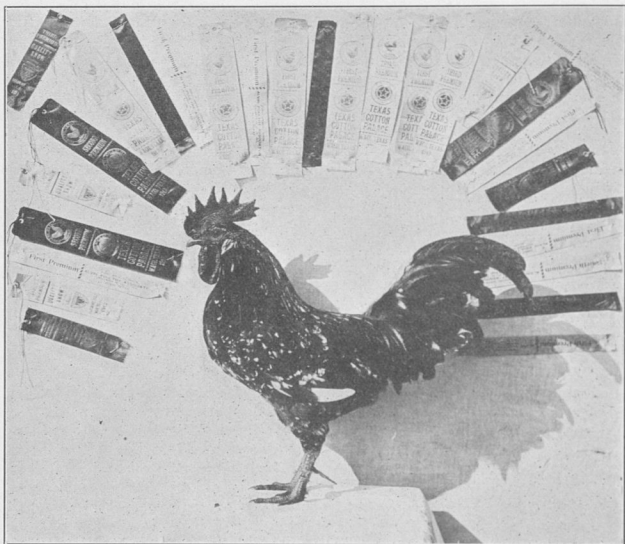


Fig. 34—Mottled Ancona male.—Courtesy L. L. Kellogg.

same as for the mature stock. Always feed them near the roosting place so they will be accustomed to coming there for the night. Do not forget to provide something green for them every day, also some finely cut cooked meat if they are in confinement.

The turkey hen with the poults are placed in an A-shaped coop, high enough so the turkey hen can stand erect. The coop is placed in a large pasture, where turkeys have never been raised before. The turkey hen is kept confined in the coop for the first month, and the young turkeys allowed free range from the start. If the hen is bound to

roam too much when given free range it is advisable to tie a weight to one of her legs. The coop should be moved to fresh ground every day. Everything in and about the coop must be kept scrupulously clean and well disinfected. Young poults appear to do better on grasshoppers, insects, grass, free range, pin head oatmeal, and clabber than on anything else you can feed.

Young turkeys are very likely to have lice, especially upon the head. If they appear weak and lifeless at two weeks of age, they frequently have lice. Anoint head, throat, and vent with carbolated vaseline. If hens are used for mothers, dust these before and while sitting with a good lice powder, being careful not to use too much.

Some turkey growers start their poults off on coarsely ground corn, milo, or kafir, mixed with sour milk, just enough to make it moist and crumbly. As the poults grow older gradually change to cracked corn, kafir, or milo, and finally to whole corn. The serious objection to this is the danger that comes from overfeeding a too fattening ration. It could be improved by adding bran, bread crumbs and middlings.

#### FATTENING.

The fattening of turkeys as a rule can be done profitably only late in the fall when the weather turns cold and insect life is scarce. They will then cease roaming about so much and the cold weather will increase their appetite. A good many successful turkey fatteners simply increase the feeding of corn and during the last week or ten days feed all the corn they will consume.

Another good fattening ration for turkeys is equal parts of ground oats, corn, and buckwheat moistened with sour milk. Do not over feed. Provide grit and charcoal.

As a rule attempting to fatten turkeys in close confinement is not practical.

#### KILLING.

When ready to kill and dress, be sure that turkeys have had no food for thirty-six hours. Suspend the turkey by a loop around its legs to a hook on the wall or ceiling. With a pointed, sharp, two-edged knife give a quick thrust through the roof of the mouth into the brain and sever the main arteries by two slight cuts. The next instant begin plucking the feathers. Do not cut the skin at any place nor remove any of the interior organs so that the outside air can possibly get to the inside, because as soon as the interior is exposed to the air decomposition sets in.

#### FENCING TURKEYS.

In neighborhoods where turkeys are a great nuisance to neighbors, it is sometimes advisable to clip their wings and place them in a large fenced lot. Where many are raised it is a good plan to thus fence in a large orchard, say, ten acres, with hog fencing. This method is advisable in closely settled neighborhoods.

Turkeys, in order to do well, must be allowed free range, and appear

to do best where they can always range over a considerable area. This prevents the ground from becoming contaminated.

#### BLACK-HEAD.

Where this disease is very common, as a rule it is best to raise chickens instead of turkeys. Black-head, as far as we know at present, is incurable. In some sections of the State this disease, for one reason or another, does not appear to flourish. To prevent black-head, raise the young poults on fresh ground each year. Allow free range. The mature stock may be herded like sheep, thus preventing their being very long on contaminated ground.

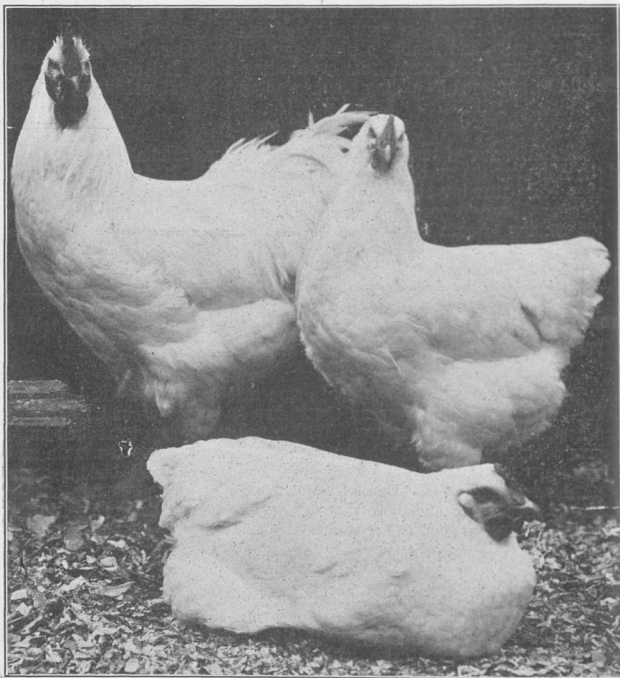


Fig. 35—White Plymouth Rock male and female.

## CHAPTER XI

### DOMESTIC GEESE.

BY F. W. KAZMEIER,

Poultry Husbandman, Extension Department A. and M. College of Texas.

Geese raising in some parts of Texas can be carried on very profitably. Geese are easy to keep and raise. All they require is a little protection from the cold northern winds and rains, a pasture to roam over and some grain foods.

They can be raised very profitably near any large city, or within easy shipping distance of some large city market.

#### BREEDS.

The most popular breeds are the Toulouse, Emden, Chinese and African. Of all these the Toulouse are the hardiest and appear to be in greatest demand in most markets. The pure breeds are better than the mongrels, because they are larger, grow faster, feather quickest and present the most uniform appearance.

