

AGRICULTURAL EXPERIMENT STATION

KANSAS STATE COLLEGE OF AGRICULTURE
AND APPLIED SCIENCE

MANHATTAN, KANSAS

DEPARTMENT OF POULTRY HUSBANDRY



CULLING POULTRY¹

LOYAL F. PAYNE

The purpose of this publication, first issued in 1922 as Circular 93 and revised in 1929 as Circular 147, is to present a simple procedure for culling laying flocks. While culling can be applied to most poultry flocks throughout the year, it is of special importance to cull systematically during the summer and fall months. The object in summer culling is to remove the non-layers from the flock and dispose of them as market birds; while in early fall culling the purpose is to select the most desirable birds in the flock for breeding stock as judged by high past-production, vigor, uniformity in size, type, and color.

A poultry improvement program has been in operation in Kansas since 1922. Poultry-selecting agents receive training in flock-selec-

1. Contribution No. 158 from the Department of Poultry Husbandry.

tion and blood-testing for pullorum disease (Bacillary white diarrhea) at Kansas State College usually the first week in September each year. Figure 1 shows a portion of those who attended the school in 1942.

The annual selection of superior birds for reproducing the flock has, together with improvements in feeding and management, lead to a marked increase in egg production. For example, the average

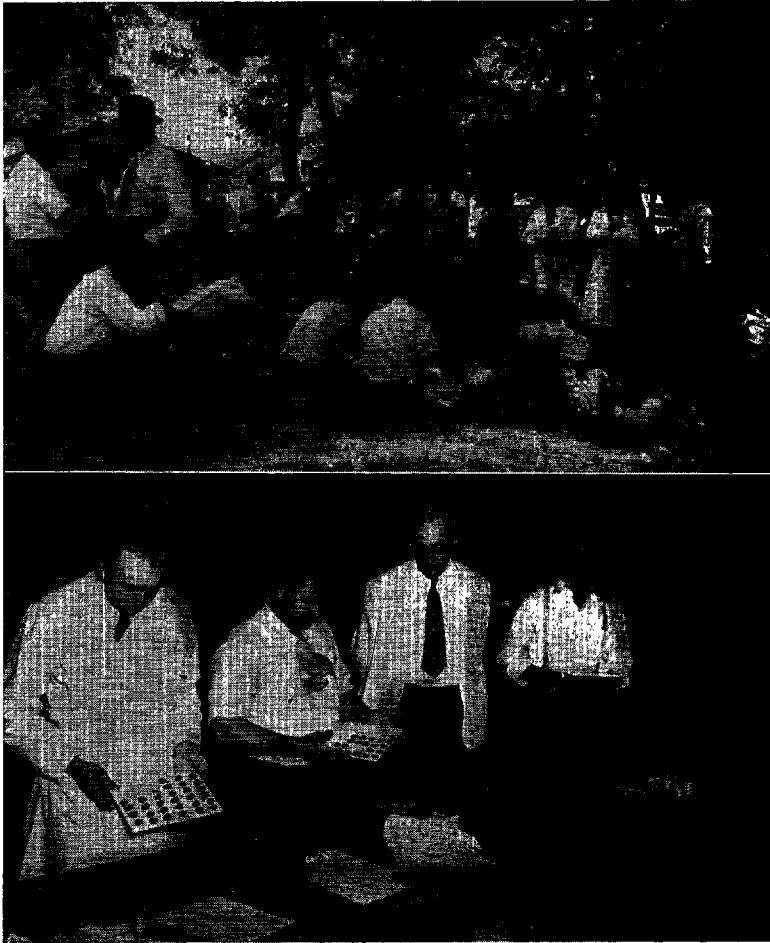


FIG. 1.—Instruction in flock selection at the college poultry farm. (Above) Selecting agents were also taught to blood-test breeding stock to detect birds infected with pullorum disease. (Below) Each spot on the white plate represents a sample of blood from a different bird. If the spot becomes cloudy or coagulates when antigen is added, the bird from which the sample came is a reactor and should be removed from the breeding flock. This instruction was given by the Department of Bacteriology.

production for the Kansas demonstration farm-record flocks in 1922-'23 was 124 eggs per hen, while in 1941-'42 the average had increased to 166 eggs per hen. This is an increase in 20 years of 42 eggs per bird.

Other results of flock-selection work covering all sections of Kansas are given in Table 1. This is a compilation which includes five leading varieties for more than 1,700 flocks handled by selecting agents in 1942-'43.²

TABLE 1.—The number of flocks and birds handled, the number and percentage rejected as culls, and the number and percentage which reacted to the blood test for pullorum disease.

VARIETY.	Number.		Rejected as culls.		Reactors.	
	Flocks.	Birds.	Number.	Percent.	Number.	Percent.
White Ply. Rocks	617	152,204	27,494	18.1	4,106	3.3
White Leghorns	613	196,708	28,108	14.3	3,018	1.8
New Hampshires	174	89,630	6,577	16.6	1,696	5.1
Rhode I. Reds	159	44,466	7,133	16.0	1,196	3.2
White Wyandottes	143	38,321	7,090	18.5	1,727	5.5
Totals	1,706	471,229	76,402	16.2	11,743	*3.0

* Calculated from 394,527 birds tested.

The White Leghorns showed the smallest percentage of rejects or culls and the lowest percentage of reactors. The White Wyandottes showed the highest percentage of culls and reactors, with New Hampshires a close second for reactors. The average of 3.0 reactors for all flocks is small considering the number of birds involved. A fairly large percentage of flocks showed no reactors.

The high producers, when selected in September or later are usually identified by an absence of yellow pigment (in pigmented varieties) in all sections, absence of a molt, and other indications of good capacity and high quality, as discussed later in this publication.

TRAPNESTING AND CULLING

The trapnest has made it possible to study the record of individual hens and to compare their records with certain characteristics. The results have shown that low, medium, and high producers may be recognized by certain of these characteristics at some seasons of the year and sorted with a fair degree of accuracy. This sorting is referred to as culling. It should not be understood that culling is as accurate as trapnesting. A daily record of each hen is the only accurate means of determining individual egg production. But the equipment, inconvenience, and labor involved in trapnesting makes it an impractical method for the average farm flock. The trapnest is indispensable for all who pedigree their stock, or desire individual records.

2. Figures supplied by courtesy of Kansas Poultry Improvement Association, Manhattan, Kansas.

CULLING DEFINED

Culling³ in the broad sense, as practiced by poultrymen, refers to the sorting of the desirable and undesirable hatching eggs, chicks, pullets, cockerels, hens, or breeding males. The greatest emphasis, however, has been placed on the sorting of hens, not only to eliminate the nonlayers but also to determine the laying period of the remainder. No pretense of forecasting future production is made except in so far as it is correlated with past production. If a hen has been a good producer, it usually follows that she will be a good producer in the future if she maintains good health and is properly cared for. And *vice versa*, a poor hen is likely to continue so unless her poor record has been due to poor housing or poor feeding and these items of mismanagement are corrected.

PREREQUISITES FOR SUCCESSFUL CULLING

A general knowledge of culling that will enable one to select the nonproducing hen is readily obtained, but to become capable of intelligently judging the length of time a hen has been laying, the rate of her production, her vacation periods, etc., requires more study and considerable practice. The first requisite of successful culling is a normal flock, *i.e.*, one that has escaped serious disease epidemics, is physically "fit" and has received reasonably good care, as to feeding, housing, and general management. The age of both hens and pullets should also be considered.

