ING MONEY FROM HENS

HARRY R. LEWIS

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MAKING MONEY FROM HENS

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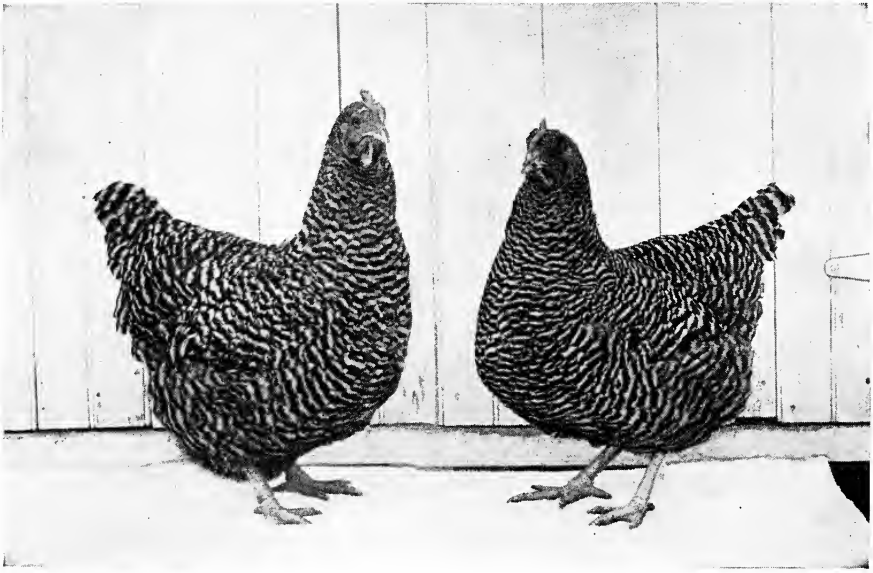

TWO WONDERFUL PERFORMERS

Bird No. 17 (at left) laid 272 eggs, and bird No. 19 (at the right) laid 278 eggs during their pullet year at the Vineland International Egg Laying and Breeding Contest

MAKING MONEY FROM HENS

By
HARRY R. LEWIS, M. Agr.
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A PRACTICAL BOOK FOR PRACTICAL PEOPLE
THIS BOOK DESCRIBES THE METHODS WHICH HAVE ENABLED THOUSANDS OF PERSONS TO MAKE MONEY FROM HENS

12 ILLUSTRATIONS

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THIS VOLUME IS DEDICATED TO AMERICA'S POULTRY INDUSTRY; AN OCCUPATION FINANCIALLY SOUND AND TRULY WORTH WHILE; AN INDUSTRY WHICH IS A NATIONAL ASSET OF FAR-REACHING ECONOMIC IMPORTANCE

PREFACE

Is it possible to make money from hens? Is the poultry business really worth while? Is the poultry industry a national asset, sound financially and economically? If so, what are the best ways to start, and what are the best and most modern methods to follow in caring for the birds?

These are all vital questions, of great interest and concern to every poultry raiser, be he large or small. To answer these in a simple, popular, honest, straightforward way has been the aim in the preparation of this volume.

Poultry keeping is one of our most widely distributed agricultural occupations. There is hardly a farm in our land or a home in our suburban communities which does not keep some hens. In many sections, especially in the Atlantic and Pacific Coast States, the

development of specialized egg farms has been very rapid, and their success, when properly managed, has been all that could be desired. Success with poultry, under any of these conditions, means the application of modern methods of care and management. During the past ten years poultry practices have advanced very rapidly and what was considered the best practice yesterday has been succeeded by improved methods to-day; so to be successful with poultry one must, first of all, be up to date.

It is possible to secure a handsome return from the home flock or the commercial flock if certain very definite principles of production are understood and followed. With the purpose of outlining these principles and their application to the successful management of the home flock, a series of popular stories was written during the spring and summer of 1919 for publication in the *Country Gentleman*. These stories, since published, have created such wide interest and have been

received with such popular approval that, in order to meet the demand for this up-to-date information, it has seemed best to publish them, with slight additions, in book form.

It has been the author's distinct purpose to present, in as clear and brief a manner as possible, those fundamental rules which insure success and to give very definite advice in the way of rations, methods of feeding and management and rules for handling birds of different ages and at different seasons which would make it very easy for anyone to apply them with every chance of success.

The methods described and the practices recommended are approved by the leading Agricultural Experiment Stations and have, in the main, been evolved by them. The methods described are in most general use among successful poultry raisers. Frequent reference has been made to the practices used at the Vineland International Egg-Laying and Breeding Contest; the exceptional results secured there in the way of high egg

production, excellent growth of chicks and maximum returns in dollars has created a national interest in the methods employed. All of the practices suggested have been tested at the New Jersey State Poultry Farm by the Poultry Department of the New Jersey State University.

Success with poultry is assured, if the right start is made with the right kind of birds and the right methods are used in caring for them. These "Rights" are fully explained in "Making Money From Hens."

HARRY R. LEWIS.

NEW BRUNSWICK, N. J.,
September 25, 1919.

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CHANCES WITH CHICKENS

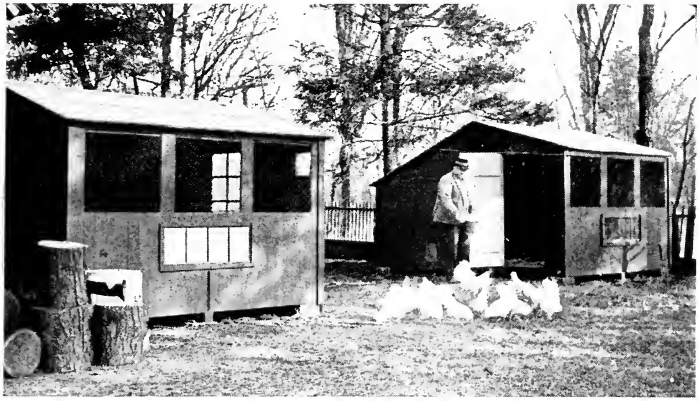
WHAT FIVE-CENT EGGS MEAN TO POULTRY RAISERS

With the poultry population of America materially depleted as a direct result of the world war; with the price of eggs past the dollar mark for weeks each winter; with the reserve supply of eggs in cold storage exhausted each year, weeks before the normal period of depletion; with every promise of an exceedingly heavy demand for poultry and eggs for export; and, lastly, with every indication of a sufficient supply of poultry feeding stuffs at prices commensurate with a reasonable profit, the element of chance has surely been taken out of poultry raising, and

success is positively assured to those who study their birds and practice proper methods of management.

During the period of the war, due to high feed prices, scarcity of feed and an exceedingly low selling price for eggs and poultry meat, poultry raising was not especially attractive; but now, due to new conditions, the tables have turned and our American hen has come into her own.

It was during the period of gloom and depression in January, 1918, that the author happened to be lecturing at an agricultural institute in Northern New Jersey. During the luncheon hour, while talking with a group of local farmers, many of whom kept farm flocks of considerable size, frequent expressions of disgust with prevailing conditions were heard. Many of the men had given up all effort along poultry lines; a few had greatly reduced their flocks. It is needless to say that the discussion did not wax very warm in favor of the good old American hen.



A TYPICAL SUBURBAN POULTRY PLANT
Just enough poultry for recreation and a home supply

A TYPICAL FARM POULTRY FLOCK
Truly a profitable side line to general farm work

A TYPICAL COMMERCIAL POULTRY FARM
Four acres and an independent self-supporting occupation

The Stickers Have Prospered

All at once in the midst of a rather pessimistic discourse, Nathan Jones, a local farmer, known in the vicinity as "Uncle Nate" and recognized as somewhat of a sage, interrupted the discussion with the words: "Say, boys, I reckon when people are going out of the hen business it is just the time for me to stick. I'm going to raise double the amount of chickens this spring." Uncle Nate did as he said he would and his view of the situation was sound, as measured by recent developments. He expressed in his "I reckon" way one of the fundamental laws of economics—namely, that every business has its ups and downs and that all periods of depression in any business are sure to be followed by periods of equal or even greater prosperity.

Appreciating the shortage which these conditions were sure to bring, the United States Food Administration recently issued a national appeal for a greater egg produc-

tion and for greater attention to poultry in meeting our food program during the reconstruction. The appeal closed with the following words: "The American hen practices conservation by instinct. Compared with other animals, the domestic fowl is a small unit, but wide distribution and large numbers make it a very important factor in supplying the nation's food requirements. In brief, the poultry industry appears to be one of our national food resources which may wisely be developed both in amount and quality. The meat and eggs of our domestic fowls will help maintain nutrition at home while the United States is supplying vast quantities of the food required to stop the threatened famine and anarchy abroad."

In addition to our shortage at home, the poultry flocks of Europe have been almost entirely wiped out, especially in those countries over which the armies fought. It is a duty we owe the Allied peoples to supply them with the stock necessary to revive

their destroyed industry. Mr. Edward Brown, of England, President of the International Association of Instructors and Investigators in Poultry Husbandry, and frequent representative of the British Government on foreign missions relative to the poultry industry, expressed this need when he recently said: "The problem of rebuilding the poultry industry on the other side is of vast magnitude. All of Belgium and Serbia and parts of France and Italy, as well as the Central Powers, must be entirely restocked. There will be a very great demand for birds of many races. America must be largely looked to for this breeding poultry stock."

This demand which is already under way from Europe means wonderful opportunities for American poultry breeders and commercial poultrymen who produce their own stock and who cull and breed for production. The demand for stock abroad and for eggs and meat for export is going to mean continued high prices for poultry and eggs, and this

will mean profit to the producer. Every economic factor points to a period of great prosperity for poultry keepers.

To you, Mister Commercial-Egg Producer, originator and producer of the nearby superior article, and to you, Mister Farmer, with the free-range flocks gleaning the wasted grains from the fields, the future offers unlimited demand for both eggs and meat at attractive prices—prices high enough to leave a satisfactory balance on the credit side of the ledger.