#### HOUSING.

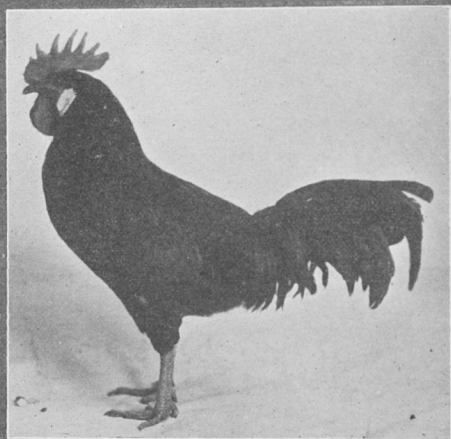
In the line of housing all they require is a little protection from the severe weather. Locate the shelter on some high and dry spot. Put up a building with the north, east and west ends fairly tight. The south side can be left open, with perhaps a foot or two high boarding at the bottom to keep in the litter. Do not house chickens and geese in the same house. Keep the house, floor and fixtures clean and disinfected. If possible, allow geese access to a stream of water.

#### BREEDING STOCK.

Mate your geese early in the fall, using nothing but two-year-old stock. Do not use immature stock in the breeding pen. One gander mated with two or three geese is a good breeding pen.

In feeding your breeding stock, if possible, allow them the run of a plot of grass and access to a creek. They feed on grass to a large extent, and relish insects, bugs, etc., to be found on marshy land. Geese do well on marshy land and can pick up almost their entire living on the same during the summer. In the winter and spring they require a slight feeding of almost any kind of grain, giving a variety as much as possible. When it is desired to fatten geese, grain feeding is necessary.





Figs. 36 and 37—S. C. Black Minorca Hen. Courtesy O. H. Roberts. (B) S. C. Black Minorca Male. Courtesy O. H. Roberts.

## REARING.

When only a few are raised the natural method undoubtedly is the best. Where large numbers are reared the artificial method is most practical.

For the reason that most geese are reared by natural means, this only will be discussed here. During the hatching time it is best to keep the gander away from the goose, but during the rearing period he is a great aid and protection.

When the goose is noticed to be walking around straw stacks, fences, brush piles, or other like objects, or is seen with straw, feather or other kind of nesting material in her beak, just make up your mind she is laying. Watch her to find out where her nest is, then carefully remove the eggs, leaving china eggs in their place until she has laid all she can cover. Replace the eggs, and generally she will soon begin to set on them. Provide her with food and water. At hatching time remove the goslings as fast as they dry off, putting them in some warm place until all are hatched, when they can be returned to their mother. This is necessary to prevent the goose from leaving the nest before all are hatched. Confine them to a grass covered and clean yard for the first week. For the first few days feed bread crumbs and bran, mixed with sour milk. Water, grit and charcoal are necessary. If they do not have access to plenty of small, short, succulent grass, provide something that will take its place as nearly as possible. Finely cut lettuce, dandelion and cabbage are excellent. They must have green food. After the first week, allow free range, giving a good feeding every night. They will take care of themselves outside of this.

## FATTENING.

In the fall, when they are fully grown and it is your wish to fatten them, pen them up in a roomy, clean, rather dark, but well ventilated and dry pen. Keep them quiet. Feed for the first week three times a day rather sparingly of whole and ground kafir, milo or corn. Towards the end of the fattening period feed all they will eat. This should be supplemented with water, grit and grass, or shredded roots and vegetables. Frequently they increase in weight as much as eight to nine pounds in a month.

## KILLING.

Killing is done by bleeding in the mouth and debraining, as with chickens. Dry pick. Both feathers and down should be saved and dried. They are valuable.

Sometimes the dry picking of geese is found to be a tedious job. The easiest method of plucking geese for the market is by immersing the carcass in hot water, lifting it out for a second, then giving it a second dip; next, roll it in a sack, or some burlap, and leave from five to ten minutes to steam. Then begin picking. Remove feathers and down at the same time. If many are to be picked, the bird may be suspended

so that the work may be done in a sitting position. To avoid tearing the skin, remove but a few feathers at a time. When all feathers have been removed, "plump," by dipping for a second, first in hot water and then into cold. Some people pick ducks in the same way where the market does not discriminate against wet picked stock.

#### PLUCKING.

Plucking geese, by many people, is considered cruel. Some consider it a waste to allow all of the soft feathers to go to waste. In plucking them, all of the feathers should never be removed.

## CHAPTER XII

## INCUBATION.

BY F. W. KAZMEIER,

Poultry Husbandman, Extension Department A. and M. College of Texas.

The advantages of natural incubation are: It is more economical where a small number of eggs are to be hatched, and it is not desired to make a large investment. The hen-hatched and brooded chicks are subject to less disease and possess as much or more vigor.

The disadvantages of natural incubation are many and well founded. In the first place, it is not always possible to have setting hens on hand when they are wanted. They do not as a rule set early enough to make it possible to get out early chicks for winter layers. Some eggs are always spoiled by hens leaving the nest for good before the hatch is over. The hen is never as a rule very much under man's control, at least not as much as the incubator. The hen is apt to break some eggs, step on some chicks and be unwilling to stay where you want her to. At best, the labor involved in natural hatching and brooding is entirely too much considering present high price of labor.

For those keeping less than fifty hens the natural method probably is the best, but for those that have more, I would recommend the artificial method, namely, incubators and brooders.

Probably the best time to pick up a brooding hen is late in the afternoon, when all other laying hens as a rule have left the nest. In the spring is the best time to do natural hatching and brooding, as at this season of the year it is perfectly natural for hens to perform this function of reproducing their kind. Hens are more reliable than pullets.

Unless absolutely necessary, do not change the location of her nest, because in so doing very often her brooding desires are shattered and a fickle broody hen is more undesirable than an improperly working incubator. Of course in all cases it is desirable to renew the nesting material. If absolutely necessary to change the location of her nest, do it after dark and place in entirely new surroundings, as far away from her old nest as possible. Confine her to her new nest without good eggs for the first day or two to make sure she approves of the change of location. It is well to let her have during this time about half a dozen china eggs or even common stones about the size of eggs. In preparing her new nest or old nest be sure and thoroughly disinfect the nest, nest box, if any, and nesting material, and dust the hen several times with a good lice killer. In dusting her, exercise care not to overdo the matter, because we have had the experience that in so doing she often lost her brooding desires. We like to have the nest on the ground, if in a location where she is not apt to be bothered with four-legged enemies. If it is necessary to place in a coop or box it is a

good idea to place about a foot of earth under her nest. This aids in controlling the vermin, holds moisture and makes a good bottom for the nest. Have the nest sloping from all sides towards the center. Cut straw and hay of about six-inch lengths is best for nesting material.

The number of eggs to place under her depends, of course, to a large extent, on the size of the hen. Do not attempt to place more under her than she can comfortably cover, if you do, she is apt to break some and chill others.