THE KIND OF POULTRY TO CULL

Culling should start with the eggs and never cease as long as chickens inhabit the farm. The crippled, wobbly, or weak chick should be destroyed soon after hatching. Scrawny, unpromising individuals should be eaten or sold and only the fittest allowed to survive.

The demand for information on culling pullets is rapidly increasing, and poultrymen, farmers, and investigators are giving the subject more study and attention. It is obvious that it would be more profitable to eliminate the cull early in life. Birds of low vigor which are crow-headed, or have long rangy bodies, as well as slow-maturing, off-type individuals, should be culled before the pullets begin to lay. Culling and selecting the breeding males is equally important, and will be treated later.

Culling domestic poultry other than chickens has been given little attention, but there seems to be no good reason why ducks, geese, turkeys, and guineas may not be culled for present production, though perhaps less accurately, by much the same method employed in culling chickens.

3. A glossary of terms and a culling chart will be found on pages 80 and 81 of this circular.

WHEN TO CULL

Systematic culling, that is the handling and examining of every bird in the flock, should start about the middle of July and continue periodically about once a month until the middle of October. Generally speaking, systematic culling is not practical at other seasons of the year.

The principal object in summer culling (July and August) is to eliminate the low-producing hens, while the object in September and October culling is to observe and select the best individuals to reserve as future breeders. Health, vigor, size, trueness to standard type and color, as well as heavy egg production, are points to consider in late fall culling. Some hens are able to stand the strain of high egg production and maintain good physical condition, while others "lay themselves out." The latter are of no use in the breeding pen and should be disposed of after finishing their laying season.

HOW TO CULL

The first thing the culler wants to know when examining a hen in July or August is whether or not she is laying. Hens which are laying at this season of the year are usually kept as the price of eggs makes them profitable. If, upon later examination, they are found to be medium producers only, they can then be disposed of. The flock should be confined in the poultry house the day they are to be



FIG. 2.—Selecting and blood-testing a breeding flock. Note the birds are driven from the house into coops. They are then examined individually by a selecting agent. A numbered band is sealed on the leg of hens that qualify. The tails of birds which do not meet the standard specified are clipped and the birds are sent to market. The banded birds are next blood-tested for pullorum disease. The reactors are immediately removed from the flock.

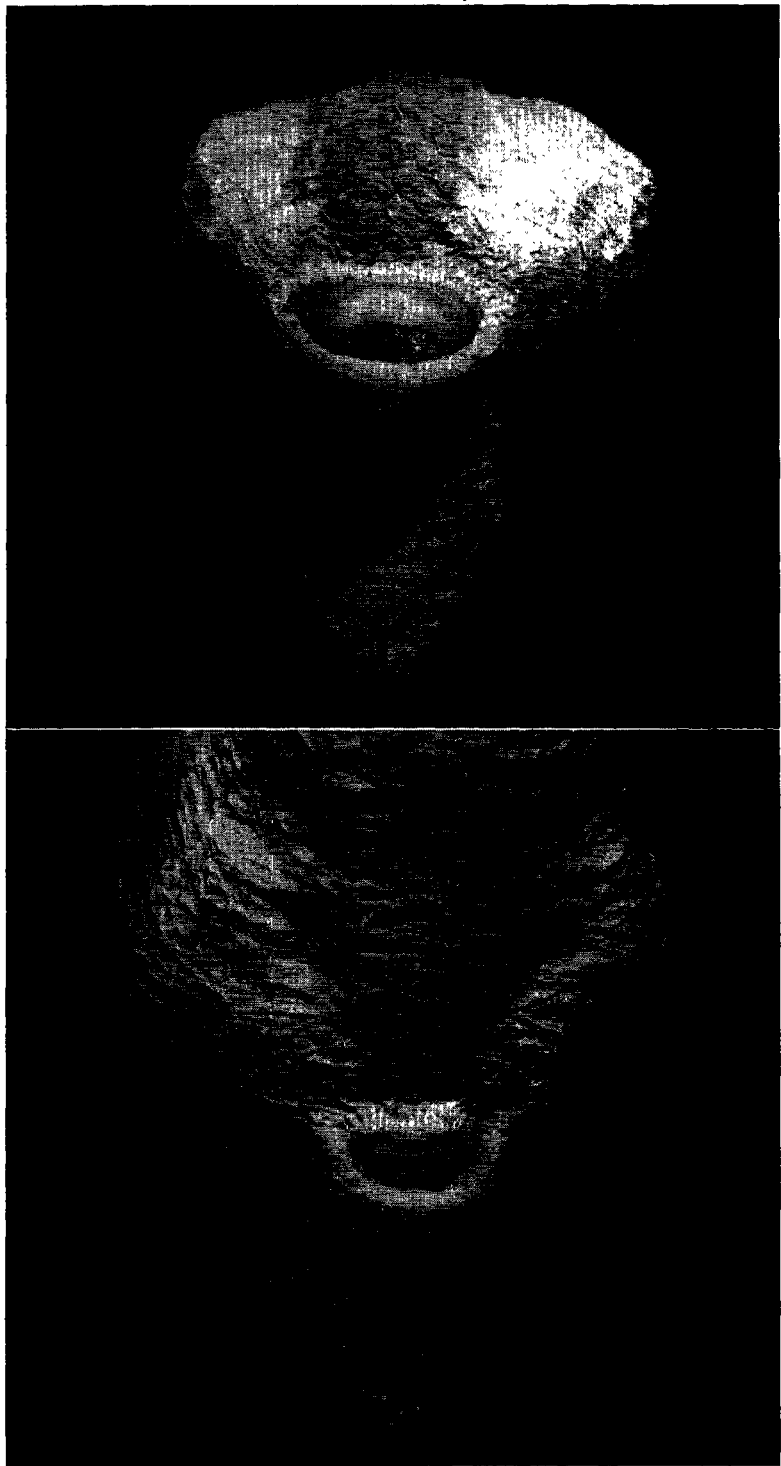


FIG. 3.—The vent and abdomen of a laying hen (above) and of a nonlaying hen (below).

culled, or in the event there is no house available, they should be taken from the roosts and cooped the night before. Figure 2 shows a crew of four men selecting and blood-testing breeders for the approaching hatching season. It is necessary to handle every bird and consider all of the characters to be discussed, before passing judgment. The culler should be able to determine three things: Present production, persistence of production, and rate of production. A detailed discussion of each follows:

JUDGING PRESENT PRODUCTION

Present production may be determined by examining the vent, pubic bones, comb, wattles, and earlobes.

