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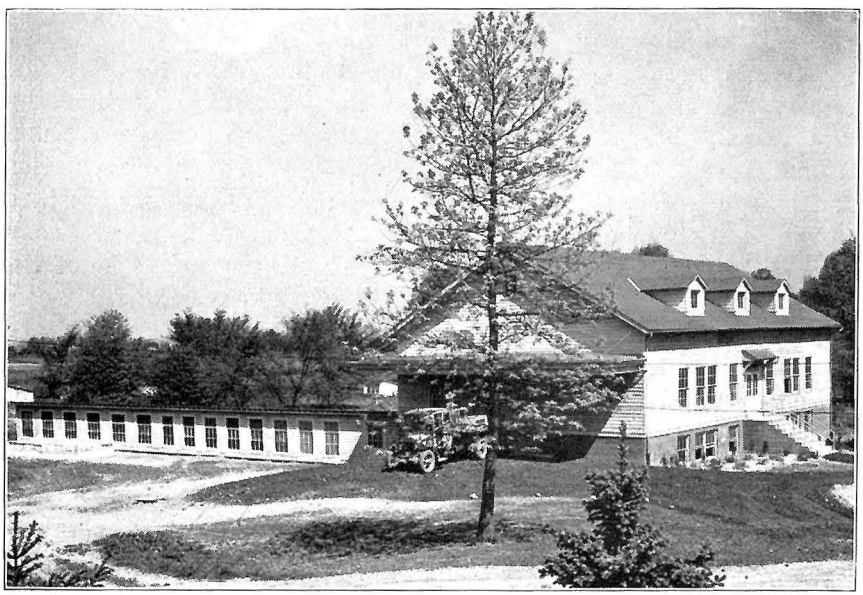
POULTRY



OHIO AGRICULTURAL EXPERIMENT STATION
WOOSTER, OHIO

GETTING WINTER EGGS FROM HENS

D. C. KENNARD AND V. D. CHAMBERLIN

Getting winter eggs from hens may no longer be considered like trying to get "blood from a turnip". By special feeding and management hens can be made to lay comparably to pullets from November to March according to results being secured by some poultry keepers and by tests conducted by the Ohio Experiment Station during the winter of 1929-30. This accomplishment offers promising and valuable opportunities for many poultrymen. From point of economy of winter egg production pullets and hens show some interesting contrasts. In the first place a select pullet, November 1, is usually valued around $1.50 because of her potential production of winter eggs; whereas a select hen of similar breeding could usually be secured for 75 cents. The value of a pullet becomes that of a hen by March 1, and this 75-cent depreciation must be charged against her winter eggs; while the hen goes thru the winter without depreciation. In fact, hens will usually command a better price in the spring. This increased value of the hens in the spring should in many instances take care of their cost of feeding while they are out of production during the fall molt and reconditioning period. This would leave the 75-cent depreciation of the pullet to the credit of the hen, which would require that the pullet lay about two dozen more winter eggs, considering the smaller size of its eggs, than the hen, to break even with the hen by March 1. Obviously the odds are in favor of the select hen. Hens laying winter eggs have a further advantage over pullets in that they are less subject to colds, roup, bronchitis and pox, and certain other diseases. Tuberculosis, on the other hand, is more likely to affect the hens. Furthermore, hens' eggs are larger, command the highest prices, and are preferable to pullets' eggs for early hatching.

MANAGEMENT AND FEEDING

The tests to be described involved no difficult procedure, nor any equipment other than that which most poultry keepers already have. The hens used were from various experiments which were discontinued Sept. 3, 1929, when the hens were transferred to another house and carried as one flock. They had previously been confined indoors but, after moving, the birds had access to a fairly

good range. At this time shelled corn was put in mash feeders and kept before the hens at all times, and the mash was restricted to about two-thirds of what would have been consumed had the birds been given free access to it all the time. Oyster shells and chopped alfalfa hay were always available.

TABLE 1.—All-Night Light Versus Morning Light for Winter Egg Production From Hens

Lot number	Per cent egg production			Eggs per bird December 3 to March 1
	December	January	February	
1 All-night light 40 hens	42	55	50	44
2 All-night light 40 hens	48	50	46	42
3 All-night light 60 hens	29	51	57	40
4 Morning light 4:30 a. m. 60 hens	18	46	60	36

The above procedure was continued until December 3, when the best hens were removed for other tests. The remaining inferior hens were divided into four different lots and given all-night or morning light. At this time the shelled corn was discontinued and the all-mash-oats mixture composed of coarsely ground yellow corn 45, coarsely ground wheat 20, whole oats 15, wheat bran 5, meat scraps medium 10, dried buttermilk 5, poultry bone meal 2, salt 1, cod-liver oil 1 was substituted. No additional grain or moist mash was fed. Results from four groups of hens thus treated are tabulated in Table 1.

DISCUSSION OF RESULTS

These hens might well have had the light, starting November 1, but owing to unavoidable delay they did not receive it until December 3. After this they came into production promptly, especially those given all-night light. For instance, in Lot 1, 40 hens started with three eggs December 3, and six days later laid 23. Lot 2 did practically the same. In Lot 3, of 60 hens, but one laid before December 11; at that date others began, and eight days later they laid 28. The groups given all-night light laid a greater number of eggs in December and January, but in February the hens with morning light slightly exceeded the others. The better production in December from Lots 1 and 2 was due to the better grade of hens used. However, the better hens in this case were only

second grade since they were the ones left after the best had been previously selected for other tests. The hens not only laid well during the winter months but also increased their body weight. The average weight of Lot 3, with all-night light beginning December 3, was 3.45, January 1, 3.60, February 1, 3.68, and March 1, 3.73 pounds per bird. At the same time Lot 4, with morning lights, weighed 3.42, 4.14, 4.05, and 3.71 pounds, respectively.

Eggs from Lots 3 and 4 were hatched each week from January 20 to February 10. Those from Lot 3 were 84 per cent fertile, and 82.5 per cent of them hatched. The eggs from Lot 4 were 88.5 per cent fertile, and 80.2 per cent of them hatched.

METHODS OF PROCEDURE

Each poultry keeper usually accomplishes a given object by a different or modified procedure, because each must be governed by a variable combination of circumstances and conditions. Individuality also plays an important part so that no two individuals accomplish the same object in the same way. This principle applies to poultry keeping in general and to getting winter eggs in particular. Hence no attempt will be made to suggest a definite procedure that will apply to all alike for getting winter eggs from hens. One way by which this object was accomplished by the Station has been described somewhat in detail; it may offer some general suggestions. Further adaptations of the procedure and other suggestions follow:

Molt and recondition the hens in August or September by moving them to different quarters, and, if possible, by giving them a good outdoor range of blue grass, clover, or alfalfa. At the same time give the hens free access to shelled corn in suitable feeders at all times. To insure a more liberal consumption of shelled corn the mash should be limited to about one-half or two-thirds the amount they would eat if given all they cared for. The change to heavy feeding of corn is to discourage egg production, hasten the molt, and fatten the hens so they will be in condition to withstand winter egg production. About two months after the corn-restricted mash, range, and molt treatment, the hens will usually be in condition to be transferred to winter quarters where they are confined and given a suitable winter laying ration and all-night light to insure the heavy feed consumption essential for winter production. The ration should contain, on the basis of total feed consumption, not less than 10 per cent meat scraps or its equivalent, 5 per cent dried buttermilk or skimmilk, 5 to 10 per cent highest quality alfalfa

meal, and 1 per cent of a potent cod-liver oil or its equivalent, in addition to the corn, wheat, oats, bran middlings, etc., which serve to make up the greater proportion of the feed. The ration may be fed as one feed mixture or grain and mash may be fed separately if so desired. If both grain and mash mixtures are employed the grain should be fed in mash feeders, on top of the mash, but never in the floor litter which is always more or less unsanitary. The open box type of mash feeder 8 inches wide and 4 inches deep inside—as described and illustrated in Circular 14—which will provide 30 feet of feeding space, counting both sides of feeder, for leghorns, and 40 feet for heavier breeds, is a necessity if the desired winter egg production is to be secured. Such feeders with ample feeding space provide the best means for feeding grain (if it is to be fed separately), moist mash, condensed buttermilk, or germinated oats—simply put such materials in the mash feeders on top of the dry feed. Moist mash may, or may not, be fed, as may be preferred—it is not essential. But it is essential to have warm water available both night and day. This is easily accomplished by use of a simple, inexpensive, electrical water heating device, Figure 2.