Under ordinary conditions in the natural season the average hen will conveniently cover fifteen average size eggs. Eight or ten duck eggs, five goose eggs, and six turkey eggs are about the number of the different kinds of eggs that can be properly covered by an average size hen. In warm weather more eggs can be placed under her, and during cold weather less.

In the case of the setting hen, especially where quite a few are used in this manner, it is important that some system is practiced in their care and management. As a rule it is a good practice, especially where more than one hen is in the same room, to keep them confined at all times, except when letting them out for food and water. Feed and water them at regular intervals so they will always know just when you are coming; this will prevent them from becoming uneasy and breaking some of the eggs.

The best feed for a setting hen is cracked grain, such as corn and wheat. Fresh water is, of course, important. Do not feed wet mashes to your setting hens.

One of the greatest and most important factors in natural incubation is thorough cleanliness of the surroundings, nest, nesting material and the hen, eggs and chicks. The droppings should be frequently removed, as well as any broken eggs and soiled litter. Provide a dust and water bath for the hen. I have repeatedly noticed that they use both. Dust the hen several times with a good lice powder before setting and at least two or three times before the chicks come off. A good time to do this is the seventh and fourteenth day and just before the chicks hatch. The last time it is advisable to use the powder very carefully and in limited quantities.

As a rule we have found it good practice not to bother her too much—allow her to do about as she pleases in most ways.

Test out all infertile eggs on the sixth or seventh day to make more room for the rest of the eggs in the nest, thus reducing the danger of breaking them.

The periods of incubation are: hens' eggs, 21 days; ducks' eggs, 28 days; swans' eggs, 32 to 35 days; geese eggs, 30 to 35 days; turkey, peafowls and guineas' eggs, 28 days; ducks, Muscovy, 32 to 35 days; pigeons, 16 to 19 days.

At hatching time leave the hen as much to herself as possible. It is necessary that she sit very close to the nest at this time, so as to keep up a high temperature. During the night it is sometimes a good idea to feel under her and remove the egg shells to give the chicks more room.



Do not take the chicks away from the hen until they are 24 to 36 hours old or the hen leaves the nest of her own free will. Examine both hen and chicks for vermin and act accordingly. Remember the two never do well together.

#### BY MAN'S METHOD.

To do this subject justice, it is advisable to begin with the stock that is to produce the eggs for incubation. The stock used in the production of hatching eggs is generally known as the breeding stock or flock.

Keep your breeding stock under as nearly natural conditions as possible. The nearer to nature you can come in this respect the better the results. First, select the required number of your best breed from your entire flock and keep these separate. Never breed from your entire flock. In making your selection, select for constitutional vigor first, then for egg laying characteristics, or meat producing characteristics, or both, as desired.

After carefully selecting your breeding pen place them in a fresh-air house, away from the rest of the flock, so you can allow them unrestricted range with plenty of green grass and shade. A wood lot or an orchard comes about as close to providing these conditions as any other location. Here in the South it is of prime importance that some protection be provided from the hot sun during the middle of the day. Fowls suffer much from heat, even more than from cold.

In the feeding of the breeding stock eliminate all forcing feeds, like wet mashes and large amounts of animal foods. Feed the cracked grains in the litter, and the dry mash in self-feeding hoppers always accessible. Provide plenty of grit, bone meal and oyster shell. Fresh, pure water is, of course, very important. In the winter time it is advisable to feed the grains in such a way as to induce exercise. Fresh air in abundance without drafts is essential. The house can be practically open on the south side, but the other ends should be so arranged as to make it possible to close them up practically air tight. It is, however, a good idea to arrange shutters in these ends in such a way as to make it possible to open them during the spring, summer and fall, so as to induce a more thorough circulation of air.

#### CARE OF EGGS FOR HATCHING.

Gather the eggs as soon after they are laid as possible—the sooner the better. This is important in our warm or hot climate. If the eggs are left in the nests long enough to start development of the germ and then stored in a cooler temperature, which checks this development, the result when you come to incubate them will be a large percentage of infertiles and a larger percentage of dead germs. Remember, the germ starts to develop at a temperature of about 70 degrees or above. It is of prime importance that the eggs be gathered very frequently and stored in a temperature as close to 55 degrees as possible. Turn these eggs once a day to prevent the yolk from adhering to the shell or shell membranes. Cover them to prevent excessive evaporation.

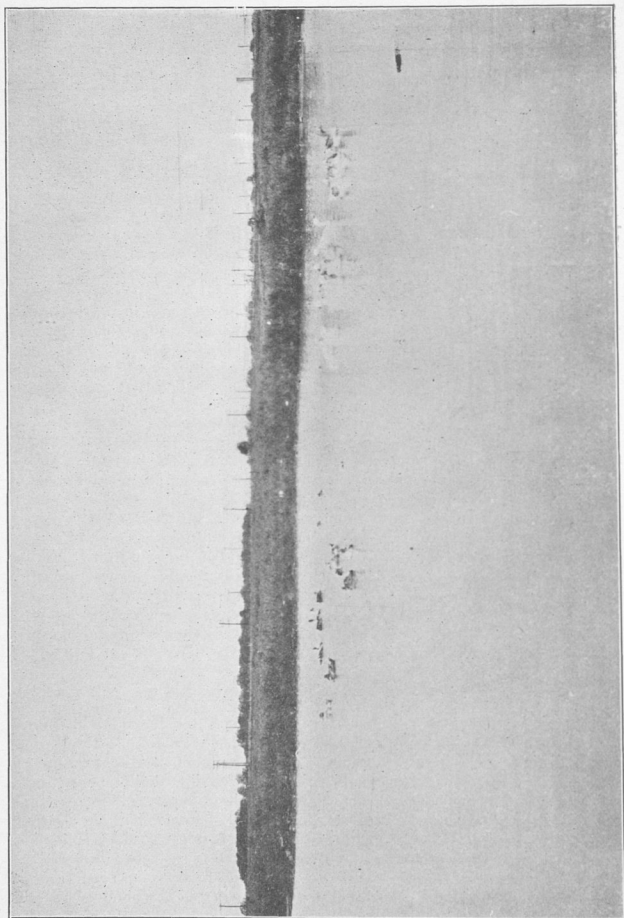


Fig. 38—A flock of geese and ducks.

Handle the hatching eggs very carefully, because excessive jarring may injure the germ, which is very delicate at this time. Never shake eggs for hatching to note the condition of the contents—it is certain to injure them. In selecting eggs for hatching, select only such as are of normal shape and good size. Incubate no eggs that weigh less than two ounces apiece. It has been proven that small eggs produce small chicks, and small chicks have always been found lacking in vitality. Use only eggs from mature stock, perfectly free from any kind of inherited disease.

We know of no reliable means of determining either the sex or fertility of an egg before incubation. The fertility of an egg, however, can be determined before incubation by breaking and with the aid of a microscope note the germinal disc.