Vent.—The vent of a laying hen is large, moist, and dilated, and tends to become oblong in shape. The lower edge appears flat and extends almost straight across, and the upper edge blends evenly into the surrounding tissue which has a smooth, loose, pliable appearance. (Fig. 3, above.) Contrasted with this is the small, contracted, dry

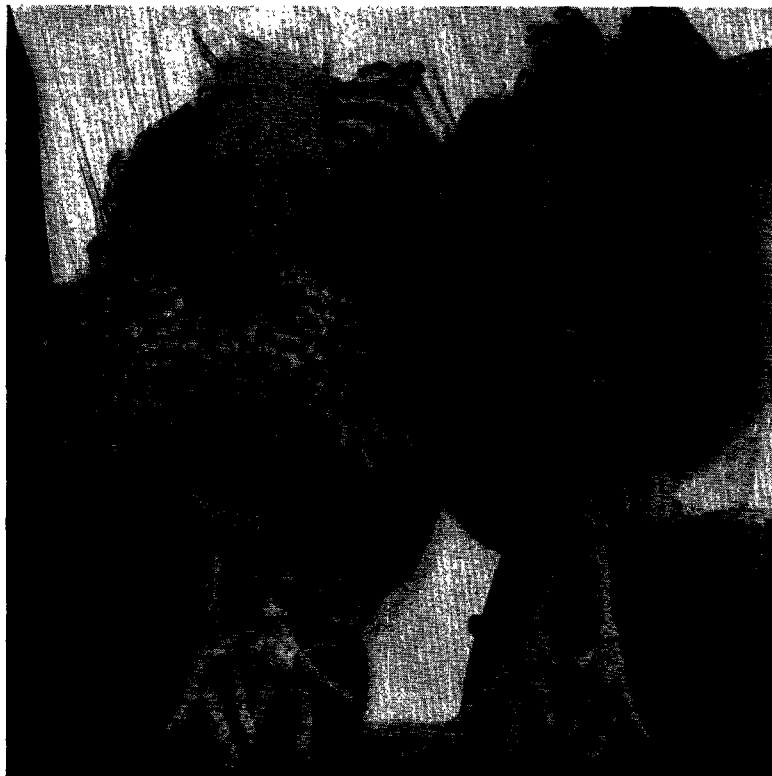


FIG. 4.—Illustration showing the width between the pubic bones of a laying hen (left) and of a nonlaying hen (right).

vent of the cull or nonlaying hen. The corners are drawn in giving the vent a round appearance with thick, prominent edges. The region around the vent is puckered, rough, and hard. (Fig. 3.)

Pubic Bones.—The pubic bones of a laying hen are wide apart, usually the width of two or more fingers, compared with the close-fitting bones of the nonproducer which are no farther apart than the width of one or two fingers. This measurement is illustrated in Figure 4.

Comb, Wattles, and Earlobes.—An increased circulation of blood in the comb, wattles, and earlobes accompanies the development and functioning of the egg organs. They assume the large, full, glossy appearance characteristic of the laying hen. These characteristics are most noticeable when the pullet comes into the height of her production. As the laying season advances the appendages of the head lose their gloss and prominence. Near the close of the production period, though still retaining their red color, they appear limp or wilted and reduced in size.

The comb of a hen that has quit laying is small, contracted, dry, and usually covered with a white scale or dandruff. It is cool to the touch indicating only a slight circulation and a dormant condition of the egg organs. The wattles and earlobes react in a similar manner, but being less prominent they are not so noticeable. The comb is one of the best external characters to indicate nonproduction in hens as they are observed in the pen or yard. (Fig. 17, B.)

PERSISTENCE IN LAYING

As the culling season progresses, not only the culls should be separated from the layers, but the layers should be graded and classified as well. In early September the low producers that were passed in July and August because they were laying a few eggs should be eliminated. The early spring pullets are coming into production by this time and a part of the houses that have been occupied by the hens are needed for their accommodation.

Color.—Persistence in laying is determined largely by color and molting. The yellow pigment or color (xanthophyll) observed in the skin, beak, and shank of a pullet or hen is the same as that which causes the yellow color found in the yolk of the egg. When a hen is not laying, this color is stored up in the body tissue and is readily seen in the vent, eyelids, earlobes (if white) beak, and shank. But when laying begins, all the pigment of the feed is required for the eggs and hence its course is diverted from the exterior body tissue to the fat globules of the egg yolk. If this visible pigment is not continually renewed the parts fade, leaving them white, or as commonly expressed, bleached.

The disappearance of yellow pigment from the shanks of laying hens was reported in the *Cultivator and Country Gentleman* as early as 1879. However, experimental data showing a correlation between yellow pigment and egg production did not appear until about 1914.

When a yellow-skinned pullet begins to lay, the color first fades from the vent, disappearing in a few days. The edges of the eyelids bleach a little slower than the vent. The earlobes, of white-lobed varieties, are next to lose their creamy color followed by the lower and upper mandibles of the beak. The color leaves the corners of the mouth or base of the beak first, gradually fading toward the tips, disappearing from the arch of the upper mandible last. (Fig. 5.) From 4 to 8 weeks' production or the laying of 25 to 50 eggs will usually eliminate all color from the beak. The shanks are the



FIG. 5.—The head of a high producer. The arch of the upper mandible is the last section of the beak to fade.

last to lose their color, fading first in front and retaining longest the color just below the feather line at the rear of the hock joint. Normally, 2 to 5 months' laying is necessary to bleach the shanks completely.

When a hen stops laying the yellow color reappears in each of the above regions in the same order in which it disappeared, that is, in the vent, eyelids, lobes (if white), beak, and shanks. It returns much faster than it disappeared.

Pigmentation observations should always be made in daylight, artificial light being unsatisfactory. The order of the most common breeds according to the rapidity with which the pigment fades is as

follows: Leghorns, Wyandottes, Plymouth Rocks, and Rhode Island Reds. The dependence to be put on the pigmentation test seems to be greater in the case of the Leghorn than with the heavier breeds. June, July, and August observations seem to be more reliable than April and May pigment studies.

Color changes are perhaps affected by more conditions than any other set of characteristics. For example, the feed, range, size, and age of birds, thickness of skin, management, vitality, and amount of color normally carried in different strains, influence fading and should be considered in culling. Many of the white varieties that have been bred for exhibition purposes show very little yellow pigment whether laying or not. The amount of pigment originally carried in a strain of hens can be determined in a measure after they have been laying sometime, by observing the relative amount of pigment carried in the shanks of related males, preferably brothers.

When culling white-skinned birds such as the Orpingtons, Sussex, and Dorkings, or the dark-shanked breeds such as the Langshans or Andalusians, no attention can be given to color changes. Birds of these breeds are judged by the molt and by other factors discussed below.

Molting.—Persistence of production is measured also by the condition of the plumage during the summer and fall. As long as the hen lays regularly she usually retains her old feathers, but, if for any reason other than sickness or broodiness she stops laying, the feathers begin to drop, she is then said to be molting. The order in which the feathers fall is first from the neck, then the back, wings, and body. The neck molt is rather common at any season of the year even in good layers, but if the molt progresses to the back, the primary feathers of the wing generally molt also. This stage is seldom reached unless the hens have entirely ceased laying. In other words, the cessation of laying is likely to bring on a general molt. Soon after the old feathers are dropped, new ones grow in to take their place. About 20 weeks are required for low producers to complete the molts.⁴ Flocks bred for high production, which are well cared for, may produce some eggs while molting. Birds which molt late have a shorter molting period than those which molt early; however, birds which molt slowly have a higher rate of egg production during the molting period than birds which molt more rapidly. Egg production is usually retarded more severely when the tail and wing feathers are molting. High producers may begin molting before they stop laying. With low producers it has been found that little, if any, molting occurred before egg production ceased. A molting condition can be determined easily by examining the base of the feather. The web appears new and glossy, the quill is large, full, soft, and the accessory plume is not visible. (Fig. 6.)