Fig. 2.—Warm water device

KINDS OF HENS TO USE

The hens to be selected for winter eggs should be in good condition, vigorous, and up to size; that is, they should show no indications of being afflicted with disease or intestinal parasites. Yearlings are much to be preferred, altho two-year-olds may sometimes be used to advantage; older hens would seldom, if ever, prove suitable.

The pullets which laid well during the previous winter and continued in heavy production the following spring and summer afford an important source of yearling hens. Such hens generally fall off in production after July and become available in August or September. After being reconditioned by the fall molt and rest period, they are particularly well adapted, not only for winter egg production, but for high quality, early hatching eggs.

The largest source of hens is those displaced by the pullets in August and September. On this account thousands of valuable yearling hens go to market each year, which, if properly prepared for winter production, could in many instances be made more profitable than the pullets that displaced them.

There are also the hens which for one reason or another molt early. The practice has been to market these birds in July, August, and September. However, such hens, if in good condition, may well be separated from the late molters and prepared for winter production. Where a special breeding flock is maintained the early molters can be selected and prepared for winter production while the late molters can be continued in production so as to qualify finally for the breeding flock.

Getting winter eggs from hens offers an opportunity for some who do not have the room or facilities to raise first class pullets, or those who fail with pullets, to succeed without having to raise pullets or depend on them for winter eggs. In every community there is a splendid opportunity for a few such enterprises which should prove very profitable for one who knows a good hen when he sees it; he can go out and purchase suitable hens which are plentiful in August. The select hens could be kept for winter egg production, and the others not qualifying for this purpose could be marketed. The hens kept for winter egg production might in many cases be sold in the spring when eggs become cheap, or after they are no longer desired to produce hatching eggs. At this time market poultry usually commands a better price and the hens would often sell for more, after laying 3 to 4 dozen high-priced, winter eggs, than they cost before; whereas the pullets, which usually lay about the same number of smaller eggs, would suffer a depreciation of about 75 cents each when they became hens in the spring.

For example, Charles Tessmer, Hartman, Ohio, who is making it a practice to keep only hens for winter eggs, secured 500 hens for 49 to 79 cents a head in the fall of 1929, and after securing an average of approximately 50 per cent egg production during the winter months, sold them on the market in April for $1.10. In this case the increased value of the hens from fall to spring more than paid for their feed during the fall molt and reconditioning period.

Other poultrymen, particularly those in southeastern Ohio who were the first to employ all-night light for hens, have been succeeding in getting profitable winter egg production. It seems that J. E. Morris was the first to start this practice in 1925, and during the past five years others in that section have likewise succeeded.

In general their practice has been to molt and recondition the hens in September and October and start the all-night light around November 1, when the hens promptly come into 40 to 50 per cent production, which they maintain thruout the winter months.

WARM WATER FOR WINTER LAYERS

Warm water is one of the essentials for best winter egg production. Hens drink sparingly of cold water, but relish warm water. A liberal intake of water increases egg production by stimulating feed consumption and supplying the large amount of water required for egg formation.

The insulated water pail and electric heater illustrated in Figure 2 is a simple, effective, and inexpensive device for its purpose. This outfit with a 16-quart pail amply serves 100 layers.

Insulation of water pail.—The construction of a box container is self-explanatory from the photograph, Figure 2, and the sketch, Figure 3. The galvanized iron cover is cut to fit snugly under the rim of the pail, and sloped so as to carry off drip water to keep the inside packing dry. The bottom of the box is removable so as to

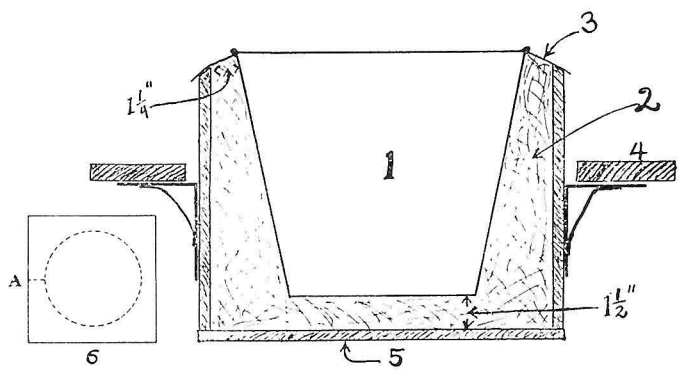


Fig. 3.—Insulated water pail and container

1. 12, 14, or 16 quart galvanized water pail.
2. Straw or excelsior for insulation.
3. Galvanized sheet iron top to keep insulation dry.
4. 1- by 3-inch running board.
5. Removable bottom.
6. Sheet iron top marked for cutting.

pack easily or renew insulation around the pail. When the box with iron cover is completed the pail is put into place and the box turned upside down so as to pack straw, excelsior, or newspapers firmly around the pail. The bottom is then fastened in place. The pail can then be removed when desired and the packing will stay in

place. One packing will usually last thru the winter season. The 1- by 3-inch boards for hens to stand on are placed 4 inches below the top of the pail and one inch from the box. The size of box provides 1½ inches of space for packing between the top edge of the box and the pail.

A simple inexpensive electric heater.—Figure 2 shows a simple electric heater which has been used at the Ohio Experiment Station during the past three winters and has proven highly satisfactory. It consists of a piece of galvanized iron conductor pipe 12 inches long and 2½ inches in diameter, water tight at one end. To this bottom end a six-inch disc of galvanized iron is attached so as to keep the heater upright. Then one inch of sand is put in the bottom and an extension cord inserted in such a way that the bulb rests on the sand. More sand is then added to fill around bulb and to a point three or four inches above so as to hold the heater on the bottom of the pail when it is full of water. A tin cap is put on top of the heater to keep out any water the hens might flip about, as the heater must be kept dry inside to prevent a short circuit. Carbon filament bulbs are best suited for heating as they give off more heat and less light than other types. Bulbs of 16 to 50 candle power may be used depending on requirements. If carbon filament bulbs are not available locally they can be secured from wholesalers of electrical supplies.

ALL-NIGHT LIGHT FOR LAYERS

It seems that all-night light can be used to advantage for securing winter egg production from hens and late hatched or slowly maturing pullets. Only a dim light is required. A 16-watt bulb properly located will serve a pen of 100, and a 25-watt bulb, 200 layers. The use of all-night light is little, if any, more expensive than morning or evening lights, when more intense light is used, and requires less expensive equipment because of its simplicity.

Obviously all-night light is the best method when gas and lanterns are used as these cannot be turned off and on automatically as can electricity. Success with all-night light is largely determined by having warm water available both day and night, suitable feeders providing ample feeding space, and a light located over the feeding and drinking equipment so the birds can easily see to eat and drink. The light may or may not be shaded. If shaded

it should not prevent light from reaching roosting quarters and should permit the light to cover most of the floor space so the birds can see to go to and from the roosts.

It would seem, that since hens can be molted in the fall and reconditioned for winter egg production and that with the greater certainty of maintaining production thruout the winter afforded by all-night light, the select yearling hen has a new and promising potential value not heretofore recognized.

THE PROTEIN REQUIREMENTS OF GROWING PULLETS

R. M. BETHKE, PAUL R. RECORD, AND D. C. KENNARD

The protein requirements of chicks for the first 8 or 12 weeks have come to be generally well understood and many rations have been formulated which supply an adequate amount of protein during this early period. To date, however, the protein requirements of pullets for the period extending from 8 or 12 weeks of age to maturity have not been definitely determined for any given protein supplement to be used with specific rations.

It is a common practice to reduce the amount of protein in the ration after the pullets are 8 or 12 weeks old. The amount of protein fed is not based on any standard established by experimental work, but rather on the experience and ideas of the feeder. Opinions differ as to how rapidly a pullet should be developed. Some poultrymen are of the opinion that rations too high in protein bring pullets into production before they attain the desired size and weight and that these birds are not capable of withstanding the strain of heavy egg production as well as are those which receive a ration of lower protein content and are allowed a longer growing period.