To you, Mister City and Suburban Dweller, your chance is here. For years, if you will but admit the truth, your desires have turned more and more toward a home in the country, where it would be possible for you to get away from the hustle and bustle of city life. A city flock will make it possible for you to acquire experience in the handling of poultry while still engaged in city business, and this training will always stand in good stead when you are able later to devote

your entire time to the raising of chickens on the farm.

For years you have been compelled to face a constantly increasing cost in the necessary foodstuffs. Why not break away from the old order of things? Keep some chickens in the back lot; turn your table scraps into fresh eggs. Eggs, like milk, are a necessary part of our daily diet. We cannot do without them. They are necessary to maintain a normal growth in our "kiddies." Eggs are also economical carriers of protein and fat in our own diet. But why argue their merit?

A fresh egg every morning
And a chicken now and then
Is always relished by the best of men.

But many will say that the price of eggs is prohibitive. Not a bit of it. The producer on the farm is entitled to a fair interest on his investment and a fair return for his labor. He must make a living. Aside from the high food value and the peculiar property

which eggs possess to make growth, there is no more sanitary human food than a fresh egg. Where can you find another human food which man has never seen or touched, but which is put into a sterile, sealed package by the producer?

Hens Produce Cheap Food

You who raise poultry are dealing with one of the most efficient transformers of raw material into a human food that we have on the farm. Dr. Raymond Pearl, Chief Statistician for the United States Food Administration, in a recent statement regarding this point said: "I have been gratified because my work in the Food Administration has put me in a position to realize how acute the food problem may become under certain circumstances, and also the studies we have conducted here have made it increasingly clear that the day of the large unit, such as the beef animal, in the production of necessary foods of animal origin is rapidly passing. The

steer is too uneconomic a transformer of energy to last long as a chief source of animal foods for mankind. The war has very much accentuated this development and has turned our attention to the relatively greater economy in the production of smaller units, such as poultry."

Hence, we are assured that there is a great need for increased poultry production; we are likewise assured that our product will be in great demand at remunerative prices, and to those of us who must purchase our eggs much saving can be accomplished and a fresh article guaranteed by keeping a small flock in the back lot. But you ask: "What must I do, how shall I proceed in order to insure my success with chickens?"

Getting the Start

Before making the actual plans for the flock, study the field and acquire every bit of knowledge from every possible source regarding the care and management of the

birds. Read poultry and agricultural papers; study birds at poultry shows; get in touch with your experiment station by visit and letter; read the best poultry books and, if possible, take at least a short course at your state agricultural college. Experience on a well-organized and successful poultry farm is invaluable. These latter experiences are especially desirable if the poultry venture is to be large and is to be made a strictly business enterprise. In starting out with chickens, remember that all the experience you gain at someone else's expense means just so much saved, for otherwise these lessons must be learned in working with your own flocks.

Begin the poultry venture in a small way. Gain experience with small numbers and thereby minimize the losses from the errors which the beginner is sure to make. The small flock can readily be expanded as its profitableness is proven and as the operator gains in his ability to handle larger numbers.

The quality of the foundation stock is a

big factor in success. Since the object is to be the production of eggs and meat for food choose a strain noted for production rather than show. The breeding of exhibition fancy poultry belongs to the large poultry farm, where much stock, eggs and chicks can be grown to meet the demand resulting from successful winnings at poultry shows. Choose a breed noted for its ability to produce both eggs and meat in the same individual. Representative varieties of the American class, such as the Plymouth Rock, Wyandotte or Rhode Island Red, will possibly be the most useful, although the Leghorns have proven so well their great economy as egg producers that they are frequently kept for backyard flocks in spite of their inferior meat qualities.

No city flock should be kept for meat alone, for meat can be the most economically produced on farms, where range is abundant and where larger numbers can be kept. When choosing the kind of birds to keep

never forget the superior value possessed by the standard-bred bird. They are more efficient producers, they are more reliable in breeding, they are more pleasing in appearance and their products—eggs and meat—are more uniform in quality and in greater demand. The family flock is kept to reduce the high cost of fresh eggs; it must, therefore, possess not only an attractive appearance, but it must also lay well.

Keep the Best by Test

Since it is the laying hens that pay, remember when determining the size of the flock that a few well-selected birds, each with individual ability to lay, are better than a larger flock, many of the individuals in which are non-productive for many months in the year. Eliminate the slacker hens and weed out the boarders. It costs little more to feed a good layer than a poor layer. The large flock kept at a sacrifice of high average production is a mistake. Fifteen to twenty good hens in

the backyard, properly cared for, should provide all the eggs required by the average family. In the winter the daily yield would just fill the immediate requirements, and the period of shortage in the fall can be provided for by putting the surplus eggs produced in the spring in water-glass.

A flock of not more than twenty hens will always prove more desirable than a flock twice the size. Likewise, on the farm the same principle applies—namely, one hundred selected hens will lay as many eggs and pay a much greater profit than a flock of two or three hundred not selected or culled. The non-productive hen is a parasite, living on and at the expense of the better hens. For Profit's sake, eliminate her!

Pullets lay more eggs than hens and, since the backyard does not provide room for brooding and rearing, the safest and probably the best plan will be to purchase each fall the desired number of pullets from a specialist breeder with a reputation for a

productive strain. The start could be made with hatching eggs or baby chicks, each of which methods has advantages, but each requires increased equipment, more room and greater practical experience on the part of the poultry keeper.

The purchase of from fifteen to twenty good pullets about October 1st, managing them throughout the winter and spring for the greatest egg production, and then as they stop laying during the summer killing them and using for meat on the family table, will, in the majority of instances, be the most satisfactory plan. This allows the complete disposal of the old birds each fall in time to clean the house and yard in preparation for the new flock of pullets.

Simple houses and equipment are the best. Much money can be thrown away upon expensive, fancy and poorly designed buildings and appliances. A poultry house of simple design, well lighted and ventilated, which is dry and clean and which protects the birds

from storms and severe cold, is all that is needed. Such a house, about eight feet wide and ten feet deep, will have a capacity of twenty birds and will cost, including all materials and labor, approximately forty dollars. This amount can be materially reduced if the owner builds his own poultry house. Such personal work is to be desired, for the actual work of preparing for and working with the birds furnishes much of the enjoyment resulting from keeping the city flock.

Posts and fencing material to provide suitable range for the birds will cost from five to ten dollars additional, depending upon the size of the yard. Each house must be provided with a feed hopper for dry mash and a small one for grit and shell, as well as a drinking vessel.

These appliances, together with two pails, a hoe and rake, will cost around four or five dollars. All other equipment, such as nests, perches, and the like, should be built into the

house and its cost included in the cost of building the house.

The total equipment necessary to house and care for a city flock of twenty birds will cost from fifty to sixty dollars.

With the house ready, one next asks: "Where shall the pullets be secured and how much must be paid for them?" Always buy from a reliable breeder; get stock which has been bred from a recognized laying strain.

If possible, visit the farm and get acquainted with the breeder and his birds. Order pullets in midsummer for delivery on October 1st. Prices for mature pullets, selected with every external appearance of excellent laying ability and bred from a strain of producers, will range from $1.50 to $3, depending upon breed. It never pays to buy poor birds because they are cheap.

The best is always the cheapest. After the house, equipment and pullets are purchased, the only operating cost for the next twelve months will be feed, a small amount of litter

for floor and nests, and possible miscellaneous purchases of disinfectant, lice powder, and seed for yards.

The Test of a Home Flock

Given a suitable house and good birds, success is not assured without proper care. Laying hens must be kept in a healthy, vigorous condition and they must be properly fed.

With these objects in view be sure to keep the interior of the house clean, remove droppings frequently and keep the litter on the floor dry, clean and deep. Give the flock plenty of dry mash in a hopper, being sure that the mash is constantly available. This mash should contain from 15 to 20 per cent. of meat scrap.

Supplementing the mash, a grain should be fed morning and night in a litter. Feed about one pound of grain each day to every ten pullets; this will require them to eat quite largely of mash. Keep plenty of fresh water always available. Give succulent feeds when

possible and keep grit and shell always present. Good birds, suitably housed and properly cared for, will always mean a satisfactory and profitable egg production.

A city flock of the size and quality outlined, properly cared for, should produce at least twelve dozen eggs a bird, or 240 dozen eggs from twenty hens. The average retail price of eggs during the present year will be about five cents each. This will mean a net return on the eggs produced of $144, to which must be added the value of the birds for meat as they are killed off during the summer and used on the family table. Thus, a handsome return for labor and interest on the money invested is left, at the same time resulting in a direct saving in living costs, as well as insuring eggs of the finest quality.

But actual experiences tell the story better than generalities. From among the records of some thirty-five city flocks kept during the past year, here is a typical successful and well-managed family poultry enterprise:

The flock consisted of thirty-five White Wyandottes, kept in the backyard of a suburban home just out of New Brunswick, New Jersey.

The man of the house commuted to New York City daily and this experience with poultry belongs to the wife, who loved her birds and who worked faithfully to make them a success.

The pullets were hatched during the spring of 1917 and purchased early in October of the same year. The egg records show a production during the twelve months beginning November 1, 1917, of a total of 5670 eggs, or 162 a bird. The value of these eggs at prevailing retail prices, which averaged five cents, amounted to $283.50. The cost of all purchased feed for the year was $108.50, or $3.10 a bird.

The thirty-five pullets were purchased from a nearby poultry farm and cost, at six months of age, $59.50, or $1.70 each. The keeping of this family flock required an in-

vestment in buildings, fencing and appliances amounting to $82; and in order to determine the profit resulting from the effort it is necessary to deduct the interest on the investment, amounting to $4.10. The total expense of operating such a flock was $172.10, leaving this housewife a net return for her labor of $111.40, or $3.20 a bird. To this amount should be added the meat value of the hens, which is sufficient at present prices to restock the flock with a new lot of pullets for next year's work.