From the foregoing it is obvious that the later a hen molts in the fall the longer has been her laying season, and hence the greater her

4. Hendricks, Walter A. A biometric study of molt in White Leghorn hens. Poultry Sci. 12:287-291. 1933.

production is likely to be. This means, with the exception of high-producing flocks previously noted, that the early molting hens have taken vacation periods and are probably low producers. The new plumage of the early-molting hen is easily recognized by its clean, bright color, with every feather perfect in shape, while the plumage of the heavy-laying hen that has not molted is rough, soiled, dry,

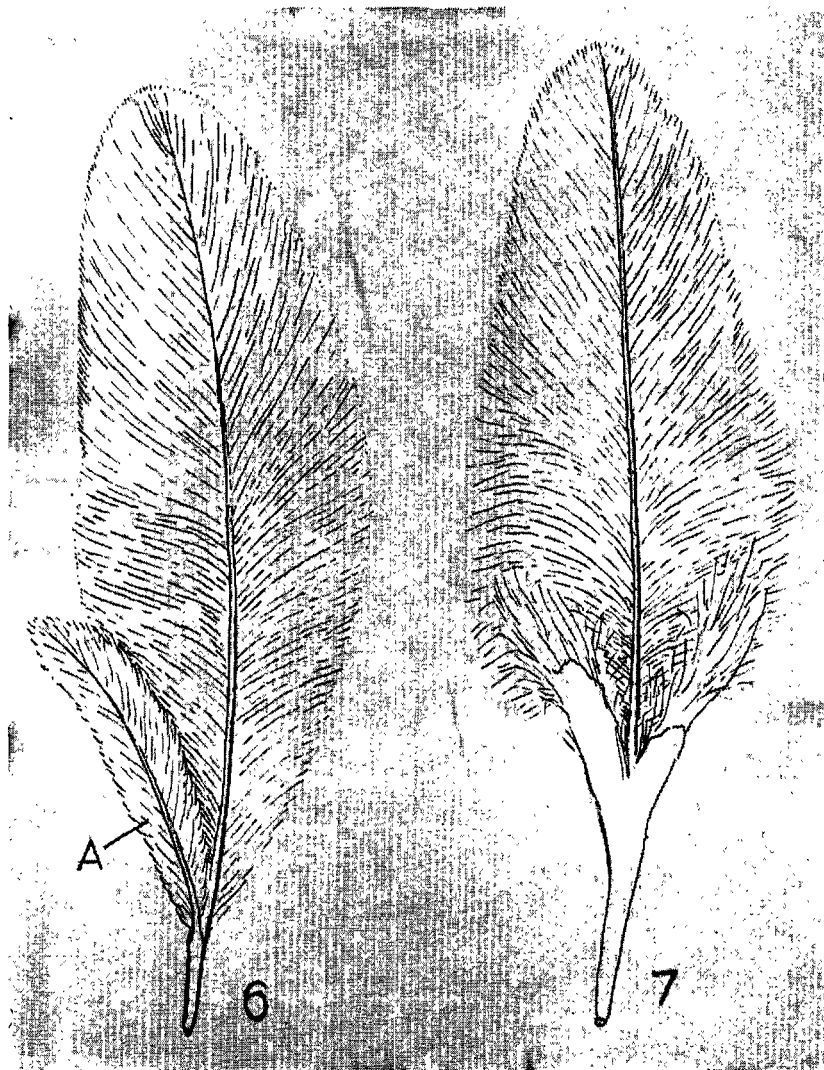


Fig. 6.—An old feather (6) with its accessory plume (A) and a new feather (7) as seen in a molting hen. Note the large quill and absence of accessory plume in the new feather.

and worn threadbare. The tail and wing feathers, as well as those about the back, head, and neck, are frequently ragged, worn, and broken. Many high producers develop bare backs and bald heads as a result of the brittle feathers being broken by the treading of males and entering and leaving nests. This is not serious. New feathers will cover these areas when the birds go through a complete molt.

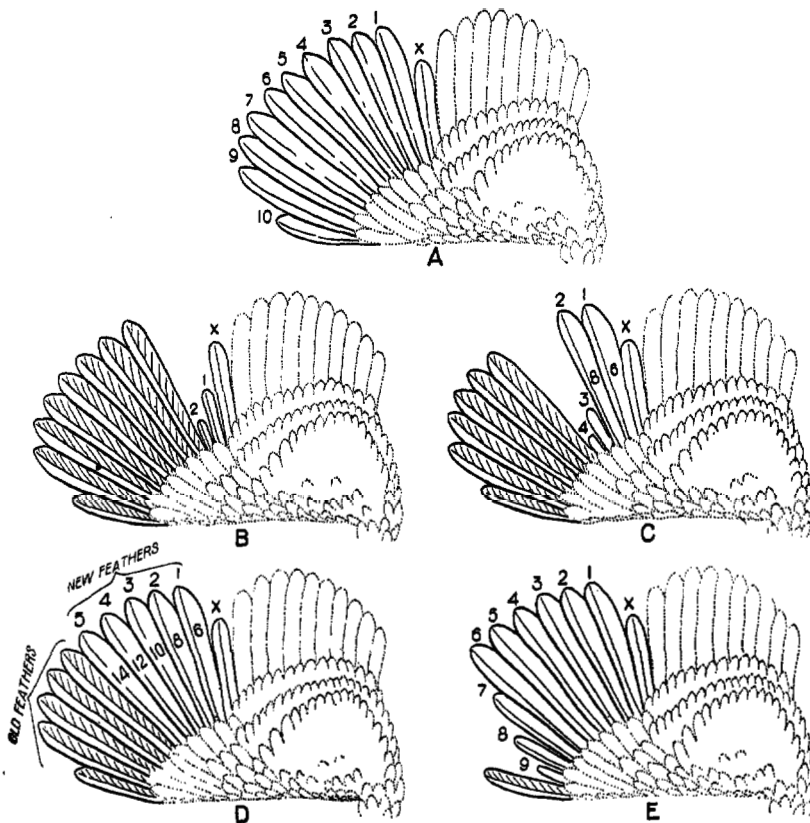


FIG. 7.—(A) A normal wing showing the primary feathers, Nos. 1 to 10. They are separated from the secondary feathers (in dotted outline) by a short axial feather, X. (B) The beginning of a wing molt. Nos. 1 and 2 are new feathers growing in. (C) An eight-week molt. Nos. 3 and 4 are not counted until fully grown. (D) An instance (abnormal) in which five feathers only were molted. (E) A wing completing a normal molt.

There was a time before the advent of culling that farmers sold their ragged and faded birds because of their unsightly appearance and kept the slick-coated, yellow-legged individuals because of their attractiveness. But that time is past and the practice now is reversed.

Wing Molt.—When a general molt, as opposed to a partial molt, starts, that fact is registered in the primaries of the wing and the length of time a hen has been molting can be calculated by the number and length of the new feathers in the primary. The primary feather next to the axial feather (Fig. 7, A-1) drops when the body molt starts and 6 weeks on the average is required for it to grow to full length. Feather 2 is dropped about 2 weeks later and so on with each subsequent feather until the 10 primaries have been renewed. In calculating the time elapsed since a molt started, 6 weeks should be allowed for the first full-grown feather and 2 weeks more for



FIG. 8.—A molting wing showing four new feathers starting next to the axial feather, ranging in age from a few days to about three weeks.