From experience it is known that birds which have access to a good range very frequently mature rather rapidly altho very little animal protein may be included in their mash. Apparently birds that are outdoors have a variable intake of protein depending upon the condition of the range. With the present rapid advancement in the practice of keeping chickens of all ages in confinement it is imperative that we know what the protein requirements of the

growing bird are under these conditions as compared to those of birds having access to a good range. The object of the experiments here reported was to obtain information on these questions.

The work was divided into two phases; the one dealt with feeding different kinds and amounts of animal protein to 10-week-old pullets confined indoors; the other involved feeding different amounts of animal protein to pullets 10 weeks old that had access to a good blue grass range. These birds were reared under average conditions.

TABLE 1.—Rations Fed Indoor Pullets From 10 Weeks to Maturity

Ingredients	Lots						
	1	2	3	4	5	6	7
Yellow corn	63.0	59.0	55.0	51.0	57.7	52.4	47.1
Wheat	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Wheat bran	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Alfalfa leaf meal	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Meat scraps*	.....	5.0	10.0	15 0	3.3	6.7	10.0
Dried buttermilk†	.....	.....	.....	.....	3.0	5.9	8.9
Bone meal	5.0	4.0	3.0	2.0	4.0	3.0	2.0
Salt (NaCl)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cod-liver oil	1.0	1.0	1.0	1.0	1.0	1.0	1.0

*62.54 per cent protein. †35.31 per cent protein.

The pullets in the indoor experiment were brooded for the first 8 weeks in experimental brooders provided with wire-screen bottoms. The results from the rations used during this period were variable; however, in our experience they have always been good. At 8 weeks the pullets were transferred to 5 by 7 foot pens with wood floors covered with pine shavings, and were given a standard complete ration containing 10 per cent meat scraps for 2 weeks. When the pullets were 10 weeks old, they were divided according to weight into 7 lots of 15 each, and were fed the rations as indicated in Table 1, with water to drink.

The birds were continued on their respective rations until they were 27 weeks of age. During this period each bird was weighed every two weeks. The pullets in Lots 1 and 5, 3 and 6, and 4 and 7 received rations approximately the same in protein content. One third of the meat-scraps' protein in Lots 2, 3, and 4 was replaced by an equivalent quantity of protein in the form of dried buttermilk and fed to Lots 5, 6, and 7, respectively.

The average weights of the birds in the different lots are given in Table 2. Excluding Lot 1 (no animal protein) there was no significant difference in the weight of the various lots. Apparently, the quality and amount of protein in the different rations of Lots

2, 3, 4, 5, 6, and 7 were satisfactory to develop the birds at a rate normal for this particular strain. Depriving birds of animal protein (Lot 1) materially retarded their growth as revealed by a difference of 217.4 grams, or approximately one-half pound, between Lots 1 and 7.

TABLE 2.—Average Weight (Grams) of Pullets That Lived Thruout Experiment

Age in weeks	Lots						
	1	2	3	4	5	6	7
10	637.8	636.2	651.5	637.9	633.5	636.7	638.8
14	761.8	856.2	894.1	910.8	858.8	891.1	887.1
18	897.5	1061.7	1096.8	1143.5	1078.8	1128.6	1139.6
22	1060.0	1277.5	1274.1	1279.6	1260.8	1318.2	1316.3
26	1242.1	1430.0	1416.8	1428.8	1458.8	1437.1	1441.7
27	1294.2	1465.0	1489.0	1492.2	1482.9	1468.5	1511.6

Table 3 shows the distribution of the pullets according to weight at 27 weeks of age. It is apparent that the birds in Lot 1 (no animal protein) were much smaller. Over one half of the birds in this lot were below the average in weight. The birds in the other six lots were fairly evenly distributed. It is of interest to note that all birds in Lot 7, which had received one of the highest protein rations, were up to average or better.

TABLE 3.—Distribution of Pullets According to Weight (Per Cent)

	Lots						
	1	2	3	4	5	6	7
Below average 1300 grams or less	58.3	16.7	18.2	15.4	16.7	14.3	0.0
Average 1301–1500 grams	25.0	41.7	54.5	46.2	58.3	50.0	50.0
Above average 1501 grams or better	16.7	41.7	27.3	38.4	25.0	35.7	50.0

There was no correlation between the per cent or kind of animal protein in the ration and size or state of maturity of the bird as revealed by the date of the first egg (Table 4). All lots in general, except Lot 1, came into a fairly uniform rate of production. In case of Lot 1 production was delayed approximately one month. The mortality, in the main, was due to fowl paralysis. No parasites were found on post-mortem examination.

For the second phase of the work 700 day-old, White Leghorn chicks from the same hatch as those used in the indoor experiment

were brooded in two separate colony houses for 10 weeks. They received an all-mash ration of yellow corn 49, wheat 20, wheat bran 5, meat scraps 10, dried buttermilk 10, alfalfa leaf meal 3, bone meal 2, and salt 1. The feed ingredients were of the same shipment as used in the indoor test. When the chicks were 2 weeks old they were given access to a good blue grass range.

TABLE 4.—Mortality, Egg Production, and Per Cent of Birds Laying

	Lots						
	1	2	3	4	5	6	7
Number of birds lost	3	3	4	2	3	1	3
Per cent mortality	20.0	20.0	26.7	14.4	20.0	6.7	20.0
Age at first egg (days)	189	156	156	167	168	159	142
Eggs per bird to 27th week	0.67	7.25	4.28	1.38	5.25	6.85	4.92
Per cent of birds laying on or before 27th week	41.7	66.6	81.8	53.8	75.0	64.3	41.7

At 10 weeks 250 of the better pullets were banded and divided according to weight into 5 lots of 50 each. Each group was placed in a 10- by 12-foot colony house and was given access to approximately one fifth of an acre of good blue grass range. The rations fed are given in Table 5; Lots 2 and 5 received rations comparable in total protein content.

TABLE 5.—Rations Fed Range Pullets From 10 Weeks to Maturity

Ingredients	Lots				
	1	2	3	4	5
Yellow corn	69.0	65.0	61.0	57.0	63.7
Wheat	20.0	20.0	20.0	20.0	20.0
Wheat bran	5.0	5.0	5.0	5.0	5.0
Meat scraps*	.....	5.0	10.0	15.0	3.3
Dried buttermilk†	.....	.....	.....	.....	3.0
Bone meal	5.0	4.0	3.0	2.0	4.0
Salt (NaCl)	1.0	1.0	1.0	1.0	1.0

*62.54 per cent protein. Rations of Lots 2 and 5 are comparable in total protein.
†35.31 per cent protein.

The pullets were continued on their respective rations until they were 24 weeks old. During this period they were weighed individually every two weeks. The average weights of the birds are recorded in Table 6. These results again reveal no significant difference between the lots that received different amounts of animal protein. In this respect they are comparable to the six lots kept indoors. The birds in Lot 1 (no animal protein) were on the average somewhat smaller than those in the other four lots, Table 7; but the difference was not so marked as in case of the groups confined indoors.

TABLE 6.—Average Weight (Grams) of Range Pullets That Lived Thruout Experiment

Lot No.	Protein supplement	Weeks				
		10	14	18	22	24
1	No animal protein	630.7	866.9	1061.0	1274.9	1366.2
2	5 per cent animal protein	628.3	935.8	1100.1	1308.6	1413.9
3	10 per cent meat scraps	628.2	966.4	1154.5	1348.1	1436.2
4	15 per cent meat scraps	618.4	991.8	1146.8	1365.1	1428.2
5	3.3 per cent meat scraps 3.0 per cent dried buttermilk	629.5	954.0	1108.8	1359.4	1422.2

There was no correlation between the amount of protein in the ration and the time at which the birds came into lay (Table 8), all lots coming into production at about the same time. The birds in Lot 1 (no animal protein) were not quite as uniform in size and development as the other lots, and did not lay as many eggs. Mortality was high in several of the lots. In the majority of cases this was due to fowl paralysis. Very few parasites were found at the time of post mortem.