This particular flock produced many more eggs than required by the immediate family, thus allowing the sale to neighbors during the year of $196 worth of eggs. This means that the eggs used by the family of five, including new-laid eggs and many put down in water-glass for fall and winter use, cost nothing except the labor of caring for the flock.

Such is truly a profitable and highly interesting venture and within the possibility of

achievement of most suburban families throughout the country.

The family flock has a definite place to fill on the farm and in the suburban communities of America. Its greater development at this time is both appropriate and profitable. It will help us meet our national food program and insure at reasonable cost an abundant supply of eggs and meat for the home table. Isn't this worth while?

Prosperity is surely ahead for poultry keepers. Many of the handicaps under which poultry producers have been working are disappearing or have already disappeared.

I cannot do better than use the expression of our good prophet, Uncle Nate, by saying: " I reckon " your chances with chickens were never better.

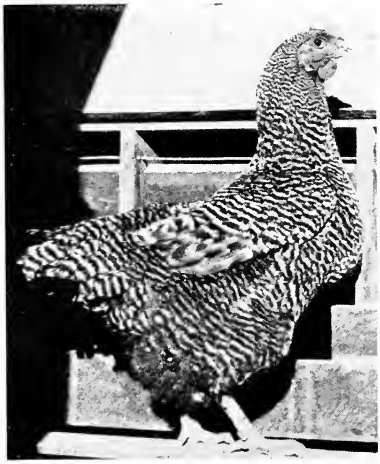
THE RIDDLE OF THE BREEDS

A WAY OF SOLVING THIS PERPLEXING PROBLEM

Did you ever stop to think why there are fifty breeds and more than one hundred and ten varieties of poultry? This question is certainly a perplexing one to the amateur choosing the breed which he wishes to keep, and is frequently equally perplexing to those who have had considerable experience in handling various strains and varieties.

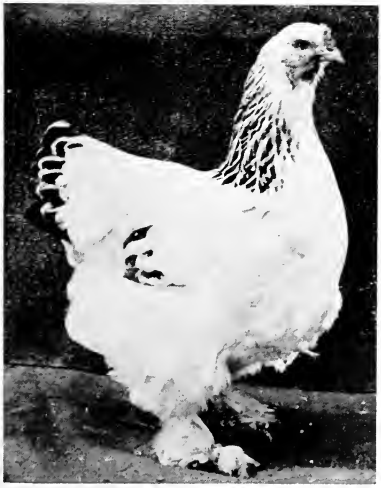
All of our domestic fowls of to-day trace their ancestry back to the wild jungle fowls, still to be found in the forests of India. Our modern breeds have been developed over a long period of years with many purposes in view. Some of the more promising were originated in America; others were developed in European countries.

Many of these breeds and varieties have been developed primarily with a view to



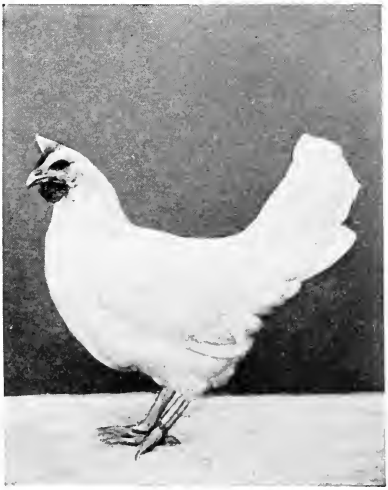
BARRED PLYMOUTH ROCK

Noted for both eggs and meat and popular the country over



LIGHT BRAHMA

The largest of all poultry, famous for quality and quantity of meat



SINGLE COMB WHITE LEGHORN

The world's greatest egg machine, especially popular on commercial egg farms

beauty of plumage and color pattern, yet in recent years the development of our more popular varieties has been governed more by the idea of their usefulness as producers of human food. Much can be said relative to the controversy between beauty and utility, but, after all the minor arguments are eliminated, one must recognize the fact that for the greatest permanence and popularity the useful bird must be beautiful and attractive in appearance, and the attractive bird must likewise have useful qualities.

Nothing can be said in support of either the ultra-utility or the ultra-fancy viewpoint. Each has a narrow-gauge, selfish perspective of the big problems confronting our poultry industry to-day. Our aim should be to develop existing breeds and, when promoting and originating new breeds, to strive for the greatest efficiency in the production of foodstuffs, such as eggs and meat, and at the same time to breed birds which are true to their respective types and color patterns.

Our poultry industry is and must be a national asset and not a national burden.

Some will say this is impossible, yet the records of our egg-laying contests from one end of this country to the other, and the practices of our successful poultrymen, show that these two qualities go hand in hand. A breed or strain, developed to the exclusion of either, has little to recommend it and will surely be short-lived in its period of popularity. Likewise, there is no advantage in the promiscuous crossing of existing breeds or varieties in the hope of securing definite improvement. The reverse is always true—namely, that cross-bred birds are unreliable as breeders, are not efficient producers, are not attractive in appearance, nor are they in general demand for stocking purposes. The first principle in solving the poultry-stock problem should be the consideration of standard-bred birds only.

There are four words commonly used in poultry terminology which to the uninitiated

need defining. They are the terms *class, breed, variety* and *strain.*

The term *class* is commonly used to define larger groups of birds, such as the American class, the English class, the French class, and the like. The term refers to the place of their natural habitat.

The term *breed* is used to classify groups according to body shape and form. In the American class there are the Plymouth Rocks, Wyandottes and the Rhode Island Reds, each with a distinct breed shape or type. The Plymouth Rock type is represented by oval curves, the Wyandotte by circular curves and the Rhode Island Red by rectangular or angle lines.

The term *variety* refers chiefly to color pattern of plumage, and is used to subdivide the various breeds into still smaller groups. For example, there are six varieties of Plymouth Rocks; all should be exactly the same shape, the only difference being in the color of their plumage. In some instances, this term is

also used to separate birds of the same breed into groups, according to comb character, the color, in such instances, being the same.

The term *strain* is used to denote a family of birds of a single breed and variety which have been closely inbred for a number of generations. Strains are generally originated by large breeders who have succeeded after years of patient mating and breeding in the development of superior birds of their respective breeds or varieties. It is not possible in this brief discussion to mention all of the standard breeds of poultry.

The table giving the classes, breeds and varieties which are at present recognized as standard bred, will serve, however, to make more clear the definition of these terms and will be interesting in that it shows the distribution and points of origin of the more popular breeds of to-day.

Any utility classification of the breeds and varieties of poultry is at best largely arbitrary, yet we find it of interest to so classify

TABLE I

Standard Classification of Domestic Fowls

Class and Name	Breed	Variety
1. American	Plymouth Rock	Barred, white, buff, silver penciled, partridge and Columbian.
	Wyandotte	Silver, golden, white, buff, black, partridge, silver penciled and Columbian.
	Java	Black and mottled.
	Dominique	Rose comb.
	Rhode Island Red	Single-comb and rose-comb.
	Buckeye	Pea comb.
2. Asiatic	Brahma	Light and dark.
	Cochin	Buff, partridge, white and black.
	Langshan	Black and white.
3. Mediterranean	Leghorn	Single-comb brown, rose-comb brown, single-comb white, rose-comb white, single-comb buff, rose-comb buff, single-comb black, silver and red pyle.
	Minorca	Single-comb black, rose-comb black, single-comb white, rose-comb white and single-comb buff.
	Spanish	White-faced black.
	Blue Andalusian.	
	Ancona	Single-comb and rose-comb.
4. English	Dorking	White, silver gray and colored.
	Redcap	Rose comb.
	Orpington	Single-comb buff, single-comb black, single-comb white and single-comb blue.
	Cornish	Dark, white and white-laced red.
	Sussex	Speckled and red.
5. Polish	Polish	White-crested black, bearded golden, bearded silver, bearded white, buff-laced, nonbearded golden, nonbearded silver and nonbearded white.
6. Hamburg	Hamburg	Golden spangled, silver spangled, golden penciled, silver penciled, white and black.

TABLE I—*Continued*

Class and Name	Breed	Variety
7. French	Houdan	Mottled and white.
	Creve-Cœur	Black.
	La Flèche	Black.
	Faverolles	Salmon.
8. Continental	Campines	Silver and Golden
9. Game and Game Bantam	Game	Black-breasted red, brown-red, golden duckwing, silver duckwing, birchen, red pyle, white and black.
	Game Bantam	Black-breasted red, brown-red, golden duckwing, silver duckwing, birchen, red pyle, white and black.
10. Oriental	Sumatra	Black.
	Malay	Black-breasted red.
	Malay Bantam	Black-breasted red.
11. Ornamental Bantam	Sebright	Golden and silver.
	Rose Comb	White and black.
	Booted	White.
	Brahma	Light and dark.
	Cochin	Buff, partridge, white and black.
	Japanese	Black-tailed white, black and gray.
	Polish	Bearded white, buff-laced and nonbearded.
	Mille Fleur	Booted.
12. Miscellaneous	Silkie	White.
	Sultan	White.
	Frizzle	Any color.

them that we can group the birds according to their peculiar characteristics, for these must be considered in choosing the best breed for one's flock. The more common breeds of poultry group themselves naturally into four

distinct types, according to their usefulness to man. They are the egg breeds, the meat breeds, the general-purpose breeds and the so-called fancy breeds.

In the egg-breed group we find a class of fowls which are medium to small in size, but which from years of breeding and selection have developed a pronounced tendency toward the economical production of eggs. The birds of this group vary slightly in size and form, but they are decidedly different from the other types mentioned. They are rather tight-feathered birds with a neat, trim carriage, which gives them a rather alert, active appearance. In the development of this group it seems that the primary aim has been not to sacrifice egg production for the sake of increased body weight.