Courtesy of Connecticut Agricultural College Extension Service.

FIG. 9.—(A) wing with three mature feathers followed by five growing out at the same time. The first three were shed during an early broody period. (B) A wing with five new feathers showing four weeks' growth, counted as one feather. After the feathers reach maturity it is difficult to tell whether they grew out together or singly, except by the hardness of quill and general conditions of body molt.

each additional mature new feather. For example, D, in Figure 7, shows five mature new feathers which indicates that the molt had been in progress 14 weeks. Figure 8 shows the early stages of a wing molt as represented by four new wing feathers. This hen was a high producer and had been molting 3 weeks. Such a molt though faster than normal for a low-producing hen is not unusual for a high producer.

The new primary feathers make about two-thirds of their growth the first 3 weeks and one-third the last 3 weeks. That is, if the feathers when mature are 6 inches in length, they will grow about 4 inches the first 3 weeks and 2 inches the last 3 weeks. The application of this growth rate is made in determining the beginning of a molt before any of the new primaries attain full length. (Fig. 7, B.)

The new primary feathers when mature may be identified by their clear, bright appearance, with the web slightly wider and less pointed. The base of the shaft on the under side of the wing shows less of the clear horny quill than is seen in the old feathers. The molt is usually at the same stage in both wings. The above description holds very well for the early, slow-molting, poor-producing hen, but is not so reliable for the high-producing, late molters. The principal difference comes in the rapidity with which good hens molt. Instead of dropping the primary feathers separately, they frequently drop, two, three, four, or even five at a time. (Fig. 9.)

When two or more new feathers grow in together they are counted as one in calculating time. This works very well until the feathers reach full length when it is impossible to judge whether they have come in one at a time or all together. Such a wing with four new feathers might indicate 6, 8, or 12 weeks molt, that is, the feathers may have come in individually, in pairs, or all together. In such cases the length of new feathers over the body, hardness of quill, and the number and position of the additional new wing feathers may throw some light on the situation. Heavy producers frequently shed nearly all of their feathers at once. These grow in again quite rapidly, requiring usually 5 to 8 weeks to become full grown, after which time the hens are again ready to lay. Such quick molters do not always renew all of the primary feathers but retain some of them a second year. The low producers usually molt very slowly and require several months to renew their coat of feathers. It is frequently assumed that these early-molting culls, not having to grow feathers in the late fall, occupy their time producing winter eggs, but careful study and close observations have failed to prove this assumption.

RATE OF PRODUCTION

High rate or intensity of production and persistence in production are characteristic of the best layers. Hens may be laying and show no signs of molting but have a low rate of production, *i.e.*, 2 to 3 eggs per week. In order to make a good record a hen must produce at a high rate, *i.e.*, 5 or 6 eggs weekly, as well as for a long period. (Figs. 10 and 11.)

It is from the high-rate producers that breeders should be selected. Fortunately, persistent layers usually have a high rate of production



FIG. 10.—The egg organs of two hens showing high (2969) and low (3158) rate of production as indicated by the size and number of yolks in each ovary.

as well. The intensity or rate of production is judged largely by the body capacity, condition of the abdomen, and quality of the skin.

It has been stated by one authority that the ovary and oviduct of a hen in full production is about 20 times as large as the same organs of a nonproductive hen. (Fig. 12.) Accompanying this difference is an increased appetite and an enlargement of the digestive organs. These changes require more space in the body cavity, which is provided in part by a lowering of the floor or keel. The lateral or sternal processes are also forced downward and outward. Capacity to produce eggs is shown by the depth or distance from the front of

CULLING POULTRY

KANSAS AGRICULTURAL EXPERIMENT STATION
POULTRY DEPARTMENT

LAYING YEAR 2 **INDIVIDUAL EGG RECORD** YEARS 1920 TO 1921
 MATING NO. LEG BAND NO. 2485
 HOUSE NO. 12 WING BAND NO. BREED Salaced Andal.

HATCHING DATE April 1919 BEGAN LAYING 19 AGE AT FIRST LAYING 182 DAYS

DATE	1919																															TOTALS	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	MONTH	TO DATE
Jan	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	13	13	
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Oct	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
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PREVIOUS RECORDS 1ST 152 2ND 3RD 4TH REMARKS YEAR'S RECORD

5TH 6TH 7TH 8TH Killed Sept. 10, 1921

MATED TO

KANSAS AGRICULTURAL EXPERIMENT STATION
POULTRY DEPARTMENT

LAYING YEAR 1 **INDIVIDUAL EGG RECORD** YEARS 1920 TO 1921
 MATING NO. LFG BAND NO. 3158
 HOUSE NO. 10 WING BAND NO. BREED Barred Rock

HATCHING DATE Feb 17 1920 BEGAN LAYING 19 AGE AT FIRST LAYING 249 DAYS

DATE	1920																															TOTALS	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	MONTH	TO DATE
Jan	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	15	15	
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Nov	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
Dec	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
Jan	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			

PREVIOUS RECORDS 1ST 2ND 3RD 4TH REMARKS YEAR'S RECORD

5TH 6TH 7TH 8TH Killed Sept 10, 1921

MATED TO

FIG. 11.—Individual egg records illustrating high and low intensity or rate of production as indicated by the number of eggs laid without skipping a day as well as by the monthly production. The egg organs of 3158 are shown in Figure 10. The organs of 2485 were not in condition to photograph when she was killed.



FIG. 12.—Egg organs of a heavy producer (2969); a cull hen (3450) that had stopped laying 3 weeks; a broody hen (4154); and a hen (3252) that was once a good producer but had not laid for 3 months.



FIG. 13.—Capacity of abdomen of a cull (A) and a good layer (B).



FIG. 14.—Illustrations showing method of determining relation of keel to back. In the high producer (A) the finger tips of the lower hand point downward. In the nonproducer (B) the finger tips of the lower hand point toward the tail. The first year's production records of these hens are: (A), 187 eggs; (B), 97 eggs.

the keel to the center of the back, the space between the end of the keel and the pubic bones, the width and length of the back, and by the width and length of the keel. These dimensions are more or less fixed in the adult bird except that the end of the keel moves up or down. The downward tendency is somewhat regulated by the demand for more internal space which usually indicates a greater intensity in laying. A depth of 4 to 5 fingers from the end of the keel to the pubic bones is associated with good rate of production, while a depth of 2 or 3 fingers indicates fair to poor production. (Fig. 13.)



FIG. 15.—Skeletons of the cull (left) and the high producer (right) shown in Figure 14. When judging body type of *good* hens that are *not* laying, emphasis is placed on the size of the triangle, E-F-G. The triangle emphasized in judging hens in *full* production, is A-B-C. When a hen stops laying, the point C moves toward B so that the distance B-C varies with egg production, while the points E and F remain the same whether the hen is laying or not; hence the value of the points E and F in judging type. H shows the lateral processes.

The position of the keel relative to the back can be determined by facing the bird and running one hand down the top line and the other along the bottom line as in Figure 14. The finger tips usually point downward in laying hens of high intensity. This test is applicable to laying hens only. Other measurements must be resorted to when judging hens that are not in a laying condition.