TABLE 7.—Distribution of Range Pullets According to Weight (Per Cent)

	Lots				
	1	2	3	4	5
Below average 1300 grams or less	41.6	21.4	23.4	24.4	12.2
Average 1301–1500 grams	37.5	50.0	34.0	37.8	68.3
Above average 1501 grams or better	20.8	28.6	42.5	37.8	19.5

When 24 weeks of age, or Nov. 1, 30 of the better pullets from each lot were selected and continued separately on the same laying ration. No significant difference in egg production, mortality, or weight has been observed in the various lots. It is planned to continue these lots thru the first year.

TABLE 8.—Mortality, Egg Production, and Number of Birds Laying (Range Experiment)

	Lots				
	1	2	3	4	5
Mortality	2	8	3	5	8
Per cent mortality	4	16	6	10	16
Age at first egg (days)	160	161	155	158	161
Total No. of eggs to 24th week	46	80	122	83	83
No. of birds laying on or before 24th week	10	14	17	12	14

DISCUSSION*

The small difference between the average weight of pullets in the lots that received animal protein, either indoors or on range, suggests that probably in many cases pullets are being fed more animal protein during the growing period than is necessary for satisfactory growth and development. On the other hand the results of these experiments suggest that it is advisable to feed to growing pullets at least 5 per cent of meat scraps or its equivalent from some other source of animal protein to insure uniformity of development.

It is of special interest that the pullets on range made much better growth, when deprived of animal protein, than those confined indoors. This observation lends further support to the hypothesis that indoor feeding is more exacting if results equal to those on range are to be obtained. Under the conditions of these experiments no evidence was obtained which would tend to show that liberal protein feeding during the growing period caused the pullets to lay before they attained their normal size and weight. Under average practical conditions where economy in feeding is practiced it is questionable whether growing pullets will come into production before they reach the normal size or weight for the particular breed or strain.

*For a more practical discussion of summer management of pullets consult May-June, 1930, Bimonthly Bulletin.

COARSE VERSUS FINE MASH

D. C. KENNARD

Grinding feed and preparing mash feeds for poultry are comparatively new procedures. The advent of the "balanced ration" some fifty years ago involved the use of mash to incorporate protein and mineral feeds to supplement the grains. However, the feeding of mash has become a standard practice with most poultry keepers only within the past 15 years and the phenomenal development of commercial feeds for poultry has been a still more recent accomplishment. The question of texture of feeds has become of importance in connection with modern methods of poultry feeding. This has been emphasized by the advent of the all-mash method of

feeding and the preparation of complete feeds. In the preparation of ground feed mixtures the tendency has been to make a finely ground preparation of good uniform appearance on the assumption that such a mash would be more readily digested.

The fanciful idea that a poultry mash must be finely ground to be of good appearance and most effective has become so thoroly established with many feed dealers, salesmen, and poultrymen, that if feed manufacturers were to change to coarse feed preparations they would probably encounter considerable opposition. Like all questions, this has two or more sides to be considered; each has its advantages and disadvantages.

Coarse or granular feeds have the advantage of being more palatable and less subject to deterioration, such as becoming stale, rancid, musty, or caked in the sacks, than finely ground material. The disadvantages of a coarse and fine feed mixture as compared to a finely ground, uniform mash is that the birds may pick out the coarse material in preference to the fine so that there may be difficulty in getting them to consume the left over material. This also involves the possibility that some of the birds may get more than their share of the more palatable coarse material and thus unbalance the ration for all. Furthermore, much wastage of mash may result while the birds are picking it over for the coarse material unless waste proof mash feeders are used. However, these disadvantages can be effectively overcome by use of suitable feeders providing ample feeding space and the method of feeding to be suggested later.

PALATABILITY OF POULTRY FEEDS

The value of a feed stuff or a feed mixture for chickens depends largely upon how well they like it. Poultry keepers are concerned chiefly in how to get their birds to eat more rather than about overfeeding, since profitable production of eggs or meat depends upon heavy feed consumption; therefore the palatability of a feed mixture is important.

Of the grains, chickens like wheat and corn most and rye the least. Barley and oats share an intermediate place in this respect. Meat and milk products usually rank high in palatability. Chickens naturally like granular or grain-like material better than the same material finely ground. Dusty feed is disliked.

A coarse mash mixture is one of coarse or granular and fine materials. Unless a special process is employed there will be both coarse and fine material. To make a coarse-fine mash mixture, the corn can be ground so the larger particles are about the size of a

kernel of wheat. Even so there will be a considerable amount of fine material. Likewise, coarse, cracked wheat, medium meat scraps, and granulated bone can be used in preference to the finely ground products. However, it may be desirable to grind finely some materials like oats, barley, legume hay, etc., when such products are to be made a part of the mash mixture; altho this would not be necessary if the whole oats or barley were mixed in with the mash. This would likewise apply to chopped legume hay which could be fed separately.

The fact that whole or cracked grain is more palatable than ground grain or dry mash presents a troublesome problem in poultry feeding. Because of this, considerable skill in feeding the grain is required if the ration is not to be unbalanced by an excess of grain, since it is the mash that is the balanced part of the ration so far as proteins, minerals, and some vitamins are concerned. Obviously the simple solution of this difficulty is to feed the grains along with, or as a part of, the mash. Thus the whole ration will be definitely balanced without involving the care and skill required to feed the grain and mash separately. Consequently, many poultry keepers have found in the all-mash method of feeding an effective solution of this problem.

Palatability test of coarse versus fine mash.—To secure definite information as to how the coarseness or fineness, and how different ingredients affect the palatability of a feed mixture, the Ohio Experiment Station conducted tests in 1925 with one group of 100 White Leghorn pullets and another of 80 Barred Rock pullets. Three reel mash feeders each 4 feet long were placed end to end in each pen and located so that all were equally lighted and accessible. The test was conducted for 11 months during which careful records of the consumption of the three different all-mash feed mixtures were made. 1. A mixture of coarsely ground yellow corn 65 per cent, winter wheat middlings 20, medium meat scraps 10, granulated poultry bone 4, and salt 1, was kept in one feeder. 2. This was the same mixture with all ingredients finely ground as is the customary practice. 3. A popular mash mixture composed of coarsely ground yellow corn 30 per cent, coarsely ground wheat 20, finely ground oats 20, wheat bran 10, winter wheat middlings 10, medium meat scraps 10. Chopped alfalfa hay, oyster shells, and grit were before the birds at all times. The first two mashes are of interest with respect to the effect of the degree of fineness of the same mash mixture on the palatability. The third shows the effect of ground oats and wheat bran upon the palatability of a mash mixture as compared to corn.

For each 100 pounds of the coarse mash No. 1 consumed, the Leghorns ate 70.2 pounds of the same mixture No. 2 ground finely, and 47.5 pounds of the mash No. 3 containing finely ground oats and wheat bran; and for each 100 pounds of the coarse mash No. 1 the Plymouth Rocks ate 56.4 pounds of the No. 2 fine mash, and 23.8 pounds of the mash No. 3 containing finely ground oats and wheat bran. For each total 100 pounds of the two corn mash mixtures, No. 1 and 2, the Leghorns ate 27.9, and the Plymouth Rocks 14.4 pounds of the mash mixture No. 3 which contained finely ground oats and wheat bran. These figures are of interest in that they may serve as a rough index as to how palatability of a mash mixture may be affected by certain of its ingredients or by the relative degree of its fineness. At the same time such results should not be taken too seriously in judging the relative value of mash mixtures. For example, suppose the groups of birds had been fed either of the less palatable mash mixtures only—they would then have consumed probably about the usual amount needed to meet their requirements in spite of the difference in palatability. That is to say, similar groups of layers each fed a different one of the mash mixtures would not have yielded differences in egg production at all comparable to the differences in palatability. In fact, tests comparing the coarse corn mash mixture with the mixture of ground oats and wheat bran indicate the latter to be the better of the two.

Coarse versus fine mash for egg production.—After the tests which indicated the distinct advantage of a coarse mash over the same mash finely ground with regard to palatability, later tests were conducted with coarse versus fine mash in an effort to determine if egg production or mortality would be affected. Three tests during the past three years have been conducted with a total of six groups of 50 White Leghorn pullets. The results will be found in Table 1. The birds were confined indoors, weighed individually each month, and trapnested. The all-mash method of feeding was employed with mash mixtures as follows:

In tests No. 1 and 2, the rations were the same. The one group received coarsely ground corn 70, coarsely ground wheat 20, meat scraps medium 10, granular poultry bone 2, salt ½, cod-liver oil 1. The other group received the same mash finely ground. All groups had access to oyster shells and chopped alfalfa hay at all times.