Some of the more representative breeds which might be mentioned are the Leghorns, the Campines and the Anconas. These birds are very active in disposition, both in the house when scratching and when on the range

searching for feed. As a class they are rather small in size, weighing from three to five pounds. They are possessed of well-developed power of flight which makes it hard to confine them. The clipping of the primary flight feathers of one wing usually corrects this rather troublesome feature.

These egg breeds are early maturers. They attain many sex characteristics at an early age and reach maturity in from four to five months. As a class they are poor sitters and make poor mothers. The tendency has been to develop their egg-laying ability to such an extent that the maternal instinct has been in a large part obliterated. Due to their rather large comb and wattles, they are relatively more susceptible to cold than are the heavier breeds with smaller head parts. Being close-feathered means that for best results they should be given rather more protection against severe weather. Due to the small size and active disposition of this group of birds they stand close confinement better than

heavier birds, which trait is in part responsible for their general adoption on commercial egg farms. Due to their small size and hence lessened requirements for maintenance, they consume less feed than heavier birds, and for that reason are more economical producers of eggs.

The table on the following page shows the efficiency of four common popular breeds of poultry, as producers of eggs, as measured by results at the Vineland International Egg-Laying and Breeding Contest during the pullet and yearling years of 1916–18.

The Leghorns have become especially popular in the Atlantic and Pacific Coast States, where a premium is paid for white-shelled eggs and where the commercial egg farm has seen its greatest development.

The body flesh on birds of the egg group is poor, being limited in quantity and of low quality. There is little fat on their bodies and the lean meat has a tendency to be rather coarse-grained and dry when cooked. The

egg breeds, more especially the Leghorn, are principally adapted to commercial purposes where market eggs are the primary object,

TABLE II

A Record of Performance Based on Efficiency in Egg Production

	Plymouth Rocks	R. I. Reds	Wyandottes	Leghorns
Number of eggs per hen, first year..	155	151	144	170
Same for yearling year.....	119	117	115	137
Pounds feed consumed per bird, first year.....	90	87	80	76
Same for yearling year.....	90	87	80	86
Average cost of feed per bird, first year.....	$2.52	$2.47	$2.30	$2.19
Same for yearling year.....	3.19	3.04	2.93	2.87
Actual value eggs per bird, first year	5.46	5.44	5.22	6.49
Same for yearling year.....	4.58	4.54	4.44	5.98
Actual returns above feed cost, first year.....	2.91	2.97	2.92	4.30
Same for yearling year.....	1.39	1.50	1.51	3.11

Note.—Brown eggs during the pullet year actually brought forty-three cents a dozen, though white eggs sold for forty-six cents. During the second or yearling year brown eggs actually brought forty-six cents, though white eggs sold during the same period brought fifty-two cents a dozen.

It will be seen from the above table that all three general-purpose breeds fall in a similar class, but owing to an increased production, backed by a decreased feed consumption, together with an increase in the selling price of the eggs, we find the Leghorns far in the lead when a financial balance is struck at the end of the year. This analysis probably explains why it is that the Leghorn has been almost universally adopted on commercial egg farms.

and also to the family flock where poultry meat is not desired—in other words, where a maximum number of eggs economically produced is the ultimate goal.

Big Birds for Meat

The second type of fowl mentioned in this utility grouping is the meat breeds. These birds receive this designation due to their large size and weight and the extra fine quality of their flesh. Birds of the Asiatic class fall in this group. Large birds are preferred for meat production, since they dress off better, there being less bone and waste material. Specimens frequently weigh twelve to fourteen pounds. Such birds can be served to better advantage at the table. The Brahma probably represents the meat type in its highest degree of development.

Meat breeds have large blocky bodies with extreme depth and width and very full breasts. These large birds always possess considerable body fat, which means tender, juicy meat after cooking. The meat breeds are slow in movement and not easily frightened like the egg breeds. They can be readily confined, are not great rangers, and are of a quiet, lazy disposition. They are slow in ma-

turing, often not getting their growth until the second season. Pullets require from six to ten months to come into laying condition. As a group they are rather persistent sitters, but too heavy for general use in that capacity, as they are apt to kill or crush many of their chicks. They are very hardy birds, not requiring extreme protection during the winter on account of their large size and abundance of body fat and also on account of their very loose feathers, which make for warmth. They are not remarkable egg producers. In fact, every stage in their development has been toward greater weight and meat-carrying capacity, and away from egg production.

This type of bird is what has made the South Shore district of Massachusetts and the Burlington County capon district of New Jersey so well known and their products so popular. Where the greatest quantity and the highest quality of poultry meat is the aim, and where egg production is of minor con-

sideration, one of the heavy meat types should be the first choice.

America's Own

American poultrymen are proud of our general-purpose breeds for, as the old saying goes, they have been produced "In America, for Americans and by Americans." They are truly a product of our Yankee ingenuity and ability as breeders and originators of new types of livestock. They have been developed largely to meet a special need and to fill a place which no imported breed could fill. The American housewife wants a meaty, rather quick-growing bird of medium weight which will produce a good yield of eggs and which must have yellow skin and shanks. The Plymouth Rocks, Rhode Island Reds and Wyandottes are typical examples of this distinctly American effort to develop a dual-purpose breed. Their quality and usefulness have been proved over and over again. The Barred Plymouth Rock has

for a generation been the leading breed in popularity on American farms and to-day her place is being hotly contested by the Rhode Island Red.

What is it about these American-made breeds that make them so popular? It is their adaptation to our needs and conditions on the farms of the land. As a class they are halfway between the egg and meat groups in nearly every respect. They weigh from four to six pounds, are moderately loose-feathered, have an abundance of meat with plenty of body fat to insure its quality. They are quiet in disposition, easily confined and are especially adapted to city and suburban purposes. They are much quicker maturing than the heavy breeds, the pullets reaching laying age in from five to six months. They are among the best sitters and mothers, bringing off excellent hatches and rearing the chicks well. They forage over considerable distances, and when given the chance search out a lot of their feed in the form of

insects, worms and grubs. They are just as hardy as the heavy breeds, being possessed of small head parts, full-feathered and accustomed to the rigors of our Northern winters. Many of these breeds originated in the North.

The Orpingtons, a breed of English origin, have gained considerable popularity in America, as they more nearly fill our needs for a general-purpose fowl than any other foreign type. These birds are slightly heavier than the native breeds and, as a rule, not quite so highly developed as egg producers, but what they lack in egg production they make up in quality and quantity of meat. Their shanks and skin are white, which fact puts them at a serious disadvantage in the markets of this country. For one wanting an all-round flock of birds, which will produce a fair number of eggs, and which, in addition, will from time to time furnish considerable poultry meat of high quality for the family table,

there is no type better than the dual purpose or America's own.

The Beauty Birds

The past has seen the development of a group of fowls which have for their chief claim peculiar beauty or attractive appearance. Some of these birds possess oddities that make them especially interesting, others beautiful plumage, still others a dwarfed size, such as the bantams. No great claims can be made for these types from a commercial standpoint. Their chief popularity lies in the love which most of us possess for something we can mold with our own hands, for that something which we can use to test and develop our own creative instinct.

And so it is that the bantams, the large-crested breeds and the spangled and highly plumaged types are kept primarily for the interest and enthusiasm one has in breeding and handling such highly specialized animals. The bantams are frequently the pets of the

young folks, and there is nothing that will give our boys and girls greater interest or a better foundation for the care later of a flock of adult hens than to have a small flock of bantams as their own special charge during their early childhood.

All of our commercial varieties of poultry are beautiful if well-bred and properly handled. All of them have definite and pronounced commercial or utility qualities as well. It is the proper appreciation by all groups of poultry keepers of the respective merits of producing ability, whether it be eggs or meat, as well as the importance of uniform breeding to color, size and type, that is going to insure the more extended use of standard-bred birds on our farms and create a greater desire for such well-bred specimens by all classes of poultry keepers. The old adage, " Don't worry about why a black hen lays a white egg, get the egg," is good logic if we consider only the ability of an individual to earn her way as a producer of human food;

but when we consider, as everyone must, the breeding ability of that bird, the uniformity and characteristics of her progeny, the uniformity of her product and the possible demand for breeding stock, one can never neglect those characteristics of color and shape which enter so much into every aspect of utility consideration.

Choosing a Breed

When attempting to make a choice of a single breed for the home flock, the first step should be to look over the field of possibilities and become acquainted with the general characteristics and traits of the more popular types such as have been briefly mentioned. Having done this there will be one or more of the several varieties which will be especially attractive and which will seem to be especially suited to one's needs.

Personal preference has much to do with the success of the poultry flock. One will rarely succeed with anything he does not like

or is not interested in. I have had hundreds of men ask me the breed of poultry best for them to keep. My reply is always this question: " Which breed do you really like best? " Their answer is usually indicative of their favorite, and the breed or variety recommended is generally that very one. There is no such a thing as one best breed or variety. Strains of the same variety often differ more than two varieties of the same breed. Personal preferences should be the first determining point. Never choose a breed that you do not instinctively like and take a real interest in.

To many the choice of the breed will be like answering the old conundrum, " Which was first, the hen or the egg? " Since either may be the correct answer, so the choice of any one of our popular breeds will be satisfactory, provided it complies with one's own personal needs and fancy.

BEGINNING WITH INCUBATOR

START RIGHT AND YOU'RE BOUND TO GO RIGHT

THE day when old mother hen with her brood of fluffy youngsters, scratching about the barnyard, could rule supreme is rapidly passing. Her place is being taken by the more modern and efficient artificial mother, the incubator and the brooder.

The old adage, "There is nothing new under the sun," holds true in this instance, for centuries ago, when the Egyptian kings were building the silent Sphinx and the mighty pyramids and when Chinese civilization was at the height of its development, we learn that hens' eggs were hatched artificially in huge ovens, holding thousands of eggs, the heat being supplied by decaying manure or smoldering fires. No thermometers were used to determine temperature in those an-

INTERIOR OF A MODERN INCUBATOR CELLAR

Note operator turning the eggs, and moisture on the floor

cient times, but operators, through years and generations of practice, became so expert that they could tell the proper temperature by simply remaining in the hatching room. The operation of these huge hatching ovens was an occupation handed down through successive generations of the same family; it was a secret trade, jealously guarded, and productive of remarkable success as compared with our more exact methods of to-day.