FIG. 16.—Illustrations showing relation of condition of abdomen to egg production. (A) Abdominal capacity of cull, 1; high-rate producer, 2; and low-rate producer, 3. (B) Relative thickness of fat of high-rate producer, 1; and low-rate producer, 2. These birds correspond to Nos. 2 and 3, respectively, in (A).

The relative position of the bones so important when judging for egg production is illustrated in Figure 15. The capacity of the abdomen is shown by B-C, and the depth of the body by E-F. As these dimensions increase the capacity for egg production increases.

Abdomen.—The abdomen of a high-rate hen is not only full and expanded, but is also soft and pliable. Capacity alone seems to mean little. A hen with a hard, rubbery, unyielding abdomen, caused by the accumulation of thick layers of fat should not be mistaken for a good layer even though the abdomen measurement indicates good capacity. (Fig. 16.) This does not mean that a fat hen cannot be a good producer, but that usually she is not unless the fat is soft and pliable. The size of abdomen is not the same for all breeds or individuals within a breed but is influenced by the size of the hen and the length of the keel. Short-keeled birds have an advantage in measured abdominal capacity over birds with long keels unless due allowance is made for the length of the keel. In general the long-keeled birds are preferred.

The examination of 354 Leghorns, Reds, and Plymouth Rocks at the Kansas Agricultural Experiment Station showed no correlation

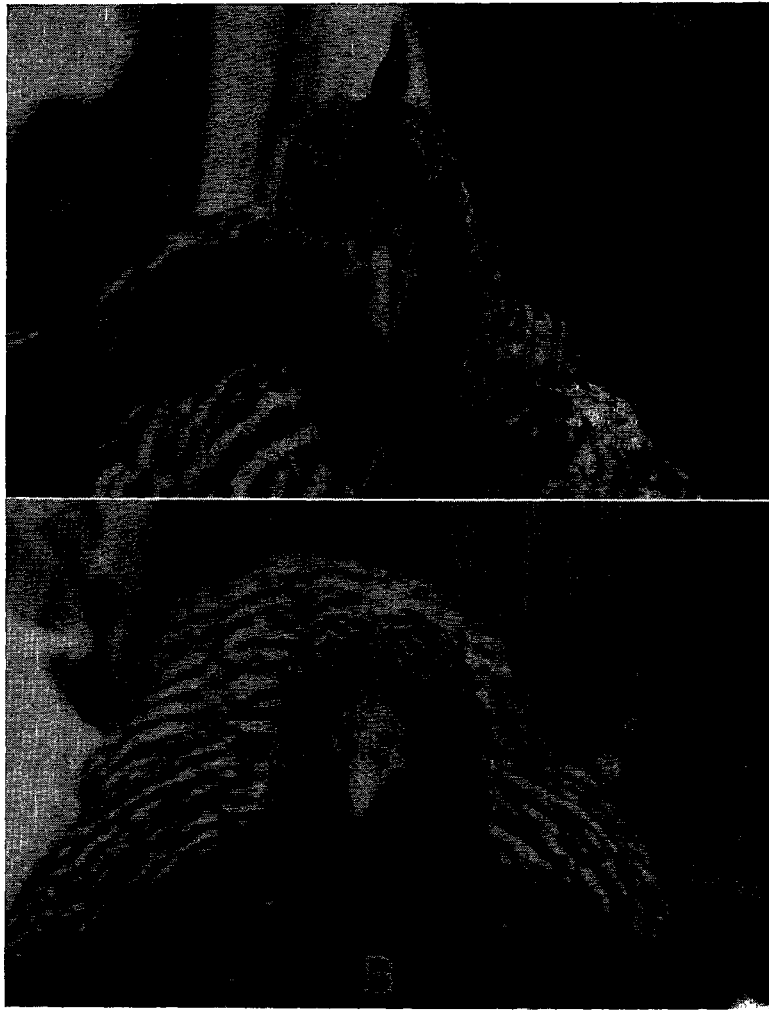


FIG. 17.—Head of high producer (A) and of low producer (B). Note the prominent bright eyes, large comb, and lean, clean-cut face in (A) and the dull eyes, small comb, and full face in (B).

between keels with downward pointed tips as (C) in high producer (Fig. 15) and date of hatch, age at first egg, intensity of winter production, or size of egg laid.

The length of the keel can be determined by placing the hand along the keel as in Figure 14; also by noting whether the hand, when placed on the abdomen as in Figure 13 extends straight down, as will be the case with a long keel, or slopes forward to touch the end of a short keel.

The pubic bones are usually thin and pliable in high-producing hens and covered with thick, hard fat in those of low production.

Quality.—Hens of high intensity possess quality as shown by a soft, thin, silky skin. This is best determined by feeling the skin on the body under the wing with the thumb and finger, or by holding the bird with head down and moving the thumb and finger up each side of the breast over the lateral processes. Slow producers are likely to have a skin that is thick, dry, and frequently covered with a scale. A lean, clean-cut face with prominent, clear eyes, and an absence of wrinkled skin about the head is a mark of good quality as in Figure 17, A.

Head Type.—Good layers usually have a well-balanced head. The width, depth, and length of head are well proportioned. A thin, clean-cut face, a full sparkling eye, a short well-curved beak, red, glossy, well-developed comb, wattles and ear lobes are associated with high egg production. Poor layers usually show a beefy head, full face, heavy eyelids and eyebrows, and eyes somewhat sunken and lacking the sparkle or brightness found in good layers. The illustration on the cover page of this circular shows the head of a good producer on the right and that of a poor producer on the left.



FIG. 18.—A head of good quality, a vent indicating present production, and egg organs indicating high rate of production.

Head type is of most value when judging birds in production. It should not be considered as a single characteristic but should be used in connection with pigment, molt, quality and other characteristics. Many studies have been made to correlate certain head measurements with egg production. Except in extreme cases of head type, such as crow or beefy heads, these correlations have not been significant. In the light of present knowledge, head types cannot be depended upon to enable one accurately to predict past or future productivity, when applied to nonproducing birds. When examining

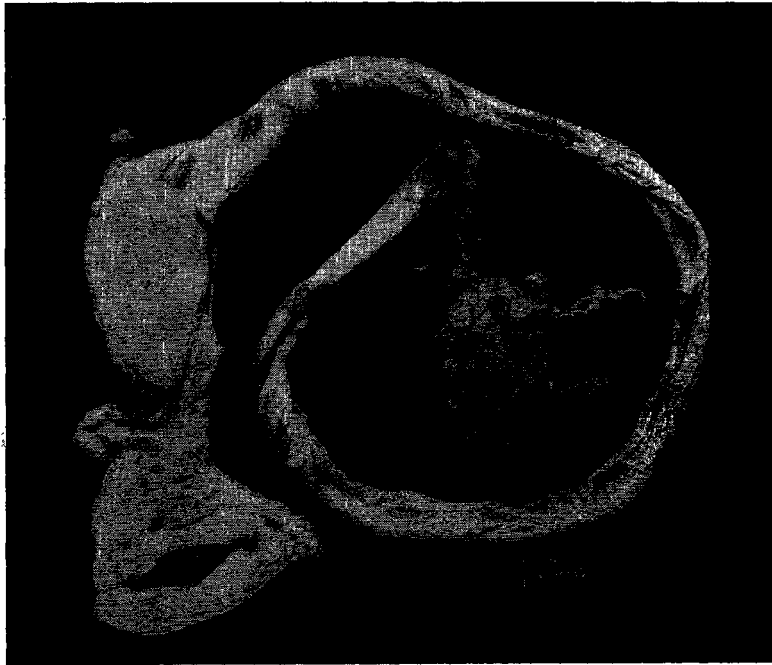


FIG. 19.—Reproductive organs of a broody hen showing the rapid absorption of immature egg yolks. For comparison with functioning egg organs, see Figure 12.

a laying flock for the selection of future breeders, one should consider the head types for balance and quality. A head that shows good quality, a vent showing present production, and egg organs indicative of a high-production rate are shown in Figure 18.