In test No. 3, the one group received a mash composed of coarsely ground yellow corn 40, coarsely ground wheat 20, finely

TABLE 1.—Coarse Versus Fine Mash With Regard to Egg Production, Feed Consumption, and Body Weight

Kind of mash	Eggs per bird		Feed consumption per bird	Average weight of birds
	November 1 to March 1	November 1 to		
Test 1 1927-1928		Sept. 4 44 weeks		
Coarse	31	93	60.9	3.29
Fine	30	83	58.8	3.32
Test 2 1928-1929		Sept. 4 44 weeks		
Coarse	48	132	64.0	3.23
Fine	44	112	58.4	3.29
Test 3 1929-1930		June 1 30 weeks		
Coarse	49	93	40.0	3.17
Fine	44	85	32.9	3.06

ground oats 15, wheat bran 5, meat scraps medium 5, dried buttermilk 5, alfalfa meal 5, granular poultry bone 2, salt ½, cod-liver oil 1. The other group received the same mash finely ground. Both groups had free access to oyster shells and grit.

DISCUSSION OF RESULTS

The coarse mash yielded better egg production in each of the three tests. The production was low in all the tests owing to the inferior quality of pullets used. The unusually low production of birds in test 1, particularly during the winter, was largely due to an outbreak of infectious bronchitis in November. The birds receiving fine mash consumed somewhat less while the average weight of these birds was slightly more in the two completed tests. In the matter of mortality there was no significant difference.

While the results are not conclusive and much more work will be required before definite conclusions can be made, the three tests in question consistently indicate that for egg production the coarse mash was more effective than the same mash finely ground.

Method of feeding coarse-fine mash mixtures.—The previously named disadvantages of a coarse feed mixture may not only be effectively overcome but converted into advantages by use of suitable, waste-proof feeders, ample feeding space, and the feeding of fresh mash daily. The same method of feeding mash should likewise be employed for a finely ground mash, especially for prevention of stale, musty mash accumulating in bottom of feeder.

Since a coarse-fine mash mixture makes it more obligatory to employ this method of feeding, it may be considered an advantage. An open type of mash feeder, Figure 1, is preferable, because it is waste proof and costs less to provide the necessary feeding space, which is 30 feet counting both sides of feeder for each 100 layers of the lighter breeds, and 40 feet for heavy breeds. By feeding fresh mash daily, the feeders are never filled more than half full, thus reducing wastage to the minimum. When only that amount of mash is fed which will about be consumed before the next feeding period, all of the birds will have a chance to get their share of both the coarse and the fine portions of the mash. Whether the mash be coarse or fine this method of feeding should be employed, if for no other reason than to prevent the accumulation of stale or musty mash in the bottom of the feeder. Poultrymen are careful to purchase only fresh, wholesome feeds and the same precaution should be continued in feeding, so as to make sure that the mash is fresh and wholesome when consumed. Chickens do not like stale feed, and must or mold may cause trouble. This method has another distinct advantage in that it offers an effective means by which the caretaker can keep in close contact with the behavior of the flock. If for any reason something happens to cause the flock to fall off in feed consumption, it is observed at once; the cause may be determined to best advantage, and perhaps corrected before loss of egg production results. Whereas if the mash is fed at irregular intervals, or in magazine feeders, the observation may not be made for some days, or until after loss of egg production takes place, when it may be too late to determine or correct the cause.

While the foregoing suggestions are based primarily upon all-mash or complete feed mixtures, they likewise apply when it is desired to feed grain and mash separately. When grain, either cracked or whole, is to be fed in addition to a mash intended for that purpose (but not an all-mash feed) the best procedure is to feed the grain in mash feeders on top of the mash. In like manner there is no better method or place for feeding moist mash, condensed buttermilk or skimmilk, and germinated oats. With suitable feeders and ample feeding space no other additional feeding equipment is needed, and certainly there is no need for feeding scratch grain in floor litter which is always more or less unsanitary.

As suggested by this Station in 1927 the ideal feed for poultry would seem to be a complete ration aggregated into granular form so that each granule would be composed of all the parts of the ration and thus the usual objections to the coarse-fine mash

mixtures would be avoided. It was further suggested that the aggregation could likely be accomplished by a combination of heat, moisture, and pressure, or possibly by the use of some sort of a binder such as molasses. The idea was cast abroad with the suggestion that the development was essentially a feed manufacturers' problem and that its solution would likely be a near future accomplishment. Since that time a number of feed manufacturers have undertaken the development of granular or pellet feeds for poultry and it seems their efforts have been attended with most promising results.

CHICKEN VICES

D. C. KENNARD

Altho feather picking and cannibalism become a more serious problem as poultry keeping becomes more intensified, they are not new vices among chickens. The "Complete Poultry Book" published some fifty years ago refers to feather picking as a "pernicious habit" and suggests that "the chopping block is the surest remedy, but for valuable fowls a wire bit passed thru the mouth like a horse's bit and held in place by being passed thru the comb, the wire being just large enough to prevent shutting the beak firmly together, will render the bird unable to grasp feathers, and it will soon abandon the habit." The chopping block or the bit is hardly practicable under present methods of poultry management; hence special precautions for prevention and control have become a necessity.

Chicken vices as used in this article are synonymous with feather picking and cannibalism, including toe, tail, wing, and vent picking, or pickouts, in young chicks, growing pullets, and mature birds, Figure 4. These vices arise particularly from confinement indoors, on a sun porch, or in a small yard.

CAUSES

While chickens of any age may contract such vices, young chickens are the most susceptible, and, if the vices are prevented among the chicks, little or no difficulty may be expected among the mature birds. Some of the most frequent causes of feather picking and cannibalism, especially among chicks and growing pullets, follow:

Overcrowding or too close confinement.—Overcrowding chickens is probably the most frequent mistake of poultry keepers. For best results chicks should have one-half to three-quarters of a square foot of floor space in the brooder house; growing pullets, 1 square foot; and layers, 3.5 to 4 square feet per bird. The floor space for chicks which are to be on range most of the time after the first two weeks can be reduced to one-third square foot per bird. By providing ample space for chickens mortality may be reduced, disease and parasitic infestation rendered less acute, and the vices of feather picking and cannibalism checked.

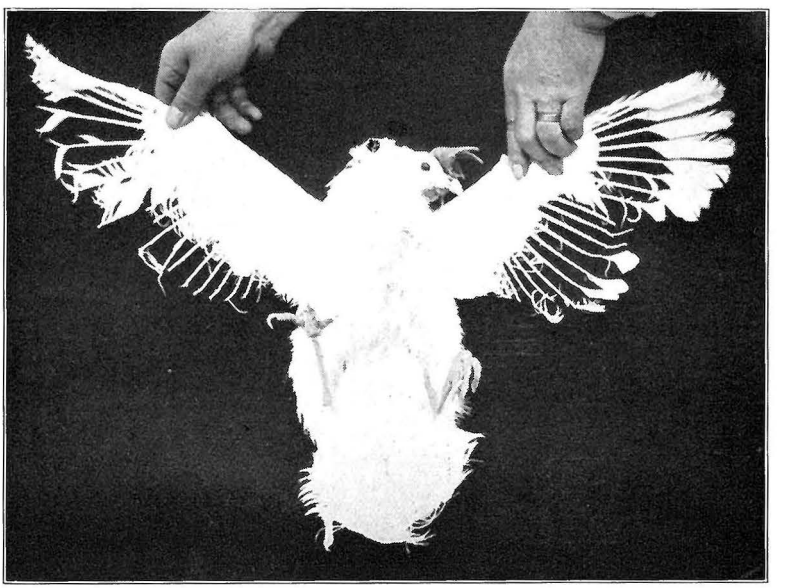


Fig. 4.—An extreme case of feather picking and eating

Overheating of brooder house.—Outbreaks of feather picking and cannibalism in the brooder house may often be traced to discomfort and discontentment of the chicks caused by excessive heat. Trouble is more likely to occur on bright days, when the brooder house becomes overheated by the sun and when the house is lighter than usual. Effective prevention and control of these unfavorable conditions require sufficient circulation of air and exclusion of excess light.