As a rule it is better not to wash eggs for hatching. When eggs for hatching are purchased from a party not well known it is sometimes a good idea to dip these eggs in a 92 per cent solution of alcohol or in a 2 or 3 per cent solution of Zenoleum. This disinfecting kills any disease germs that may be adhering to the outside of the shell. It, however, does not kill or in any way affect disease germs that may be inside the egg.

#### LOCATION OF INCUBATOR.

It has often been stated that the best place for an incubator is in a well ventilated cellar. That is true, but it is also true that most cellars are about the poorest ventilated places. A good location for an incubator is a cellar or room two-thirds below the ground, with unquestionable ventilation, free from drafts, with uniform temperature, relatively high humidity and so constructed as to prevent direct sunlight from striking any part of the machine. Of all these factors plenty of pure, fresh, life-giving air is perhaps the most essential. Remember oxygen is absolutely necessary in the development of the germ. Humidity is necessary to bring about a good hatch and strong chicks. Decaying vegetables are serious objections to have in an incubator room or cellar. Ventilation can be increased by substituting muslin, burlap or wooden bafflers in place of glass windows. If possible, have a cement floor to facilitate flooding the cellar or room once or twice a day.

#### HEATING THE MACHINE.

Place the machine perfectly level in all directions. Place your thermometer according to directions coming with the machine, starting with a small rounded flame, not turned too high. Screw the thermostat nut down enough to barely raise the thin disc above the top of the heater flue. This is important to prevent breaking the thermometer. In the case of coal heaters, work it the same way, always bearing in mind that it is advisable to heat the machine up slowly and very gradually. Watch your thermometer. Regulate the machine so it will hold a uniform temperature of 100 degrees without any eggs on the tray. Run the machine

empty for at least forty-eight hours, or until you can control the temperature.

#### FILLING THE MACHINE.

When you are confident you have got the machine fully under control, put in the eggs, but never before. The eggs should always be placed on the side and never on the ends. As a rule it does not pay to crowd too many eggs on the tray, it will mean trouble in turning and more broken eggs.

#### TEMPERATURE.

With the bulb of the thermometer at the center of the egg it should register the first two days 101 degrees. A high temperature the first week is very harmful, while a low temperature at this time is very serious, besides causing a correspondingly slower development of the germ. Towards the end of the first week it is safe to allow the temperature to run up to 103 degrees. The second week hold the temperature as close to 103 degrees as possible. The third week keep the temperature at 104 degrees until the nineteenth, twentieth and twenty-first days, when no serious harm results by allowing the temperature to run up as high as 105 degrees. However, it is not advisable to ever allow the temperature to go much above 105 degrees. During the last week it is better to have a relatively high temperature than a low temperature. At hatching time a temperature of 105 degrees appears to be a great help to the chicks. In fact, an experienced operator can always tell by the temperature along about the eighteenth, nineteenth and twentieth day as to whether he is going to have a good or poor hatch. A persistent low temperature along about that time means a poor hatch, while a high temperature would mean a good hatch.

This is explained as due to the fact that at this period of the hatch a large number of chicks in their attempt to free themselves, throw off a large amount of heat, causing a higher temperature to show on the thermometer, without the regulation being changed. This, of course, is very natural. Therefore, do not be alarmed if, at hatching time, your thermometer should show a temperature of 104 or 105 degrees. When the temperature is registered by a suspended thermometer, the thermometer should register one-half degree higher.

During the entire period of incubation it is advisable to have as uniform a temperature as possible, starting with a temperature of 102 degrees and ending with a temperature of 104 to 105 degrees at hatching time. At hatching time the chicks are apt to obstruct the view of the thermometer and maybe throw it down. Do not become alarmed. If your machine has run perfectly up to this time it will continue to do so a few days longer. Never open the door wide at hatching time.

Watch the chicks carefully at this time. If they appear to pant very much, increase the ventilation a little. It is unnatural for them to pant. Test the thermometer to make sure it is accurate.

## TURNING OF EGGS.

After the morning of the second day turn the eggs regularly and carefully twice a day, as near twelve hours apart as possible. In turning the eggs, especially during the first week, it is very important that it be done carefully, without jarring. At this time the germ is very delicate and undue jarring is apt to cause ruptured blood-vessels, causing dead germs at the first testing. In turning, it is not important or necessary that they be turned a certain amount or exactly half over, as some appear to think; all that is necessary is to turn each egg sufficiently to change its location upon the tray and also the location of the yolk in the egg to prevent the same from adhering to the shell and induce a regular development of the germ. There are various ways of turning eggs. One good way is by flopping trays, which is done by placing a second tray on top of the tray full of eggs, then taking a firm hold of two ends, gently turn or flop the two trays. This is a good method when the tray is full of eggs, or, until the first test. After the first test, up to and including the evening of the eighteenth day, the eggs had best be turned by the palm of the hand, not only turning the eggs, but shoveling them around in the tray. Aim to change the eggs around upon the tray as much as possible each day. This is necessary to bring about a uniform hatch. Stop turning the eggs after the evening of the eighteenth day.

## COOLING OR AIRING THE EGGS.

In the successful operation of incubators the experienced operator always considers these three factors together, namely: cooling, ventilation, and moisture. One depends and is influenced by the other. As a general rule we find it good practice to commence cooling them slightly upon the morning of the seventh day. In cooling them, leave them on top of the machines, or cooling table, out of direct drafts. Do not allow the ends to project over the machine, because, in that case these eggs will cool much more than the others.

The length of cooling depends entirely upon the temperature of the room. We advise cooling until the eggs feel cool, but not stone cold, to the sense of touch. If they feel stone cold, they are chilled and not cooled. A good many make a serious mistake in this respect. In that they cool them too long. During the early part of the hatch it requires only a few minutes, while towards the latter part of the hatch it may take as long as forty-five minutes or more. We are not absolutely sure that this cooling is necessary, but we find, with the present construction of incubators, cooling is necessary. The fact is, if we could get enough fresh air into the machines, without drying the eggs too much, cooling would be unnecessary. Present incubator construction, however, requires cooling to a certain extent for best results, especially is this true in our warm climate.