It is quite evident that the art of hatching eggs possessed by these ancient peoples disappeared with the decadence of their civilization, and we find no progressive development of artificial methods of hatching from that time until the middle of the past century. The development of manufacturing enterprise, coupled with our Yankee inventive genius, conceived and rapidly developed the efficient artificial incubators we know to-day, until at the present time they are far superior to the hen, in that they hatch better. For market purposes one must get eggs and

chicks out of season; with incubators the time of hatching is not subject to the whims of the hen, but is absolutely under the control of the efficient poultryman.

Chicks artificially hatched and reared are not subject to the parasites and disease contamination they are bound to contract to a greater or less extent when running with hens. Incubators save labor and make it more convenient to hatch large numbers of chicks at one time. The use of incubators has spread rapidly to the farm flocks of the Corn Belt. To-day the largest sales are made in those states. Recently a large incubator manufacturer of Ohio, making one of the popular-priced machines, said to the writer: "Do you know, it is unbelievable the great increase in the demand for small incubators on farms? I believe that the time is not far distant when every farmer will raise his chicks by artificial methods, a practice which cannot but result in earlier and better chicks and more profit from the farm flock."

Custom vs. Home Hatching

Artificial methods of hatching and brooding have already become the only practice in use on commercial farms; owing to large numbers and the early season of hatching, the hen would be utterly lost in attempting to hold down the job. Mammoth incubators with a capacity of thousands of eggs have been the direct outgrowth of these intensive methods.

The American-built incubator with designs and sizes to meet all needs is here to stay. Some will ask: "Why hatch my own eggs? Why not have them custom-hatched or why not buy baby chicks?" The answer is simple. Either of these suggestions offers certain advantages to the person so situated and so employed that it is impossible to find the time or the place to do this work himself. For the beginner it may often be the wisest plan to start with baby chicks the first year, gaining experience gradually and not attempting too many new technical operations

at the very start. But by hatching your own eggs yourself you make the poultry work much more interesting. It is possible to follow the efficiency of the breeding work more closely, and it permits pedigree hatching. By doing one's own hatching it is possible to develop one's own strain; one becomes a breeder and his poultry flock is sure to be more interesting and profitable.

Successful artificial hatching depends first upon the choice of a good incubator. Simplicity should always be the rule. The more mechanism there is and the more complicated the machine, the more there is to get out of condition and the more chances there are to make mistakes in management. The heat-regulating device is the heart of the incubator, as its effectiveness depends upon the maintenance of a uniform temperature. An efficient and complete self-regulating device should possess three requisite parts—a sensitive, well-built thermostat, a simple but accurate means of transferring the energy of

the thermostat to the lamp, and arrangements for easy adjustment and regulation.

The incubator chosen should be well built of substantial material. If of wood, it should be kiln-dried, at least half-inch material, and well put together, so that it will not swell or warp or the joints come apart when subjected to heat. It should be of plain design, well finished, with plenty of varnish to keep out the moisture. The past record of an incubator is its best advertisement; therefore, choose one which is of a recognized standard make and which has given years of satisfaction. In determining the size of the machine, remember that a small one requires as much time and labor to operate and nearly as much fuel, and that it is harder to hold at uniform temperature, being more easily affected by outside conditions than a large one.

Choose a machine of not less than a hundred-egg capacity, or, better yet, from two to three hundred, for in many cases it is the intention to increase the hatching capacity at

some future time. The larger machine can be run at half capacity the first year or two and the number of eggs increased without extra investment. The exact size of incubator needed will in the long run be determined by the number of pullets desired, and this must determine the number of eggs to be set. It will generally require the setting of five eggs to secure one vigorous pullet in the fall. It is, of course, possible to set the same machine twice and sometimes three times during the season.

The incubator should always be placed in a basement or cellar below the ground level, where the temperature is more uniform and where a sufficient degree of moisture is generally to be found.

When the new machine is received, or when getting the old machine ready for the new years' work, it should first be leveled to see that it stands plumb, in order to insure equal distribution of heat. Before putting in the eggs the lamp should be started, the machine

regulated to the desired temperature and run for at least forty-eight hours to make sure that everything is working properly. When caring for the incubator follow the instructions of the manufacturer carefully in every detail. Caring for the incubator is a matter of routine, and success will be surer if a definite plan is mapped out and closely followed.

The Magic Lamp

Since the lamp is the source of heat, and since proper temperature is the limiting factor in incubation, its workings must be thoroughly understood and the details of its care appreciated. These rules can always be followed to advantage:

1. Trim and fill the lamp at a regular time every day, preferably noon; if this is done regularly it will not be overlooked or forgotten. Never attend the lamp just before handling the eggs.

2. Be sure that the lamp is set firmly and properly into its support and that the burner

and chimney fit tightly, thus preventing danger from smoke and possible fire.

3. Do not fill the lamp too full; leave a little space at the top for air and for the movement of the oil.

4. To trim the lamp take it from the machine and lower the wick to prevent smoking. Do not cut the wick with scissors more than twice a week. When filling the lamp each day scrape off the charred portions of the wick with a match. Have a uniform, even flame, with the center slightly higher than the ends.

5. After filling be sure that all oil is wiped clean from the outside of the lamp in order to prevent odor and fire.

6. After placing a newly trimmed lamp in the machine, leave it turned low for a few minutes, as it will burn up, and if turned high immediately it is apt to smoke.

7. Keep the lamp wick always at the same height and do all regulating of temperature

by means of the thumb-nut on the connecting rod of the self-regulating device.

8. Be sure that the lamp is not exposed to violent drafts of air, as these will cause smoking and fire.

When the machine has been regulated to run at the desired temperature and the operator is familiar with the details of operation we are ready for the eggs. When filling the egg chamber, avoid subjecting the eggs to a sudden change in temperature. They should be allowed to settle large end up in the temperature of the living-room for a few hours; they should not be taken out of a cold room and put directly into the machine. The eggs in the tray should completely cover it, but should not be placed one upon another, for the temperature varies one degree for every inch of height and such a practice would mean lack of uniform temperature on all the eggs. Every machine has its rated capacity, and it is rarely ever possible to put in more than this number at one hatch.

Hens' eggs require a temperature during incubation of approximately 103 degrees Fahrenheit, which is two to three degrees lower than the body temperature of the hen. When determining the temperature it makes a difference where the thermometer is placed —whether it is hanging just above the eggs or lying on them. Probably the best plan is to place the thermometer so that the bulb is hanging about one inch above the eggs, as here it does not interfere with the handling of the eggs and the temperature can be easily read. So placed, these temperatures are to be desired: First week, 102°; second week, 103°; and third week, 104°. Never let the temperature go above 106°; if, due to accident, it goes above this point the eggs should be immediately cooled down to below 100° and the machine aired. A high temperature during the early part of the hatch is more apt to be fatal than after the twelfth day. The best time to read temperatures is morning and night, before attending to the lamp or

turning the eggs. After turning, the eggs require a considerable time to warm up, so that a low temperature, then, if not prolonged, should not be alarming.

In artificial hatching we try to imitate old mother hen as much as possible, and since she turns the eggs in the nest we must turn them on the egg trays. The effect of turning is to change the position of the embryo, thus preventing it from rising and sticking to the shell. Turning is also necessary to supply oxygen to the growing embryo. If the egg is not turned, especially during the later stages, the embryo will not be of the right shape or in the right position in the egg, and will be unable to hatch.

Here is a comprehensive rule for turning: Begin turning on the evening of the third day; continue this process each day, morning and evening, until the evening of the eighteenth or nineteenth day, or until the eggs show signs of pipping. Then prepare the

machine for hatching and do not remove the tray for any purpose. There are some machines which turn the eggs automatically, but the best and safest plan is to turn with the palms of the hands, moving the eggs gently about until the position of all has been changed.

Cooling takes place during the process of turning. It not only allows the eggs to cool off, but at the same time allows them to secure a greater amount of oxygen than is possible in the machine. Excessive cooling should be discouraged, as it checks the development of the embryo and prolongs the hatch with no apparent benefits. It is impossible to lay down definite rules for all seasons and for all conditions. No cooling should be done other than what takes place during turning early in the season. During April, and later, it is a safe practice to begin cooling on the fifth day and to cool for five minutes morning and night during the first two weeks.

During the latter part of the hatch the length of cooling may be doubled.

Hatching Eggs Need Air

The air must be changed frequently in the incubator in order that the gases generated by the embryo may be thrown off and replaced by a supply of fresh air. The problem is to bring about this change without a great loss of moisture from the eggs due to evaporation. The evaporation of the contents of the eggs is influenced by the rapidity with which the air circulates through the egg chamber and by the humidity of the air itself. Most incubators are provided with ventilators in the bottom of the machine, in the side walls, or, as in some models, the fresh air is carried into the egg chamber with the warm air as it enters round the lamp box.

It is possible and desirable to determine the degree of evaporation going on by candling the eggs and observing the size of the

air cell. As the moisture in the eggs evaporates, the air cell becomes larger. When the fresh eggs are first placed in the machine, the air cell is very small, being only about one-eighth of an inch in depth; on the third day it will have increased to about a quarter of an inch; on the eighth day to about three-eighths; on the fifteenth day to about five-eighths; and on the nineteenth day to about three-quarters of an inch in depth. Most incubators provide pans or trays by means of which moisture can be introduced into the egg chamber.

Too rapid an evaporation of the egg contents is detrimental to the hatch, whereas sufficient moisture results in an increased percentage of hatch. The resulting chicks weigh more at hatching time, there is a greater uniformity in the hatch—fewer cripples—and the chicks from a moist hatch always live better. The best test of a proper moisture content is the air cell. At hatching time the glass windows on the front of the incubator should

sweat, due to the rapidity with which the little fellows are coming out and drying off.