Too much bright light.—A frequent cause of chicken vices is too much light in the brooder house. After the second week, burlap curtains, made from feed sacks, single or double as may be required, should be placed so as to exclude the excess light from the brooder house on clear days. Most of the light can usually be

excluded without interference with the air circulation by use of a curtain, 2 to 3 feet wider than the open space, attached to the wall below, and suspended from the ceiling 1 to 2 feet away from the window, and as high as necessary to exclude the direct light and provide ample space for air to pass around the sides and top of curtain.

Faulty management.—This will usually account for most of the difficulties arising from chicken vices. Anything which caters to the satisfaction, contentment, comfort, and general welfare of chicks, is to be considered good management. Irregularity of feeding causes chicks to become restless and may in some instances lead to vices. Likewise, filthy floor litter may sometimes be the cause. Fresh, clean litter in the brooder house often adds greatly to the birds' comfort and contentment and may prove an important factor in good management.

Hungry chicks.—Feather picking and cannibalism often follow empty mash feeders. Hungry chicks are very subject to vices; whereas well-fed, comfortable, contented chicks are not.

Chick rations.—It was formerly supposed that faulty rations were mainly responsible for chicken vices because the birds craved something the ration failed to provide. Now, it is generally conceded that faulty management is a more frequent cause, altho the ration may be a contributing factor. Chickens on a faulty or deficient ration are inclined to be restless and in a depraved condition, which may lead to feather picking and cannibalism. A complete ration which satisfies and tends to keep the chicks normal in every respect will have a proper proportion of all the essentials, especially the additional roughage or fibre and protein required by confined birds. It is generally conceded that too little protein and fibre in the ration may cause chickens to be more subject to vices, altho there is as yet little or no experimental evidence to substantiate this contention.

Dead or injured birds.—These must be promptly removed in order to prevent the other birds from picking at them, for once they get a taste of fresh feathers, flesh, or blood, it may be the beginning of an epidemic of vices.

CONTROL MEASURES

Obviously the first thing to do is to determine the cause or causes, if possible, and correct them.

Darken brooder or laying house.—This is the simplest and usually the most effective control measure. How to do this without interfering too much with air circulation has been previously

suggested. As a control measure the house may be made considerably darker than for prevention. Most of the day light may be excluded and artificial light used; or some day light may be admitted at feeding time only; or, the light may only be admitted to a small portion of the house where the feeding and drinking equipment is located. As there is considerable activity among the birds when eating and drinking, usually no trouble takes place there if the balance of the house is comparatively dark so as to offer a refuge and protection against attack. The house may need to be kept darkened from one to four weeks or longer, depending upon the nature and seriousness of the outbreak.

In case of chicks in battery brooders, or chickens of any age in feeding batteries, it should be taken for granted they will start feather picking or cannibalism unless the room is kept slightly darkened from the start. Since birds being fed for market in batteries keep more quiet and make better gains in weight when the room is kept darkened, it may well be done for this reason alone.

Watch for victims.—Remove victims or apply pine tar or a special salve as quickly as possible. Once there is an outbreak of the vices, much time and attention will be required for a week or so to prevent the trouble from becoming established, for, once it becomes established the losses may continue indefinitely and render the flock of chicks, growing pullets, or layers worthless so far as profitable returns are concerned. On the other hand, if the trouble is taken vigorously in hand at the very start usually it can be brought under complete control within a few days. The caretaker should be always on the lookout for dead or injured birds because they offer a temptation for the flock to pick their feathers and flesh which gives them the taste which may later lead to an attack on their other companions.

Catch leaders.—At the beginning one or possibly a few birds are responsible for all the trouble. If the ring leaders are caught and removed or their beaks are tipped at the start it often means a quick end of what otherwise would have become a chronic trouble attended with much annoyance and loss.

Keep green feed or chopped legume hay before the birds at all times.—Confined birds have an instinctive craving for roughage or fibrous material to which they are accustomed on the range. There are various ways by which this requirement of confined birds can be satisfied. When tender succulent greens are available they are most relished. Fresh clover, alfalfa, dandelions, etc., can be

fed to good advantage in wire netting baskets holding one or two pecks, and suspended from the ceiling so that the bottom is about on a level with the birds' heads. The baskets may be made of 1- or 2-inch mesh wire netting. Two such baskets should be provided for each three or four hundred chicks or one hundred older birds.

Chopped clover, alfalfa, or soybean hay of highest quality is also much relished by confined birds and makes a good substitute for fresh greens when the latter are not available.

PICKOUTS—PROLAPSUS OR VENT PICKING—WHICH?

Outbreaks of vent picking among layers are of frequent occurrence but it is seldom observed how they start. It was the writer's opportunity to observe in considerable detail two typical outbreaks. Perhaps a brief account of what took place and the control measures employed may be helpful to others.

Case 1.—The trouble started in a flock of 44 White Leghorn pullets when one of the birds with prolapsus of oviduct was attacked by others of the flock and was nearly killed. The trouble was discovered promptly and the bird was removed before it died. However, this proved only the beginning, for the hens had had a taste of flesh and blood and their craving for more led them to attack hens with normal vents. Two hours later the birds were found in great commotion attacking each other; three had bleeding vents. Examination of these birds showed that the vents were in normal condition before the attack. The upper part of the vent in every case was picked so as to remove a wedge-shaped piece of flesh about ⅛ inch deep and as wide as the beak. The wounds were bleeding profusely and a number of other hens were pursuing the victims to get a taste of the blood on the feathers.

Two of the assailants, which seemed to be most vicious and were probably the ringleaders, were caught and their beaks were tipped. This treatment made them harmless. The birds with bleeding vents were given a generous application of pine tar on the wound and surrounding bloody feathers. The tar was healing and repelled further attack. This ended the trouble until six days later when one hen was found slightly picked. All that was done at this time was to apply pine tar. No further trouble resulted. Had the outbreak not been handled promptly no doubt this flock of birds would have suffered disaster.

Case 2.—In a group of 38 White Leghorn hens, at 2 p. m. April 11, one hen was observed plucking feathers very skillfully.

She could pluck two to four each time and other hens came rushing to her to share the spoils. Only the one hen seemed to be doing the plucking. Her beak was tipped. Afterwards a few other hens made feeble but unsuccessful attempts to pluck feathers. No further evidence of feather picking was observed. Getting the right bird at the right time no doubt averted serious consequences in this case. However, on May 25, a different kind of outbreak occurred similar to Case 1, previously described, but of greater severity. About noon a bird had prolapsus of oviduct and was picked to death. This taste of flesh and blood set the flock on a rampage. Three hours later 3 other birds, with normal vents, were picked to death and 17 others of the flock of 38 hens had bleeding vents from being picked. Thus, more than half of the flock became victims of cannibalism because of one case of prolapsus of oviduct.

As a treatment, all the birds' beaks were tipped and pine tar applied to the picked vents. There was no further trouble.

Causes.—Because of lack of understanding we are inclined to think that cannibalism is caused by a faulty ration, such as a lack of fresh meat, salt, etc., but in most cases such are not the real causes. There are a variety of causes for outbreaks of cannibalism among layers. In the epidemics cited the cause was definitely accounted for—a single case of prolapsus of oviduct in each instance. The more familiar one can become with the real causes of cannibalism the more effectively he can prevent or control it. But the prime essential is to keep in close touch with the flock and always to be on the lookout for such outbreaks so as to stop them at the very beginning.

These observations offer an explanation of the many cases of "pick outs" or "blow outs" frequently reported. In outbreaks such as described, unless the poultry keeper happens to see just what is taking place at a certain time, he will have difficulty in accounting for the trouble. The logical conclusion at a later time may be that there had been a considerable number of cases of prolapsus of oviduct, each the cause of a pickout; whereas there may have been but one case of prolapsus and the other pickouts were normal birds attacked as a result of cannibalism. Furthermore, the caretaker would not be likely to handle all the birds; so he would not become aware of the number that had been attacked. In that case he would have very little idea of what had happened or how it took place.