## VENTILATION AND MOISTURE.

As a general rule we find it advisable to restrict the ventilation the first week and to increase it after this time up to the end of the second week, when it should again be restricted a little more each day until the nineteenth day, when practically all extra ventilators should be closed to confine the moisture at this period of the hatch as much as possible. Of course, the automatic ventilation of the machine should

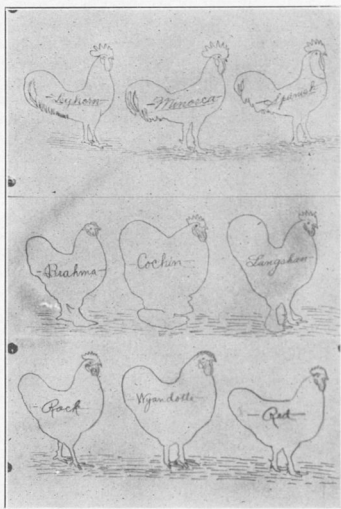


Fig. 39—Different types of chickens. Top row Leg-horns, Minorcas and Spanish. Middle row, Brahmans, Cochins, and Langshans; Bottom row Plymouth Rocks, Wyandottes, and Rhode Island Reds.

never be tampered with. Experienced operators have noticed that restricting the ventilation between the seventeenth and nineteenth days of incubation always is accompanied with satisfactory hatching results. Just why this should be the case is hard to explain. It unquestionably is not due to the restriction of the ventilation, but more so to the fact of confining the moisture. It is the moisture at this period of the hatch that is very necessary and essential.

If moisture condenses on the glass of the incubator door, it is a sure sign of a good hatch and sufficient moisture. We must have moisture

in the incubator at hatching time. We keep the incubator room floor thoroughly moist all the time, and see to it that, at hatching time especially, there is plenty of moisture in the hatching chamber.

In non-moisture machines, in a rather dry location, we find it advisable to sprinkle the eggs with lukewarm water on the evening of the nineteenth day and up to the time the first chick hatches. It is almost impossible to give any definite rules to follow in this matter of moisture and ventilation as factors in incubation. Each operator will have to

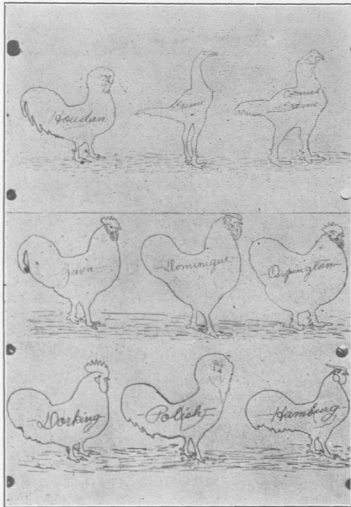


Fig. 40—Different types. Top row Houdans, Games, and Cornish Indians; Middle row Javas, Dominiques, and Orpingtons; Bottom row Dorkings, Polish and Hamburgs.

work this out for himself by watching the size of the air cell or air space and by frequent testings. Increasing the ventilation increases the size of the air space. Decreasing the ventilation decreases the size of the air space. Adding moisture decreases the size of the air space. Cooling increases ventilation and increases the size of the air space. These facts ought to make it possible for all to work out or solve their own problem.

The size of the air space should increase gradually until at hatching time it should occupy about one-third of the entire egg. The fourteenth

day of incubation the air cell should occupy about one-fourth of the entire egg.

If the air space is too large, the chick is small, and dried down too much as a result of too much ventilation and cooling and too little moisture. In a case of this kind, a large number of chicks will dry and stick to the shell, and consequently be unable to cut their way out. Result, fully developed dead chicks in the shell. Remedy, supply moisture.

If the air space is too small the chick is too large to be able to make the turning movement or circumference necessary to make it possible for it to cut its way out into the world, consequently it dies in the attempt. This is due to either too much moisture or to too restricted ventilation. Remedy, decrease the amount of moisture and slightly increase the ventilation.

#### HATCHING TIME.

At hatching time do not open the incubator. Darken the incubator door by hanging something up in front of the same, in case the door happens to be constructed partly of glass. Follow the directions coming with the machine.

Towards the end of the hatch increase the ventilation to prevent unnatural panting.

The morning of the twenty-second day, or as soon as you are sure that all are hatched, open the incubator and remove all unhatched eggs and egg shells.

Leave the chicks in the incubator for 24 to 36 hours. During this period provide plenty of fresh air and reduce the temperature to between 95 and 100 degrees.

#### TESTING EGGS.

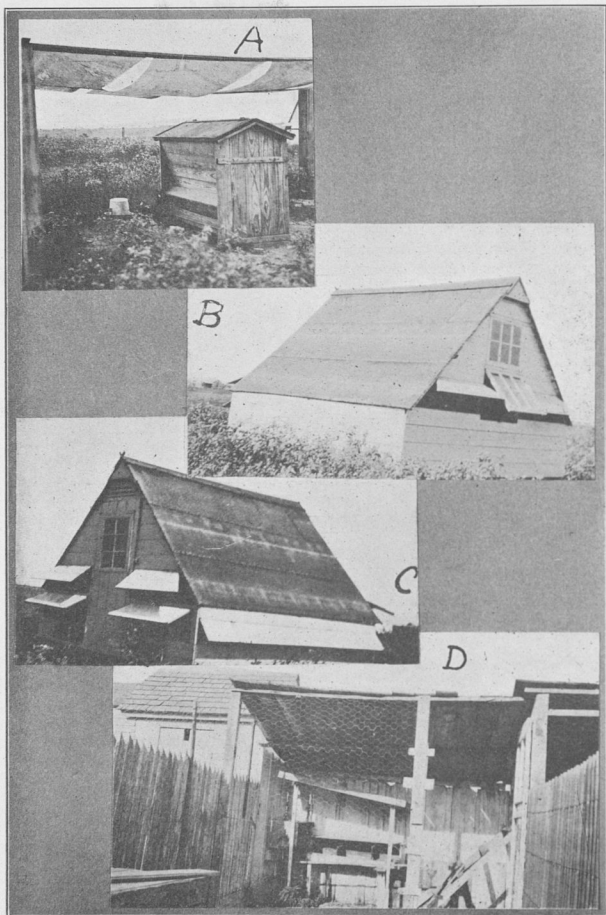
The eggs should be tested the seventh day and fourteenth day of incubation.

At the first test remove only the infertiles which, at this time, show perfectly clear. The fertile eggs at this period of incubation present much the appearance of a spider-like formation or a black spot with blood veins radiating from the same. This formation, spider or germ, should float as the egg is turned.

At the second test, the fourteenth day, a live germ in an egg will show to occupy about three-fourths of the egg. In other words, a live germ at this testing should show and be occupying nearly the entire egg, except the air space in the large end of the egg. Dead germs at this time have various forms, a common kind of which is, a blood spot with a dark red ring about it. A black portion in the small end of the egg, the rest clear, is another form of a dead germ. All dead germs should be removed at this testing.

One sure way of determining whether a germ is alive or not is by

noting the large blood vein which should show leading up to the air space. If this is visible, you can be sure that it is a living chick. The first test is generally made to make more room for the eggs in the tray. Sometimes the infertiles, tested out at this time, can be used by bakeries or cooked and fed to chicks and fowls. The second testing is made to remove all dead germs, which at this time throw off poisonous gases, very injurious to the developing chicks.