On the seventh and fourteenth days the eggs should be removed for a short time and candled by holding each egg separately before a bright light in such a manner that the condition of the egg contents may be readily seen. When testing on the seventh day all clear eggs are infertile. They should be removed and may be hard boiled and fed to the chicks. All eggs which show a pronounced blood ring are dead and should be destroyed. The normal embryo at this age will be found about one-third of the way down from the large end. It will be seen as two dark spots lying close together, and with dark lines which are the veins radiating from the embryo. If the germ is not readily detected it can be brought to the surface by rotating the eggs gently. The air cell in a normal egg is clear, with well-defined limits; in the infertile egg or one with a dead germ it is hazy and not well defined. On the four-

teenth day the eggs should be candled again and all dead embryos removed.

The running of an incubator is a matter of detail, and in order that everything about the hatch may be known a complete record should be kept showing daily temperatures, the result of the test and the efficiency of the hatch as measured by the number of vigorous chicks removed.

The incubator should be kept closed from the time the first egg is seen to pip and not disturbed under any consideration. Opening after this time not only reduces the temperature, but it results in the loss of needed moisture. Before closing the machine remove the sand tray and open the chick doors through which the newly hatched youngsters drop into the nursery drawer. Cover the glass with burlap or cloth during the hatch to darken the interior and keep the chicks from crowding to the front before they are dry. A hatch which has been properly run should begin to pip on the nineteenth day and should

be all over by the twenty-second day at the latest. Brown eggs take slightly longer than white eggs, as the shells are thicker and the embryo develops a little slower. As soon as the hatch is completed the egg trays should be removed and a little grit scattered on the nursery floor. Keep the chicks in the machine until they are forty-eight hours old.

Causes of Poor Hatches

Poor hatches can generally be laid to one or more of the following causes: Poor eggs, faulty condition of the breeding stock, great infertility or chilling of the eggs previous to hatching, or other conditions resulting from want of care previous to placing them in the incubator. Even with good eggs at the start poor hatches are often due to inexperience and faulty management of the machine, such as irregularity in attendance, imperfect regulation of ventilation and moisture, faulty temperature and prolonged cooling. A poor

thermometer is frequently the cause of poor results, and so every season the thermometers should be compared with one which is known to be correct and the incorrect ones discarded. Given good eggs, and a good machine properly located and correctly operated, one may expect to secure from 50 to 75 per cent. hatch of all eggs set.

The efficiency of the hatching work will determine whether it is cheaper to start with baby chicks or hatching eggs. Generally, the cost of chicks is a little more than double the cost of hatching eggs. Allowing for a 50 per cent. hatch, plus the cost of operation, this will mean that the cost of starting would be the same in either instance; but given a 60 or 70 per cent. hatch, the cost per chick is so reduced that it is much cheaper to hatch one's own chicks. When hatching eggs are selling for from six to ten cents, baby chicks can generally be purchased for from twelve to twenty-two cents. The difference in cost of one method over the other is very slight,

and the best method will be determined by one's ability and interest in the hatching work. Surely there is nothing more interesting in the poultry work than to watch the little fluffy balls just after hatching and to know that through twenty-one days of faithful attention one has been able to imitate Nature in a machine.

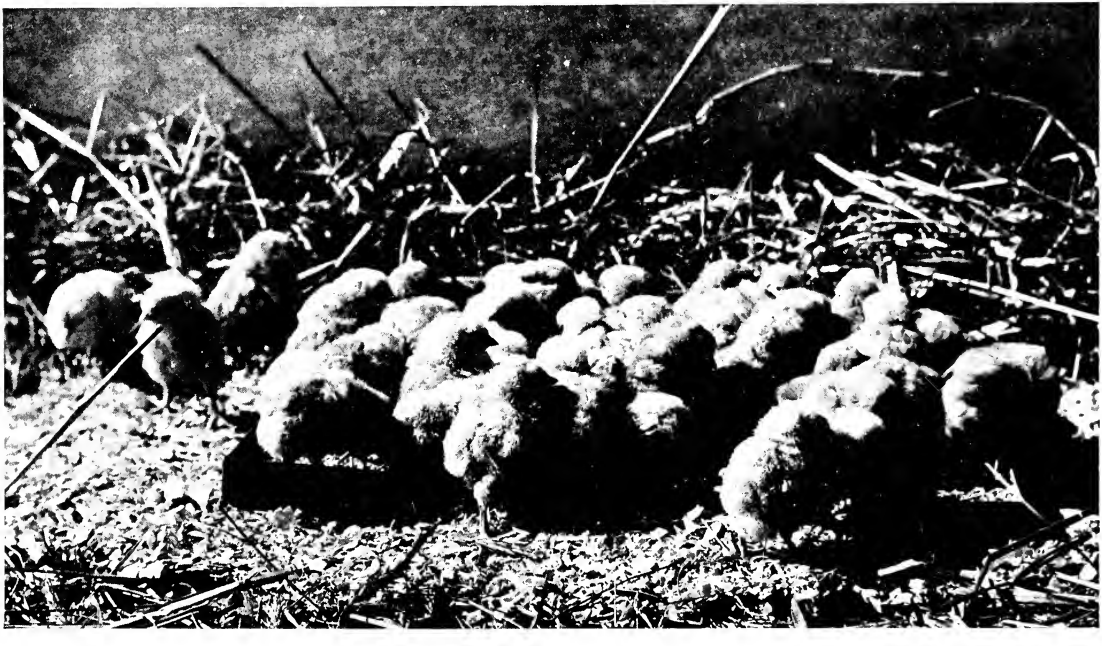
BEGINNING WITH THE BABY CHICK

THE QUICK AND EASY WAY TO START POULTRY KEEPING

PEEP, peep, peep, peep.

This, the cheery cry of the baby chick, so dear to the heart of every true poultryman, is with us every spring. On our farms old mother hen brings off her brood of fluffy youngsters; on our commercial poultry plants and chick hatcheries the mammoth incubators are turning out baby chicks by the thousands with the precision of a manufacturing enterprise. The express clerk and the parcel postman know that the baby-chick season is here, for their burdens have been increased by great shipments of specially constructed boxes, containing from twenty-five to one hundred fluffy little " peepers."

With the spring season comes the greatest



A BUNCH OF LITTLE HUSKIES JUST OUT OF THE INCUBATOR

Delicate little creatures without any mother, but my how they do respond to good treatment

responsibility in poultry production, for the weakest link is the problem of replacing a large proportion of the old birds each year—after they have passed their usefulness in the laying pen—with vigorous well-grown pullets. To meet this problem successfully a sufficient number of chicks must be hatched or purchased, after which they must be properly brooded and reared to maturity. The ability of poultry keepers to maintain the number and the quality of the flock, year after year, will be the real measure of their success.

The securing of vigorous, strong chicks which have been properly hatched from standard-bred stock is the first step that must be taken to meet this problem.

This is often a most perplexing question. To the beginner there is but one answer: Buy. To the established poultryman with quite a flock, either procedure may offer certain advantages. If the business is well established and an effort is made to develop

a breeding plant the baby chicks will always be hatched by the poultryman himself from his own eggs. This is the practice which prevails on the egg farms of the Atlantic Coast States. One frequently finds, however, that the egg farmer who devotes his entire time to producing market eggs does not make any effort to maintain a breeding flock, but buys all of his chicks from reliable hatcheries. This is the type of poultry farming which prevails in many of the famous egg-producing centers of California.

The former practice is probably the more permanent and allows of the development of a more remunerative business. The baby chick is every day becoming more and more popular as a means of securing stock for farm flocks, and in the case of the tyro poultry farmer it offers peculiar advantages for the initial start.

While talking with a group of farmers in the potato-growing section of Monmouth County, New Jersey, recently, it surprised

the writer to learn that all maintained fair-size flocks of general-purpose fowls, and that they all, with but one exception, replaced their stock each year through the purchase of baby chicks. When asked why they preferred this method, the appended answers were volunteered:

"During the rush of farm work each spring we have no time to bother with saving hatching eggs and running incubators, and prefer to buy the chicks, brooding them in coal-burning brooder stoves that require the minimum of attention." Another reply: "We find we cannot get early chicks, as our practice has been to hatch with hens, and it is impossible to get a supply of setters until late in April. We find that for best results, since we want March chicks, baby chicks purchased early have no equal in cost or efficiency as a method for the average farmer to replace his small flock." Still another: "My wife, who is the hen authority in our family, finds hens fickle and unreliable, and since she has

not the time nor inclination to run an incubator, we buy each year two hundred Rhode Island Red chicks about the first of March. For the past four years she has brooded these herself in a coal-stove brooder and from them has maintained a profitable flock of from sixty to eighty laying hens."

Baby chicks purchased early from reliable hatcheries and breeding plants will insure, with limited labor during the spring rush, an excellent farm flock at a reasonable cost.

The beginner with chickens does and should use this method very generally in getting a start. Talking with Herbert H. Knapp, president of the International Baby Chick Association, at the Madison Square Garden Poultry Show, it was a revelation to find that a considerable portion of the baby chicks hatched at commercial hatcheries are shipped out in small lots of from twenty-five to two hundred chicks to amateurs who wish to get a proper start in the simplest and surest way possible.

"The amateur," said Mr. Knapp, "can get a good start in this way without the considerable first investment in incubators; he does not require the experience necessary to operate incubators successfully; he gets his start with less labor and is assured vigorous chicks to the amount he desires. The danger of starting with hatching eggs is that infertility, especially early in the season, may cause poor results and discouragement or, more frequently, the eggs if purchased and shipped from a considerable distance may be so shaken and injured in transit that they cannot be made to hatch well. The start with baby chicks eliminates this loss and simplifies the early operations of the beginner."