Prevention and control.—In the first place the causes such as overcrowding, too close confinement, faulty ration, failure to remove promptly birds suffering from prolapsus or sick, crippled, or dead birds, and faulty management, etc., should be determined and corrected as far as possible.

Many poultry keepers experience their worst difficulty with pickouts during the first month after pullets are transferred from the open range to confinement in the laying house. This is to be expected as a result of the sudden change from liberty to confinement and idleness in strange quarters. Until the pullets become accustomed and adapted to their new environment feather picking and vent picking should be anticipated and prevented by tipping the beaks of all the pullets when they are placed in the laying house. This treatment will prevent the birds from picking feathers or flesh for two or three weeks, during which time they will usually become reconciled to their environment so that no trouble from vices will take place. Also if the laying house is kept slightly darkened during the first three weeks the pullets will be less nervous and not so easily frightened. They should also have succulent green feed or chopped legume hay always before them in suitable feeders as a preventive of vices and as a substitute for the roughage they have been accustomed to on the range. It may also be well to give the pullets a dose of epsom salts when put in the laying house and again ten days later.

Spring is often attended with serious epidemics of prolapsus and pickouts, particularly in case of the pullets which have been under the strain of heavy production during the winter months. In such cases it is well to make sure that the ration is not constipating. This condition may be overcome by a liberal feeding of green feed or milk, or by the use of epsom salts. Upon the outbreak of prolapsus and pickouts some poultrymen make it a practice to give the flock epsom salts; they claim prompt relief follows.

After heavy winter production a rest for pullets of 6 or 8 weeks during March and April when eggs are low priced, will control spring epidemics of chicken vices. Following the rest the pullets will be in condition to lay more summer and fall eggs which command better prices. Little or no difference should result in the total production for the year and, at the same time, the spring loss of birds from oviduct disorders, pickouts, and other vices which may otherwise take place may be avoided.

Pullets can be thrown out of production by sudden changes of feed and management. If the pullets have been accustomed to

light or moist mash or milk, any one, or all, of these may be suddenly discontinued. If the birds have been confined, turning them out on range will often have much the same effect; or moving them to another laying house will prove effective. Also if the pullets are accustomed to grain and mash omit one or the other for two weeks. In case of all-mash the meat scraps and milk may be omitted for two or three weeks. The first effect will be lessened production, and a light molt of short duration may follow. The pullets will generally come into production within two to four weeks after the usual methods of feeding and management are resumed. The rest will afford a chance to build up their body weight and to improve generally their physical condition for summer and fall production. The reduction of egg production, the extent of molt, and its duration will vary greatly, according to the condition of the birds and the nature of treatment to which they are subjected.

TIPPING THE BEAKS

D. C. KENNARD

Removal of the tip of the upper beak often becomes necessary as a control and defensive measure to save the flock. The tip of the beak is removed to the quick, leaving it tender and in such shape that it is impossible for a bird to grasp firmly either feathers or flesh; the bird is rendered harmless for about three weeks. During this time the birds usually forget their past vices and no further trouble results. In some cases where the vice has become chronic subsequent treatments may be required. Tipping the beaks need not hinder the birds from eating mash, nor affect egg production any more than handling for any other purpose.

Another effective use of tipping the beaks is to prevent male birds from fighting; this often becomes a serious matter when it is necessary to put strange male birds together. Many a valuable breeder has been killed or permanently injured in this way. Removal of the point of the upper beak will prevent their fighting for two or three weeks, and in the meantime they become acquainted so that there is little danger of fighting. Should certain birds become troublesome later, the treatment of such individuals should be repeated.

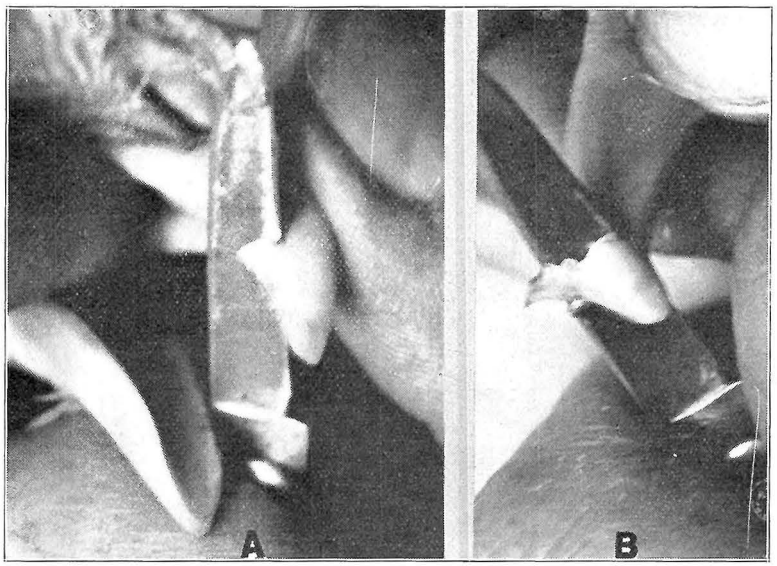


Fig. 5.—A—Showing the first cut at side of beak
B—After a slight prying and pulling against flat side of knife blade the tip of beak is removed

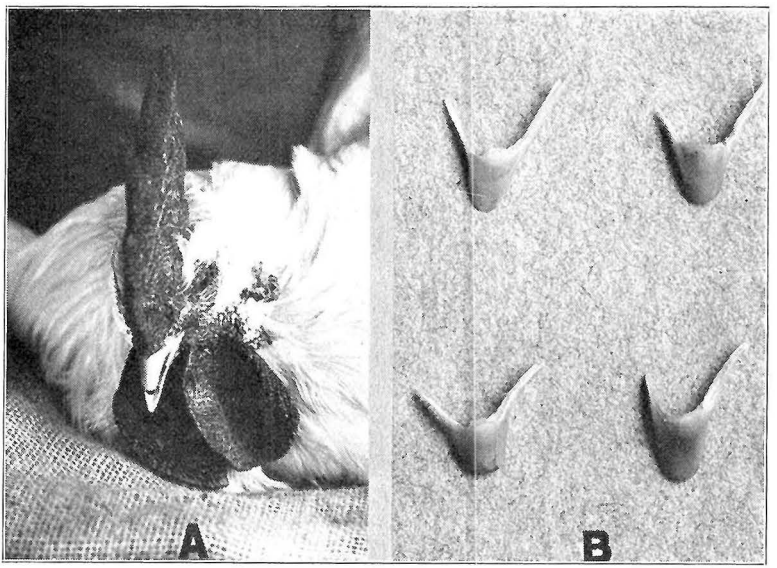


Fig. 6.—A—Cockerel after removal of tip of upper beak
B—Tips of upper beaks after removal

Method of tipping beaks.—Like most procedures there is a right and a wrong way. The edge of the upper beak is cut in about ⅛ inch and ⅛ to 3/16 inch from the tip, depending on size of beak and length of tip. Then by prying slightly and pulling against the flat side of the knife, the point of beak is removed by tearing and not by cutting. The small cut serves only to get a hold and start the tearing. By tearing the beak it can be removed much closer to the "quick" without bleeding and it is much easier and more effective than paring, even with a razor-edged knife. After the tip is torn loose, it should be pulled down toward the lower beak to remove the other edge of beak opposite where the starting cut was made, Figure 5. This gives the removed tip a V shape and prevents a bird from getting a firm grasp of feathers or flesh, Figure 6. After a little practice beaks can be removed at the rate of 200 to 225 an hour when one has a helper to handle the birds.

USE OF WOVEN WIRE IN POULTRY KEEPING

Woven wire has a variety of uses in modern poultry keeping. The poultryman of today finds less need for poultry fencing, but his requirements for woven wire for other purposes are rapidly increasing. The use of wire involves considerable expense and whether satisfactory results will be secured or not will largely depend upon whether the kind of wire is particularly suited to serve best the purpose desired. For several years the Station has been testing different kinds of wire for various purposes so as to be in position to give poultry keepers first hand information on these points.