Figs. 41, 42, 43 and 44—(A) Outdoor feed hopper placed under a temporary shade, which is necessary to get the birds to eat sufficient of the dry mash in the hopper. Natural shade would be better. (B) Rear view of movable brooder-house facing south. Note that all shutters and windows are hinged at the top to swing out. (C) Front view of A-shaped movable colony brooder-house, improved by F. W. Kazmeier. Note the shutters. This house was found to stay cool in the hottest weather. An adaptable hoover is placed in this house when the chicks are small. (D) A poorly constructed poultry house. Note cracks in rear.



## CHAPTER XIII

## SQUAB RAISING.

BY F. W. KAZMEIER,

Poultry Husbandman, Extension Department A. and M. College of Texas.

The great scarcity of game all over the country is responsible for the continuous, gradual increase of the squab business. Squab raising when properly conducted is exceedingly profitable, especially when close to a good market. In Texas, the squab industry, like the poultry industry, is still in its infancy. Squab raising appears to be well suited to village and city lots. It should, however, not be inferred from this that they cannot be profitably grown on the farm.

Squab raising is a business that requires close attention to details. Practically all failures in the squab business are due to lack of cleanliness. In this business a man or woman must be willing to look after the minor details. It is the small things in the squab business that count. Lice and mites cause trouble on the poultry farm; but infinitely more in the squab industry.

## HOUSES AND FIXTURES.

In the construction of these, it is well to bear in mind that they should be inexpensive, simple, convenient, rat and mice proof, and easily cleaned. If the house is built on the ground, it should be located on some gravelly knoll, facing south. The floor can be concrete and should be dry. Almost as many styles of lofts are used as there are squab raisers. This is something that must be worked out locally. Often some old buildings are remodeled and used for pigeon lofts. As a rule a loft above the poultry house is not to be recommended, because of the trouble from vermin. The house should be so constructed as to be as vermin proof as possible. This is very important. The floors, either wood or cement, are generally covered with an inch of sand.

It is not advisable to allow the birds to fly over the country any more than it is to allow other animals at large. If you wish to raise most of the squabs and be on speaking terms with your neighbor, construct a "fly" in the front of the house in which the birds can exercise. These flies are constructed by driving long posts in the ground and fastening them together with boards. The whole is covered with one-inch mesh poultry netting. A house 5-6 feet. to which is attached a fly 6x30 feet, is large enough for twenty-five pairs of working birds.

## INCUBATION.

There should be twice as many nests as mated pairs, and, if anything, a few more, so they will not crowd. The ordinary nest is about 10x12 inches and 8 inches high, so constructed as to facilitate cleaning. A

convenient arrangement is to have the bottom of the nest movable and work like a drawer. Watch the nests carefully for lice and mites, and keep them scrupulously clean at all times.

The period of incubation for pigeons is 18 days. Natural incubation appears to be the most satisfactory. The hen and cock take turns in incubating the eggs. The hen sets on the eggs about twenty hours every day and the cock about four hours, during which time the hens go in search of food and water.

#### FEED.

The birds should be fed a variety of pure and wholesome grains. Medium coarse, cracked corn is fed in troughs, so that they can't waste any. A mixture of whole wheat, Canada peas, kafir, hulled oats and millet should be fed twice a day on the floor all they will eat up clean quickly, in addition to the cracked corn in a trough. New corn and wheat is sometimes considered bad for the birds, because it has a tendency to loosen the bowels and may cause death. Probably the most important factor in the feeding of pigeons is to guard against feeding musty, heated or spoiled grains. Sour food is very detrimental.

This food should be supplemented with pigeon-size ground oyster shell, plenty of so-called pigeon salt and charcoal. Grit of the proper size is essential. Salt is very important in the feeding of poultry. Keep it in hoppers always before them. Plenty of pure, fresh water, in numerous vessels, should be conveniently located.

#### FEEDING SQUABS.

This is done entirely by the old birds. A milk forms in the crop of the old birds during the incubation which is disgorged from the crop of the old birds and fed to the squabs. For the first seven or eight days the squabs are fed on the pigeon milk. Then, or as soon as they can digest grains, they are fed the same by the old birds similar to the manner the pigeon's milk is fed. The grains are eaten by the old birds and then disgorged from the crop and fed to the squabs.

#### DIFFERENT BREEDS.

Good breeds for squab production are those that are most prolific, producers of good sized squabs, producers of light-colored squabs, and feed the young well. Do not buy old birds. A much better practice is to buy young birds, place them in a small house until mated, and then move to their permanent nesting place. It is important that all birds in the hatching place be well mated, otherwise they will cause trouble. Unmated birds in the loft are apt to make trouble.

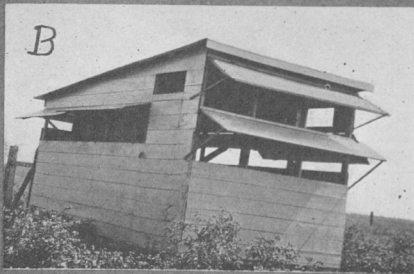
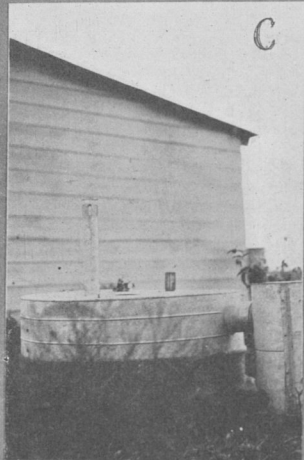
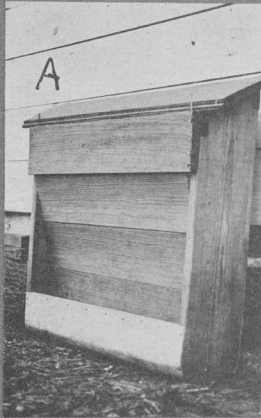
Most squab raisers consider the American Antwerps and Homers as very desirable birds for squab raising. The White German Homer, the Dragoon, the Carneaux, the Runt, the Duchess and the Belgian Homer are also very good. Some breeders use crosses of some of the above to advantage.

## VERMIN AND DISEASE.

As has already been stated, lice are a serious menace to the old and young birds. One large squab raiser provides tobacco stems which the birds use in building their nests. In addition to this, it is advisable to provide the birds twice a week with a shallow trough full of water. They will bathe in this and thus free themselves of lice. Watchfulness and attention to these details are the price of success in squab raising.

The house, fly, fixtures and utensils should be disinfected regularly to kill disease germs that may be lurking. One teaspoonful of Zenoleum or some other good coal tar disinfectant added to a quart of drinking water will help in controlling disease.

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Figs. 45, 46 and 47—(A) An indoor feed hopper. (B) A. and M. College House designed by F. W. Kazmeier. This house is built with a wooden floor and is movable. The house is blocked up 16 inches from the ground. This type has been found to give excellent satisfaction. (C) An adaptable hoover for the brooding of chicks, to be placed in movable colony house.