Disposition and Temperament.—A good layer has a friendly disposition, is tame, and does not get much excited when handled. She is alert, active, and always busy, among the last to take the roost at night and first off in the morning. Her appetite is always good as shown by her full crop at night and her worn toenails. The low producer is shy, stands around preening her feathers much of

the time, squawks loudly when caught, and displays little tendency to hustle for feed. She goes to roost early with little in her crop and is among the last off the roost in the morning. She does not work or lay and hence has little appetite.

Broody Hens.—The general purpose, meat breeds, and Austra-Whites are inclined to broodiness through the spring and summer.

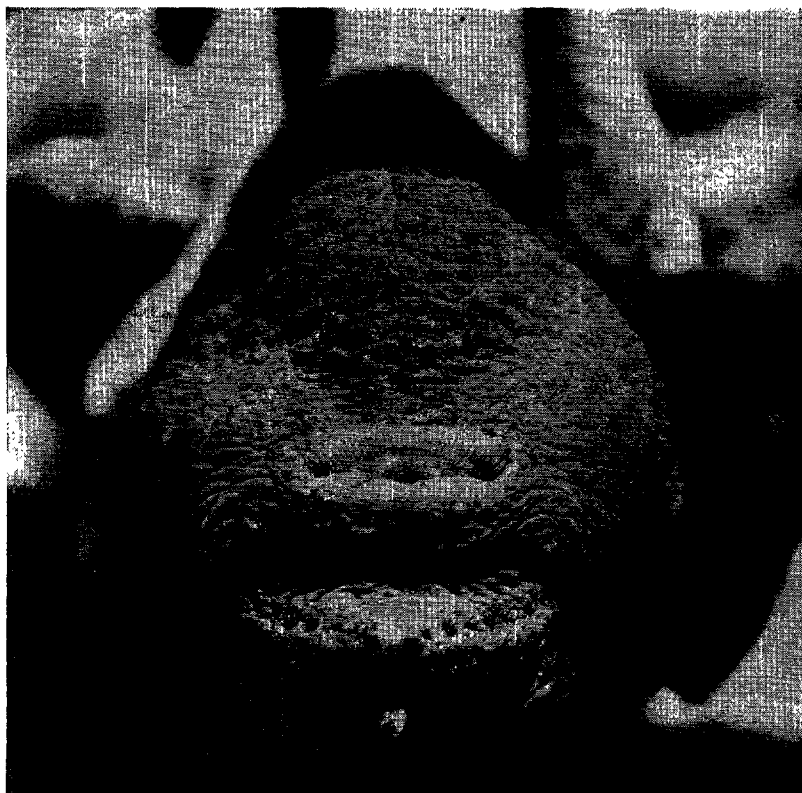


FIG. 20.—The contracted abdomen and contracted deeply-wrinkled vent of a hen 9 days after going broody.

It has been found that, on the average, hens lose 14 to 16 days' production each time they go broody, even when they are "broken up" as soon as possible.

The number of times Rhode Island Red hens go broody per year was found by Goodale⁵ of Massachusetts to average 5.39. The length of time from the first broody day to the day production began was on the average 16.3 days.

5. Goodale, H. D., Sanborn, Ruby, and White, Donald. Broodiness in domestic fowl. Mass. Agr. Expt. Sta. Bul. 199:98-116. 1920.

When a hen goes broody her reproductive organs diminish in size very rapidly. (Fig. 19.) Her appetite becomes less, and there is a tendency for the vent and the whole abdominal region to contract. As the vent does not usually take on color immediately, several days follow each broody period when it is hard to classify such birds. They usually show evidence of good past production, but the abdomen is of medium size and handling condition, vent fairly large but dry, surrounded with deep, prominent wrinkles. (Fig. 20.)



Fig. 21.—The head of a broody hen showing prominent eyebrows, wrinkled face, and masculine features. This hen had been broody on two previous occasions prior to September 1; her production until then was 151 eggs.

Heavy, overhanging eyebrows, and a lack of luster throughout the head, comb, and wattles are further indications of broodiness. (Fig. 21.) Broody hens are not necessarily culls and should not be disposed of when found, unless it is known that they are habitual offenders. This point can be determined and the whole matter of judging broody hens greatly simplified by placing a celluloid spiral legband on each hen every time she is found broody.

EGG TYPE

Most of the foregoing discussion has concerned hens when they are or ought to be laying. The question naturally arises, what about the good hen during her period of rest, or while she is in the molt? Is there any way of determining whether she has been a good, medium, or poor producer as judged by her appearance and handling qualities alone? Or in other words, is there an egg type?

The egg type as now understood consists of a deep body as measured from the front of the keel to the center of the back; deep, gradually-tapering, flat sides, wedge shape; a long, straight back carrying its width to the base of the tail; good width throughout the pelvic region; and a wide, full breast. The emphasis is placed on the individual possessing adequate capacity in all sections to properly accommodate all the vital organs and reproductive system under the strain of heavy egg production. The body of an off-type individual is shallow from back to breast with a prominent spring of ribs giving a more rounded body. There is much yet to be learned about type, and one should be cautious in depending upon it until further knowledge is obtained. So far as known, type can be applied to any breed, age (after maturity), or sex.

EXCEPTIONS

The foregoing discussion is general and should apply to the majority of normal flocks and individuals. But there is a great variation in the way flocks are handled. They may or may not be graded according to age. Some receive good care and attention while others are neglected. Some are on free range, others are confined. Some are fed rations containing much yellow pigment, as green feed and yellow corn, while others are fed rations containing very little. Exceptions will be found in flocks which receive grain alone without fish meal, meatscraps, or milk in some form. Irregular feeding or underfeeding will bring on an untimely molt and this possibility should be considered in culling.

Broodiness is a disturbing factor that must be studied carefully. Infestations of red mites or internal parasites, as well as disease outbreaks, cause irregularities that interfere with accurate culling. Abnormalities among individuals caused by ovarian troubles, such as deposit of eggs in the body cavity and the development of masculine characters in hens, are occasionally encountered. Artificial illumination, when misused, will throw the birds into a winter or spring molt which is no fault of the hens, but is the result of mismanagement. Hens used in hatching and brooding chicks will show yellow pigment late in the season. They should be marked so they can be identified. These and other conditions make it necessary for the individual culler to know the flock. The better the flock is known, the more successful will be the work of culling and grading.

In culling on the basis of present production, one should be able

to place correctly 95 to 100 percent of the birds after some experience. But in placing birds in order according to their rank in annual egg production, based on their indications of past production, one cannot expect to get more than 70 to 75 percent of them in the right order.