What is this business which has sprung up like a mushroom in a few short years and which has already been assured of a permanent place in the poultry industry of our nation? A bit of history will answer the question. Twenty-five years ago mother hen ruled supreme, hatching her own eggs and

rearing her brood. About this time modern developments in the design and construction of artificial incubators so revolutionized artificial hatching that poultrymen, appreciating the advantages possessed by the machine over the hen, rapidly adopted the incubator and made it a part of their permanent equipment. At first the machines were rather crude, but soon were developed in size and efficiency until about ten years ago the advent of mammoth incubators in a more or less perfected form, especially as to simplicity of construction and operation, insured their general use in all large poultry enterprises.

Like the last straw which broke the camel's back, the mammoth incubator was the last factor which broke forever the undisputed rule of the hen, for it made possible the hatching of unlimited numbers of chicks at any season of the year. It made possible our present baby-chick industry, also our large commercial egg farms; and it was largely responsible for the great increase in the poultry

population of our country, for without artificial methods enabling the production of maximum numbers at a minimum of labor these developments could not have been so rapid. There are single hatching plants in the United States to-day which turn out half a million chicks for one season's delivery. Think of doing this with old mother "clucker." If you are not convinced, figure out the number of hens it would take and the labor it would require, and then remember that there are thousands of farms and hatching stations turning out chicks in lesser numbers. Here we have the reasons which made possible this rapid development of the baby-chick trade. As a business, what are some of its peculiar features?

Though baby chicks are produced to a considerable extent on most commercial breeding farms, the industry—as a distinct branch of poultry husbandry—is centered in specialized hatcheries where nothing is done except to operate mammoth incubators. At most of

these hatcheries no adult birds are kept and no stock is brooded or reared. In such instances, the eggs for hatching are contracted for from general farms and poultry flocks in the vicinity of the hatchery. A small premium is paid for selected eggs, and in most cases the hatchery exercises a supervision over the mating and breeding on all farms from which eggs are purchased. This is done to insure quality of stock and proper "hatchability" of the eggs. Some few hatcheries maintain large breeding flocks, but this is not the rule. Though specialized hatching plants exist in many scattered communities throughout the country there are two sections in which this industry is especially intensified. These are Hunterdon County, New Jersey, in the vicinity of Frenchtown, and throughout the state of Ohio. The latter has the distinction of being the leading state in baby-chick production.

A modern chick hatchery consists of large incubator cellars adjacent to a packing and

shipping room. They do not as a rule require extended acreage. They are generally located in or near a city or large country town in the midst of a poultry-raising community. Adequate railroad facilities for shipping out chicks and an abundant supply of hatching eggs nearby are requisite.

Prices Vary With the Season

When ordering chicks, first decide upon the time of year and the number desired, remembering that it is better to have chicks hatched relatively early than too late. The number of chicks needed will be largely determined by the number of pullets desired for layers in the fall. A safe rule is to order at the rate of two and one-half chicks for every pullet desired in the fall. The difference is caused by mortality, culling the weak and the elimination of the cockerels. Next, choose a reliable breeder or hatchery with whom to place your order. Buy from a firm that has an undisputed reputation for qual-

ity and service. Choose an old reliable establishment, one with proper responsibility and financial standing. If the eggs are produced on the farm where the chicks are hatched it is an added advantage, as they are more apt to be produced by properly selected breeders.

Orders should be placed early to avoid delay and to insure definite shipping dates. A deposit of at least one dollar for every one hundred chicks ordered is generally required and the balance of the purchase price must be paid at least one week before shipment. No chicks are ever sent until fully paid for and no orders are sent C. O. D. Owing to the general advance in the cost of production, due to causes growing out of the war, prices for baby chicks have advanced proportionately. Prices vary considerably with the season and with the quantity ordered. They are more expensive early in the season and materially cheaper during late May and June. Prices are also much reduced if large numbers are purchased.

The cost of chicks varies with the different breeds, the light, active Mediterranean or egg breeds being cheapest. Their eggs hatch better, making the chicks cost less to produce. In the case of the heavier brown-egg American and English breeds the cost is somewhat higher. During the average season prices range from ten to thirty cents a chick, depending upon the time of year, the breed and the quantity purchased.

An interesting relation exists between the cost of hatching eggs and the resulting chicks. A chick should sell for double the cost of the egg from which it was hatched plus 20 per cent. For example, if hatching eggs are selling for ten dollars a hundred, chicks should be sold for twenty dollars plus 20 per cent. of ten dollars, or twenty-two dollars a hundred. This allows for a 50 per cent. hatch plus the overhead expenses of the hatching equipment, together with the cost of labor and fuel.

The profit to the breeder depends upon

getting good hatches, everything over a 50 per cent. hatch meaning clear profit.

Baby chicks are usually shipped on the morning of the twenty-second day after the eggs are placed in the incubator. With brown eggs it may require an extra day, especially early in the season. This means that the chicks are shipped just as soon as they are dried off and upon their feet. They are placed in specially built, standard-size, corrugated pasteboard boxes. These boxes are made in twenty-five, fifty and one hundred chick sizes. The fifty-chick box is subdivided by a middle partition into two compartments and the large one-hundred-chick box into four compartments, thus providing for not more than twenty-five chicks in any one compartment. This has been found the best number, to avoid loss from smothering and yet maintain sufficient body warmth. The chicks in the boxes during shipment are provided with fresh air through small openings punched in the sides and top. The boxes

are provided with reënforcing strips extending beyond the ends to prevent their being piled tightly together, shutting out air and causing smothering. A little cut clover or alfalfa is sometimes scattered on the bottom of the boxes. No feed or water is provided during shipment, as the chicks do not require solid feed for from forty-eight to sixty hours after hatching. The yolk of the egg, which is drawn into the chick's body just before hatching, furnishes nutriment of just the required kind during this time.

Properly hatched and packed for shipment chicks will travel hundreds of miles with no ill effects from such a long and early journey. Injury through carelessness in handling may happen as a result of leaving them in an exposed place during severe cold weather, or the reverse being the case, they may be injured by being piled too close together for a considerable time in a warm room. Frequent transfers at junction points

are the hardest experience to which the chicks are generally subjected.

If they are handled carefully and the boxes kept right side up this may not be serious, but if they are thrown round or tipped on end many chicks may be crushed. To prevent injury from this cause the boxes are sometimes tied together, from two to four boxes being made into one package.

Up to the spring of 1917 baby chicks had always been shipped by express, but owing to the extreme losses and failure of the express companies to handle the business properly, the Post-Office Department was appealed to and baby chicks were allowed to travel by parcel post. The results were most gratifying and the whole post-office organization has received the heartiest commendation for stepping into the breach and saving the baby-chick industry.

The first requirement of the early hatched chick is warmth. They are hatched at a temperature of 102 to 105 degrees and they must

be allowed to get used to lower temperatures gradually. For this reason, as soon as they are removed from the chick boxes, they must be put under a heated hover, which has previously been prepared by being regulated to maintain a temperature of from 95 to 100 degrees, and on the floor of which are chaff and fine grit.

For the first few days the chicks must be confined near the heated hover until they learn where the heat is, thus preventing chilling and crowding, which result in suffocation and digestive disorders. For small flocks of chicks kerosene-heated hovers with a capacity of twenty-five to seventy-five chicks are satisfactory. For large flocks of 200 or more the coal-burning brooder stove is by far the most satisfactory.

If possible, sour skim milk should be given the chicks for their first drink, as it is highly digestible, very palatable and cleansing to the digestive tract. Fresh water should be provided all the time in convenient vessels.

Rules for Handling Baby Chicks

Feed little and often, should be the rule. It is best to start feeding five times daily, dividing the feeding periods equally throughout the day. During the first few days nothing but fine cracked grain should be given them. A good mixture can be made by mixing equal parts of fine cracked corn, cracked wheat and pinhead or steel-cut oats.

As the chicks get older this ration must be supplemented by a proper dry-mash mixture kept before them all the time. Any tender succulent green feed can be fed to young chicks, sprouted oat tops being useful early in the season. Avoid overfeeding; keep the chicks busy and hungry.

If the ground is dry and the weather suitable, the youngsters should be let out of doors when they are a few days old. If the run is covered with green grass, preferably clover or alfalfa, it is an added advantage.

Order chicks early from a reliable firm or

breeder, thereby insuring delivery at the proper time.

Immediately upon their arrival remove the chicks to a properly heated and suitably equipped brooder.

Avoid chilling and crowding by maintaining proper hover temperature.

Early in the season avoid chilling of chicks and late in the season avoid overheating.

Feed chicks sparingly at first by keeping them busy and slightly hungry.

Keep the brooder clean and in a sanitary condition all the time.

The baby-chick industry has revolutionized poultry production, making possible unanticipated development and growth—both through the ease with which large flocks may be developed and maintained and also through the ease with which the beginner may be certain of achieving a sound and successful start.

CRITICAL DAYS IN THE BROODER

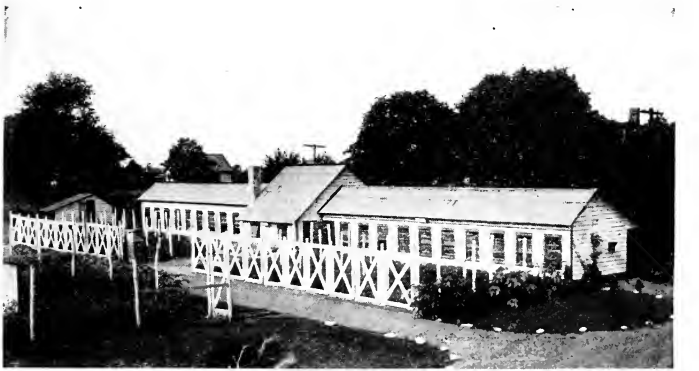
WHEN THE FUTURE OF THE FLOCK DEPENDS ON EXPERT CARE

As the chick is nourished and developed during the early days of the brooding period so will its size and producing ability in adult life be determined.