## CHAPTER XIV

## DUCKS ON THE FARM.

By F. W. KAZMEIER,

Poultry Husbandman, Extension Department A. and M. College of Texas.

Ducks should be fed and cared for in a somewhat different manner than hens. The duck has no well developed crop; hence the food passes more directly to the digestive organs and does not undergo so complete a softening process as the food consumed by the hen. Therefore, the ducks should be fed chiefly soft food, consisting of a variety of ground grains softened with water. Young or growing ducks should be fed but very little, if any, hard grains.

In raising ducks it is important to have everything in and about the duck houses and yards in the most sanitary condition. If the ducks are confined in small yards the ground should be cultivated to keep it in a reasonably clean condition. Grains are often sown in the yards to keep them sanitary and to provide a little green food.

Young ducks should be fed from shallow troughs about a foot wide and eight or ten feet long with one and one-half-inch sides. These troughs should be kept as clean as possible. In raising young ducks pure water and clean yards are essential factors especially so when they do not have access to a running stream.

Supply the ducks, both growing stock and breeders, with plenty of green and animal feed. A good ration consists of about 20 per cent animal meal and 30 to 40 per cent green feed in some form.

If ducklings are confined to comparatively small yards it is advisable to provide plenty of shade for them during the summer months. Green rye, oats, clover, alfalfa, Canada field peas, and corn makes excellent green feed for ducks when finely cut, using feed cutter for this purpose. The green feed may be fed alone or mixed with the moistened ground feed. The ground feed may consist of wheat bran, wheat shorts, corn meal, kafir meal, or milo meal, and ground oats, the hulls of the oats having been removed.

Ducks are usually kept in moderate sized flocks that roam at will over a considerable portion of the premises. When reared under these conditions the ducks on a farm often prove valuable in the destruction of various insects.

It is a well known fact that ducks are very much more free from diseases and vermin than chickens. For this reason many farmers prefer ducks to chickens. Ducks are more easily confined than chickens. A fence two or three feet high will confine them under most conditions. Ducks grow much faster than hens and for this reason are preferred to hens by some farmers.

Many of the largest duck breeders have no water for their ducks



except drinking water, but the eggs from breeding stock ducks which have the use of a swimming pond are perhaps a little more fertile and their hatching power a trifle greater and the ducklings stronger.

For successful incubation of duck eggs it is advisable to keep the place where the incubators are operated exceptionally damp. Duck eggs need more moisture for successful incubation than hen eggs. It is sometimes advisable to take a small broom and thoroughly sprinkle the eggs with water of the same temperature as the eggs just before pipping time. Leave the young ducklings in the machine for the greater part of the twenty-third day, then remove them to warm brooders previously made ready for them. Their first feed should be sand and water with the chill taken off. About an hour after the sand and water feed, feed them bread and sour milk. This is fed for three days, then feed the following mixture: one part bran, one part ground wheat, one-half part corn meal, one-fourth part middlings, one-half part beef scrap and some green food. This should be moistened with sour milk or water to a crumbly state. Feed all they will eat up clean. As they grow older feed about one-fourth of this bulk in green food.

Remember, it is the draft, dampness, and overfeeding that are the greatest causes of mortality in raising ducks.

## CHAPTER XV

## POULTRY HOUSES AND EQUIPMENT FOR TEXAS FARMS.

BY T. J. CONWAY,

Assistant Professor of Poultry Husbandry, A. and M. College of Texas.

At the beginning a word as to the necessity of poultry houses on our farms will be of interest. Knowing how sensitive an organism the chicken is, we can readily realize the very detrimental effect of housing our poultry in an unprotected place. Egg production is to a great extent dependent on the physical welfare of the individual. Therefore, for best production we must care for our stock so that at no time it will be subjected to adverse conditions. Steady cold weather or steady warm weather usually does not affect egg production other than to slightly reduce it below what is produced during seasons of mild temperature. The factors that seriously affect are sudden changes of temperature and weather conditions, and if these changes are severe the production is usually stopped for an indefinite period, if not entirely, and the health of the bird permanently injured.

One very good method in controlling these conditions is proper housing. If we let our chickens roost in the trees and on the machinery scattered about the farm they are in great danger of being injured some night when one of our frequent "northers" arrives. We also will not be able to collect all the eggs laid, as hens cared for in such manner will lay in spots hidden and scattered all over the farm. On most of our farms the sale of such eggs, which are never found, would quickly pay for a poultry house that would mean much to the stock and the owner.

In most parts of the State a shelter is all that is necessary and the cost per bird is very low. We may have fine bred birds which are fed the best of feed stuffs but if improperly housed these will not produce the desired results. Houses are important because egg production, being a productive process, is much harder to control than milk or meat production. There is no one best poultry house for all sections of our State, but the essentials for all are the same. In the first place, the house should be adapted to the purpose. If a laying house, it should protect and house the layers. If it is to be a brooder house, it should properly care for the young chicks. *Economy of construction* is very important and to the average poultry raiser is the factor first considered. Every dollar invested in a poultry house should draw interest so that our houses should be built as economically as possible and still serve the purpose. Ordinarily, we consider \$1.00 per bird as a reasonable cost for construction. It should, however, never exceed \$2.00 per bird. The size of the building, cost of materials, labor, number to be housed, and the like, are the factors that affect cost.



Fig. 48—A flock of turkeys on the Government Turkey Experiment Farm at Yoakum, Texas.

The house should be efficient and serve to the best advantage the purpose for which it was intended. Durability is important as it reduces repair expenses and lasts indefinitely. Convenience in operation means saving labor in cleaning, feeding, egg collecting, and such work. *Simplicity* usually means economy and the poultry house should be built so as not to require the services of skilled labor and all room space can be used to advantage. In respect to capacity, it should house the maximum number of birds to advantage, and be large enough so that the attendant can easily care for it economically. The comfort of the birds should also be considered, as this is very important in egg production. For this reason avoid houses which are wet, close, damp, frosty or hot. Since the body temperature of a bird ranges from 101 to 107 degrees F. we can readily appreciate the necessity for large amounts of good, fresh air in our houses. Pure air is more important than warmth. The house should also be attractive. It usually doesn't cost any more and adds very much to the looks of the farm and the pride of the owner. Attractiveness is obtained by arranging parts symmetrically and making the building harmonize with the surroundings by the proper application of color, paint and the like. The house should also be made sanitary, proof against rats and vermin and sometimes arranged for safety against fire and robbers.

Locate the house on ground sheltered from prevailing winds by hills, trees or buildings. However, never place a house in a pocket. It should face south or southeast, if possible, to get full benefit of the early morning sun. The house should have both soil drainage and air drainage. Soil on which sod will grow vigorously and abundantly and also absorb droppings is of great importance. Usually sandy or gravelly soils are best, a sandy loam being very desirable. If possible, place the house where the birds can have access to fields and be allowed to roam on them after harvest to pick up all scattered grain and feed stuffs which would otherwise be wasted.