HOW LONG SHOULD HENS SHOULD KEPT

Good hens may be kept at a profit two or three years for market eggs, and for breeding purposes even longer. Hens on the average give their greatest egg production the first or pullet year and diminish 15 to 25 percent each succeeding year. The following figures give 3 years' records at the Kansas Agricultural Experiment Station for a number of White Leghorns, Rhode Island Reds, and Barred Plymouth Rocks:

Year	ROCKS AND REDS		LEGHORNS	
	Average production	Percent	Average production	Percent
1	170	100	198	100
2	140	82	151	76
3	104	61	120	61

Jull⁶ gives results on more than 3,700 birds including Barred and White Plymouth Rocks, Rhode Island Reds, and White Leghorns as follows:

	Plymouth Rocks	R. I. Reds	White Leghorns
No. birds	540.0	811.0	2,398.0
First yr. prod. (average per bird).....	193.0	203.0	188.0
Second year production.....	136.0	137.0	151.0
Difference	57.0	66.0	37.0
Second yr. prod. as percentage of 1st yr.,	70.5	67.5	80.3

These figures indicate that white Leghorns are better second year producers than Plymouth Rocks or Rhode Island Reds. Jull further pointed out that low-producing birds may lay more the second year than the first year of production, while the middle group, those laying 100 to 200 eggs the first year decline about 22 percent the second year and high producers, those laying 200 to 300 eggs, decline about 44 percent the second year.

Most of the second and third year's production is obtained during the spring and summer when eggs are cheap, therefore the net receipts from older hens will decrease faster relatively than egg production. The age of individual birds easily can be determined if the web between the toes is slit each spring when the chicks hatch, a different one of the sixteen possible combinations being used each year.

6. Jull, Moreley A. Second year egg production in relation to first year egg production in the domestic fowl. Poul. Sci. 7:276-286. 1928.

SELECTING THE BREEDING MALE

The first requirement in a good breeding cock or cockerel is vigor. It is identified in the yard by an alert, active, and commanding disposition. Upon close examination it will be seen that a vigorous male has a short, well-curved beak, broad, deep head, full face, with a prominent, clear, bright eye and a deep red color in the comb, face, and wattles. The neck is short, arched, and blends well into the shoulders. The legs, of medium length, are set squarely under the body and the knees are straight and wide apart. Pronounced masculine characters should dominate all sections of the bird, even to the bright sheen on the plumage.

Second in importance is type. Other points emphasized for the male birds include a prominent breast, breadth across the shoulders, and great depth from center of back to center of keel. Well-bred cocks, unlike hens, are usually narrow between the pubic bones and show but little capacity in the abdomen. This apparently is due to the shape of the keel of the male which is inclined upward at the tip. Fundamentally it is due to the fact that the reproductive organs of the male need far less space than those of an actively-laying hen.

In selecting a breeding male one should not be too quick to choose the precocious cockerel, that is, the first to show the red comb and to crow and take command of the flock. Such a bird will often show high fertility in hatching eggs and other good breeding characteristics, but is likely to be fine-boned and undersized for the breed. The continuous use of early-maturing males may have a tendency to reduce the size of the offspring and eventually affect the size of the egg. The small size of the male cannot readily be overcome by the size of the females with which he is mated, for it is well known that the highest-producing hens are often a half pound or more below the standard weight for the breed.

The above points are external and are valuable only as such. The prepotency of an individual or his power to transmit character is an internal and intangible quality that can be accurately measured by the progeny test only. Just as the trapnest is the only accurate measure of egg production, so the performance of his daughters is the only accurate measure of the breeding powers of the male so far as egg production is concerned. This test consists of mating a male with a number of females and keeping records of the eggs laid by the daughters. Progeny tests can be run with a number of cockerels one season and their values as breeders indicated for the second season by the winter production of their daughters. A number of experiments have shown that pullets with a high winter production as a rule give a good yearly production. Aside from the progeny test, one who is not using pedigreed birds must resort to vigor and type in selecting the male for the breeding pen.

GLOSSARY OF TERMS

Abdomen: That part of the body below the vent covered with fluff or down feathers.

Axial Feather: The short feather in the middle of the wing that separates the primaries from the secondaries.

Beak: The horny projecting mouth parts of chickens and turkeys, including an upper and a lower mandible.

Broody: The condition of a hen inclined to set.

Cock: Male chicken over 1 year of age.

Cockerel: Male chicken under 1 year of age.

Cull: To select; to separate the desirable from the undesirable.

Capacity: The cubical content of the body case, commonly estimated in culling by the distance from pubic bones to the end of the keel.

Eyering: The edges of the eyelids.

Earlobe: Fleshy, unfeathered appendages under the ear.

Fingers: The tips of the fingers just back of the first joint are used for measuring in culling. Four fingers of the average man's hand measure about 3 inches in width.

Hen: Female chicken over 1 year of age, but used in this circular for any bird that has started to lay.

Intensity: Rate of egg production measured by the number of eggs laid per week or per month.

Keel: The breast bone of a bird.

Persistence: The length of time a hen lays without long interruptions.

Lateral or Sternal Processes: Long, narrow, boney processes attached each side of the keel.

Molt: The process of changing old feathers for new.

Pullet: A female chicken under 1 year of age.

Pigment: The yellow color found in the skin, shanks, and beak of certain breeds and varieties.

Primaries: The long outermost flight feathers visible when the wing is extended. They number ten as a rule but nine or eleven are exceptions sometimes found.

Pubic Bones: The long, slender, flat bones terminating each side of the vent.

Precocious: Early maturing. Further developed than is normal at a given time.

Secondaries: The large wing feathers on section adjacent to the body visible when the wing is folded or extended. They are usually ten in number.

Vent: Common opening of the alimentary and genito-urinary systems,

CULLING CHART

JUDGING FOR PRESENT PRODUCTION

CHARACTER	LAYING HEN	NONLAYING HEN
Vent	Large, dilated, oblong, moist	Small, contracted, round, dry
Pubic Bones	Flexible, and wide apart	Rigid, close together
Comb	Large, red, full, glossy	Small, pale, scaly
Wattles and Lobes	Prominent, soft, smooth	Inconspicuous, rough, and dry

JUDGING PAST PRODUCTION

	LONG LAYING PERIOD	SHORT LAYING PERIOD
Vent	Bluish white	Flesh colored
Eyelids	Thin and edges white	Thick, yellow tinted
Eye	Prominent, keen, sparkling	Listless, sunken
Earlobes	Enamel white	Yellow tinted
Beak	Pearly white	Yellow tinted
Face	Clean cut, sunken	Full, well fleshed, yellowish
Shanks	White, flat, thin, creased	Yellow, round, smooth
Plumage	Worn, soiled, lifeless, close-feathered	Signs of molting, loose-feathered

JUDGING RATE OF PRODUCTION

	HIGH RATE	LOW RATE
Keel	Slopes downward	Slopes upward
Pubic Bones	Tips thin, point straight out	Tips thick, curved in
Capacity	Four to five fingers	Two fingers
Abdomen	Soft, pliable, dilated	Fatty, hard, contracted
Rump	Broad, width carried back	Narrow, cramped
Lateral Processes	Prominent, pointed outward	Hard to find, pointed inward
Skin	Soft, thin, loose, silky	Thick, dry, underlaid with fat