SPECIAL WIRES FOR SPECIAL PURPOSES

1. Screening brooder house floors:
   ½-inch square mesh hardware cloth during first 3 or 4 weeks.
   ¾-inch square mesh hardware cloth, No. 15 or 16 gauge wire, preferable for started chicks 3 or 4 weeks old.
2. Flooring sun parlors for chicks or hens, or screening floors of laying houses:
   ¾-inch square mesh hardware cloth, No. 15 or 16 gauge wire, 24 or 48 inches wide.
3. Screened frames for feeding and drinking equipment:
   ½- or ¾-inch square mesh hardware cloth.

4. Bottoms of nests:
   No. 6 mesh hardware cloth.
5. Screening window openings, partitions, and sun parlors:
   1-inch diamond or hex mesh poultry netting, galvanized after weaving.
6. Screening over droppings boards under roots or flooring range shelters:
   1½-inch diamond or hex mesh netting, No. 16 gauge wire.
7. Wire guards for water and mash troughs or for fronts of sun parlors where feed and water are placed outside:
   Hens—3- by 6-inch mesh plain top lawn fence, No. 9 gauge wire.
   Young stock—2- by 4-inch mesh plain top lawn fence, No. 11 gauge wire.

If these materials cannot be secured locally, write the Station for further information.

PLAN FOR SCREENING A 10- BY 12-FOOT COLONY BROODER HOUSE

Note: The plan can be elaborated and adapted for laying houses in which case the frames may be made 4 feet wide and 8 by 12 feet long, depending upon the size of pen.

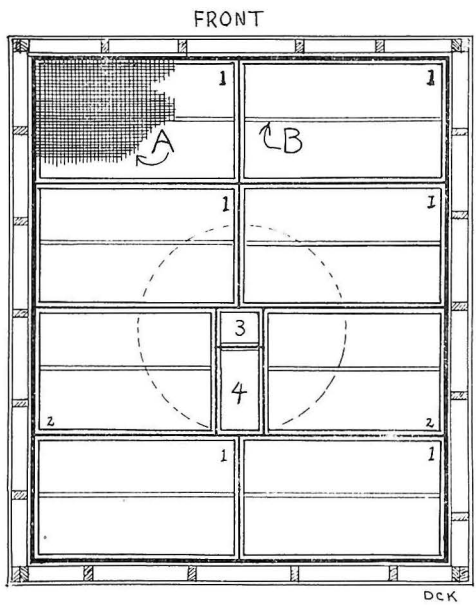


Fig. 7

1. Floor frames about 3′ x 5′ with center support (B) to prevent wire from sagging. (A) is ½-inch mesh hardware cloth for chicks under 4 weeks of age or ¾-inch mesh for older chicks or hens.
2. Frames about 3′ x 4½′.
3. Frame about 1′ x 1′ for supporting stove, the exact size depending on the dimensions of the base of stove. Since the stove sits on this it need not be screened.
4. Frame about 1′ x 2′ to fill in the space just back of the stove. All frames made of 1″ x 6″ boards placed edgewise and covered with ½-inch square mesh hardware cloth. The center supports may be made of 1″ x 4″ pieces if desired.
5. The top inside edges of the frames are beveled and the frames spaced ⅜ to ½ inch apart, as indicated by heavy line which surrounds each frame, so as to reduce area for lodgment of droppings. Likewise both corners of the top edges of the center supports are beveled to ⅜ to ½ inch in width for the same reason.

SUN PARLORS FOR CHICKS

Since chicks can be raised successfully in confinement, this method is being resorted to by an increasing number of poultry raisers each year, in order to avoid the possible hazards of contaminated yards or ranges. When chicks are confined, the wire-screen sun parlor makes a valuable adjunct to brooder or laying house, as substitute for the range.

The wire-screen sun parlor, as designed by the Ohio Experiment Station, may be made 6 by 12, or 8 by 10 feet, for a 10 by 12, or 12 by 12 foot brooder house which will accommodate 200 to 250 chicks to be brooded in confinement. The sun parlor may be made of panels held together with hooks and eyes so as to be taken down easily when desired, or a permanent set-up can be made. In the latter case, the floor of sun parlor may be made in one section. The frame work is made of 1 by 4's set edgewise, spaced 2 feet apart and covered with three-quarter inch square mesh, No. 15 or 16 gauge wire hardware cloth, 2 or 4 feet wide. Three-quarter-inch mesh wire serves equally well for chicks or hens; whereas the half-inch mesh is not suitable for either. The frame work of sides and top is made of 1 by 3's and covered with 1-inch mesh netting, to exclude sparrows, or with fly screen if flies are to be excluded to prevent tape worms, Figure 8. The width of side panels or the height of top above floor section is about 24 inches, so that netting or fly screen 18 inches wide can be used.

It is well to have a hinged top panel 2 feet wide in front of sun parlor, so that this front section of top can be opened when desired. A half, or more, of the sun parlor should be covered with single thickness burlap during warm weather, for protection of birds against excessive heat. The birds may be given feed and water in the sun parlor or the sides of sun parlor can be slatted with plaster lath or wire so that they can reach thru to the feed and water on the outside. A slanted board 10 or 12 inches wide will protect the mash from rain. The sun parlor should be inclosed around the bottom to exclude other chickens or animals. It may be placed close to the ground or elevated 12 inches, so as to remove droppings with a scraper. The ground beneath the sun parlor may be covered with straw, sand, gravel, cinders, or slag, which obviate the need of,

and in some respects are preferable to, wood or cement floors to catch the droppings. Sun parlors with wire-screen floors are usually preferable to cement, since the screen is self-cleaning; whereas cement requires daily scrubbing and disinfection, which are seldom practicable.

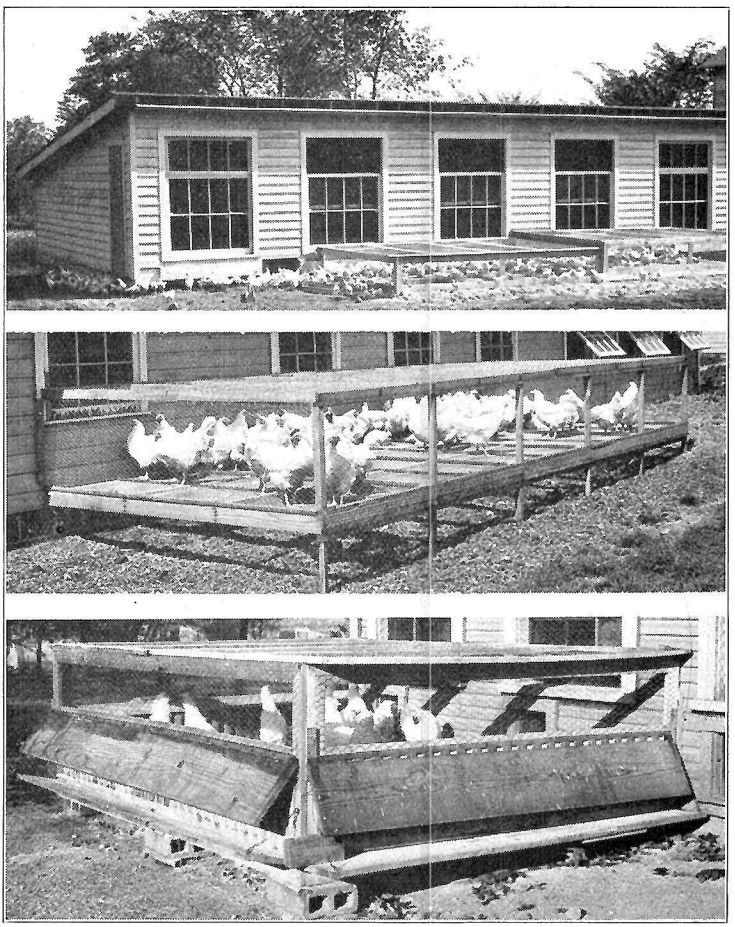


Fig. 8.—Top.—A test in progress at the Station with chicks on range, (left), and in screen sun parlor (right).

Middle.—A wire-screen sun parlor for layers. All birds are driven out into the sun parlor and kept there for one-half hour daily at noon in winter, and at 4:00 p. m. in summer. This insures the same benefit to all.

Bottom.—The lower half of side and end frames are slatted with lath thru which the birds can reach feed and water outside. The slanted boards which protect the mash feeders from rain are hinged at top so as to turn up when mash is put in troughs.