The poultry house should also be arranged so as to be attractive from the road or public highway, thus making it a valuable and inexpensive means of advertising. Convenience in doing the work is important. If the house is too far from the dwelling it is very often liable to be neglected, with bad results.

The size of the house is determined by the number of birds to be kept and the number of days it will be necessary to keep them locked up. In sections of the State where climatic conditions are ideal throughout the year more birds may be housed in a house of a certain size than in sections where it is necessary to confine them to the house for two to four or five months of the year. In determining capacity, three square feet of floor space per bird is a good proportion and in many sections two square feet of floor space per bird is satisfactory.

Housing from 100 to 500 birds in a house is usually desirable, as such arrangement saves labor and such houses are less expensive to build than a number of smaller ones, and give better opportunity for the use of labor saving devices and water systems.

The roof is one of the most expensive parts of the house and that type should be chosen which gives reasonable satisfaction at least cost. There are many types in common use. The shed roof is the one we are all quite well acquainted with and is simple to construct, durable, admits plenty of sunlight, and has other good features in its favor. Ordinarily, the shed roof is very desirable. The gable roof is another common type, and has many good features, as also does the combination roof, which is in many respects a combination of the shed and gable types. The half monitor, the full monitor, the hip types, all have their desirable features, but usually are too expensive for farm use and generally adapted only to special houses.

On most farms there are sheds or unused buildings which can readily be converted into serviceable poultry houses at very little cost.

In most parts of Texas the houses desired are ones that admit the maximum amount of fresh air without causing drafts to strike the fowls. A roof is necessary to protect the birds from the rains, and the very warm sunshine. It is also desirable to have the rear end wholly or partially boarded, as it serves as a wind break and makes the house more comfortable. All unboarded houses should be screened with poultry netting to keep out sparrows and birds which not only eat much food, but are also carriers of disease and vermin. Then, too, at times it is necessary to confine the birds to the house. On some houses the three-fourths-inch mesh has been used, which keeps out all birds.

If the house is to be a permanent structure, it should be built on a concrete foundation and have a concrete floor. If the soil about the house is damp, building a concrete floor with a layer of good roofing paper between it and the porous material below will prevent all capillary rise of the water and keep the floor always dry and warm. Three inches of concrete makes a strong, durable floor and may be made of a mixture containing five parts gravel, three parts sand, and one part Portland cement. It should be finished with a mixture of one part of Portland cement to three parts sand. Having the foundation wall extend four to six inches above the floor causes the sills to last indefinitely and prolong the life of the building.

Make the doors three feet wide and hang so as to swing to the inside of the house. In large houses, double doors are necessary if it is desired to drive a team through the house when removing and replacing litter and droppings.

The entire house should be single boarded and, if found necessary, may be covered with a good grade of roofing paper. To make an attractive appearance, the front may be built of novelty siding and painted. Covering the roof with good quality roofing paper makes an economical and serviceable roof.

Houses having the sides and rear hinged so that they can be raised during the warm weather to admit the greatest amount of fresh air with little or no draft will be found very suitable to Texas conditions. During seasons of cold, stormy weather these sides may be lowered into place, making a warm and comfortable house. A similar arrangement



may be used in front to prevent beating rains from entering and also as an awning for protection from the hot noonday sun. If there is little shade about the house the birds will spend much time in the houses. For this reason, in very warm sections of the State, it is well to make some provision for a free circulation of fresh air over the floors.

In the interior arrangement of the house have nothing on the floor. Allow the birds free range of the entire floor space. Since water is of such prime importance, provide fountains which are sanitary and easily accessible to the fowls. Have the *water* elevated eighteen inches from the floor to cause the fowls to exercise when obtaining a drink, also have it covered so that they cannot wallow in it. Water should be given fresh twice daily.

Place the roosts in the rear part of the house. If dropping boards are used the roosts should be eight inches above them. If no dropping boards are used, they should be about thirty inches from the floor. Build the roosts of 2x2-inch material, and allow six or eight inches of linear perch room per bird. Suspend the roosts from the ceiling by means of small wires, as a guard against lice, mites and similar parasites. Crossing the wires prevents swinging of the roosts. By this arrangement, if any lice, mites, or bugs should gain access to the house they will not be able to crawl on the fowls at will from the sides and other parts of the house. All perches should be on the same level, twelve inches apart, and at equal distance from the rear of the house.

Dropping boards are important. Many poultrymen do not consider them as necessary, but I think they can always be used to advantage. Poultry manure is our richest fertilizing manure, being high in nitrogen and containing lime, both of which are valuable. With dropping boards the manure may be collected daily or weekly and applied directly to the gardens, flowers, or field with good results. If dropping boards are not used, the litter becomes soiled very quickly and necessitates cleaning the house oftener than otherwise.

Nests are very important and should be built as sanitary and efficient as possible. Build them on the walls and partitions rather than under the roosts. Convenience in collecting the eggs should be considered. They should afford seclusion and be comfortable. In size, nests one foot high, one foot wide, and one foot deep, will serve the purpose. The usual proportion is one nest to every four or five hens, though when large flocks are housed together there may be one nest to ten or more hens.

In some localities it is desirable to place the nests outside the house. This may be done very satisfactorily if in a region of much fine weather. Nests so placed are very accessible to the birds and attendants and if properly constructed are very comfortable during warm weather. Such nests, however, are not desirable during wet weather as the birds in going to them will get muddy and soil the eggs in the nests. Also, during such days as it may be necessary to confine the birds in the houses it will mean making some nesting arrangement inside the houses.

Broody coops are small open coops and may be built inside the pen or in the yards. They are used to break up setting hens, to store tem-

porarily an extra breeding male, also injured or sick birds or surplus fowls which are to be disposed of. When going through the house at times we find many individuals which are undesirable and should be removed. It is easy to catch those birds at that moment and they may be placed in the broody coop, later to be disposed of as desired. The broody coop should be located near the nests, so that the broody hens may be removed from the nests and placed at once in the coops. Ordinarily the coop should be large enough to accommodate about one hen in every ten.

Feed hoppers are of great importance in planning the equipment of the house. A great number of styles and types are used for the feeding of dry mashes and whole grains. They are more generally used for feeding ground grains or mashes which are kept before the birds at all times. Usually one linear foot of feeding area is provided for every twelve birds. This proportion depends upon the size of the flock and also on the method of feeding, whether the hoppers are open all day or half the day. Hoppers should have sloping tops to prevent the birds roosting on them and should also be built so that they can be closed whenever desired. Double hoppers are often used in large houses, being placed in the partition, allowing birds from the two pens to feed from the same hopper.



Fig. 49—A turkey roost in a large tree. Texas turkeys do well roosting in trees.

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