"What is the weakest link in the whole chain of my poultry management?" is the question so often asked by even the most successful poultry raisers. "What are the causes of failure and lack of success with chickens?" is the form in which the same question is put by inquiring amateurs.

There is but one answer. Poultry are relatively short-lived, the average profitable life of a hen being but two years; so they must be replaced frequently. Succeeding generations, comprising in number from 60

A BATTERY OF SMALL KEROSENE BROODERS
Just the thing for brooding small flocks on the farm or in the suburban district



AN INTENSIVE PIPE BROODER HOUSE
Just the thing for commercial poultry growing

to 75 per cent. of the entire flock, must be produced each year if the enterprise is to be permanent and profitable. The weakest link in the poultry chain and probably the one factor which is most often responsible for disaster is the failure on the part of the poultryman to produce these new generations of layers with the regularity and of the quality which are desired.

The ultimate size and vigor of the cockerels and pullets are determined by the start which they get in the brooder. With the proper start well-developed adults are assured if continuous growth is maintained. A uniform, continuous growth from hatching time to maturity is the aim. This growing age naturally divides itself into two distinct periods—namely, the brooding time and the rearing period.

Brooding occupies the first eight to ten weeks immediately following the hatching of the chick. It is the time during which the chick must be provided with heat in

brooders. It is that age when the orphan chick with the metal brooder for a mother must be taught by proper handling many of the lessons which in former periods of less intensive practices were taught so successfully by the mother hen.

The rearing period extends from the time the chicks can do without heat, when they are placed on range, until they reach maturity and are given their permanent places in the laying houses. We are especially concerned right now with the details of care during this early brooding season. Let us see how we can give these youngsters the right start, how we can strengthen the weakest link in our entire poultry organization.

Importance of Heat Control

Proper provision must be made for the control of the temperature in the areas to which the chicks are confined. An efficient brooder will provide at least two different temperatures to which they can go at will.

These are: A heated hover where the chicks can warm up quickly and, adjacent to it, a cool compartment or room where they will spend much of their time after the first few days. The following hover temperatures have been found to be the best for the average brooder: Start the heat at 98 to 100 degrees under the hover; during the second week run it as nearly as possible at 90 to 96 degrees; during the third week slightly lower, say about 90, and during the fourth week a hover temperature of 85 degrees is sufficient. The object is to have a sufficiently high temperature to avoid chilling, yet not hot enough to weaken the chicks.

Tests conducted at the New Jersey Agricultural Experiment Station show that an exceedingly high brooder temperature continued for many days will lower the vitality of the brood and cause a heavy mortality. The temperature should be as uniform as possible all the time. The same tests demonstrated that extreme variations in tempera-

ture within a short period of time caused a very high mortality, as the chicks could not adjust themselves to such wide changes.

A good way to determine the proper temperature is to keep the hover just hot enough so that when the chicks are under it at night they will spread out over the floor without crowding. If the heat is too high they will extend their heads and pant; if it is too cold they will bunch up near the stove or heat-pipe. In this condition those underneath the pile will become suffocated, while those on the outside will be chilled.

The size and type of brooder will determine to a great extent the exact temperature and the degrees of variation which can be allowed. For example, in small, lamp-heated brooders, which have a capacity of fifty chicks, the temperature must be maintained at a very even and correct degree; while in the large brooder stoves, where the chicks can at will get away from the extreme heat near the stove, considerable variations will not

prove harmful. As it gets hotter or cooler the chicks can select the proper degree of heat by regulating their distance from the stove, which is impossible in the small individual hover where they are confined to a very limited area directly under the hover itself. A correct, uniform temperature is one of the first requisites in successful brooding.

The effect of sunlight's shining into the brooder or hover compartment should be studied and steps taken to regulate it to prevent undue crowding. It is not well to allow small patches of sunlight to strike on the floor, for all the chicks will try to crowd into these spots with disastrous results. Floods of sunlight produce no such effects; so have an abundance of sunlight shining into the brooder house or else no direct rays at all Sunlight should never shine directly upon the hover, as it causes a great variation in the temperature.

Proper rations correctly fed are of equal importance in brooding. Failure to feed

properly is responsible for digestive disorders and slow growth. A chick's likes and dislikes are few; he eats anything and everything placed before him. This is especially true during the first few weeks; so close attention on the part of the feeder is required. This is the most critical period, and mistaken methods will surely result in poor broods. Proper nutrition is primarily responsible for that uniform, continuous growth which we have said must be attained if the pullets are to be properly matured for egg production the following fall and winter.

Experience has taught that the following are the fundamental factors which must be given consideration in the feeding of brooder chicks: Do not feed too soon. Just before hatching, all that remains of the yolk is drawn into the chick's body; this provides the baby chick with nutriment of the proper kind for a number of hours after hatching. It is undesirable to force chicks to consume concentrated feed during a period of from

forty-eight to sixty hours after hatching. This pause gives the yolk material time to be partly digested, thus preparing the digestive system of the chick for the more concentrated feeds which will follow. The best practice is to supply sour skim milk and plenty of fine grit when the chicks are first moved into the brooder, giving them no grain or other solid feed until the next morning.

The first feed given should be easily seen and nutritious. The young chick, artificially hatched, has to be taught many things which under natural conditions it learns from the mother hen, such as searching for feed. The natural instinct of the baby chick is to pick up bright things, for the reason that they are easily seen; and what is easily seen is desired. A good practice is to throw a limited amount of rolled oats—what the youngsters will clean up in an hour or two—on the brooder floor. Rolled oats are very nutritious, are relished by the chicks and make an excellent first feed, but their continued use in

any considerable amount is not advisable. Hard-boiled, infertile eggs from the incubator mixed with bread-crumbs are often used as the first feed.

A Safe Rule for Feeding

Plenty of fresh water is necessary. The chicks gain in weight very rapidly early in life and much of this gain is due to the increase in the water content of their bodies. In order to maintain a pure supply of water, change it daily and rinse all vessels frequently. Wheat bran is relished by the chicks and should constitute a considerable part of their diet during early growth. Bran contains much ash, is slightly laxative and is easily digested. A little dry granulated bone added to the mash will increase the amount of available ash which is so necessary to grow the bony framework of their bodies properly.

Feed little and often, is a safe rule to follow. Owing to the small size and capacity of the digestive tract and the heavy feed re-

quirements in proportion to the weight of the chick, frequent feedings of small amounts are necessary. Feeding the newly hatched chick as often as five or six times daily is commonly practiced. Avoid wet, sloppy feeds. Dry grains and mashes are the safest and the most efficient. Some animal protein in the form of meat scrap or skim milk must be given in order to provide the materials to make flesh.

Plenty of succulence in the form of green growing grass, sprouted oats, chopped vegetables or lettuce should be abundantly supplied. For this reason, get the youngsters out of the brooder house onto a green-grass range just as early as possible. If the weather is suitable, this may be done at from three to seven days of age, for short periods at first, lengthening the time as the chicks learn where to go to find heat and feed. The object during the entire brooding period is not to feed for phenomenal growth, but rather to get the chicks through a critical

period with strong bodies and vigorous constitutions.

The following schedule will serve to outline the proper procedure in feeding the chicks during the first eight weeks. It is not a fanciful dream, but the actual methods followed in brooding four thousand chicks, under coal-stove hovers, at the Vineland International Egg-Laying and Breeding Contest during the spring of 1918, with a resultant efficiency of 84 per cent. of brood.

First Eighteen Hours in the Brooder.—Fine grit and shell in abundance, with a constant supply of sour skim milk always before them. Short-cut alfalfa or clover on the brooder floor.

Second Day in the Brooder.—Oatmeal fed sparingly three times during the day, the sour skim milk being continued.

Third to the Seventh Day.—Begin keeping drinking water before them. Feed the following cracked grain ration five times daily, giving only what they will clean up

between feedings, so that they will be hungry at each suceeding feeding:

	Pounds
Fine-cracked corn	100
Cracked wheat	100
Steel-cut or pin-head oats	100

Supplement this ration with hard-boiled eggs once daily, at the rate of one egg to every three hundred chicks. Sprouted oat tops or other greens may be fed sparingly once a day. Continue the sour milk at least until the third week, and throughout the rearing period if possible.

Seventh to the Fourteenth Day.—Start feeding wheat bran in small hoppers, getting them used to it gradually by removing the hopper for the first few days after about one hour of feeding. Omit the noon grain feeding when giving the wheat bran.

Third to the Eighth Week.—Continue feeding chick scratch ration three times daily, morning, noon and night. When the chicks are about six weeks old a coarser scratch

ration should be gradually substituted for the fine chick scratch. Supplement the scratch ration with the following dry mash in place of the wheat bran which has been fed during the second week:

	Pounds
Wheat bran	300
Wheat middlings	100
Corn meal	100
Gluten feed	100
Ground oats	100
Meat scrap	100
Milk by-products	100

In the above mash the milk products suggested are dried buttermilk and milk albumen; if liberal quantities of liquid skim milk are given the dry milk products in the mash may be eliminated. In the absence of regular sour skim milk, semi-solid buttermilk fed as a beverage will be found an exceptionally fine substitute. Feed sparingly of grain after the fifth week, compelling the chicks to consume considerable quantities of

mash. The pullets produced by the above method of feeding are now making an unbeaten record of high and sustained performance in egg production.

Segregate the Sexes

When the chicks reach the age of six to eight weeks and it becomes easy to separate the pullets from the cockerels, the sexes should be separated if the best growth and development of each lot is to be secured. The pullets will soon be transferred onto the range where they will be handled for growth and proper maturity. The cockerels should be fed a finishing ration, and after the few which will be needed for breeding are selected the balance will be sold as broilers or put on range and matured for roasters. If Leghorns are the breed kept the surplus cockerels surely should be sold as broilers at about eight to ten weeks old, or when they reach a live weight of a little over one pound.

As the season advances the market demand

is for a somewhat larger bird, so they must be held longer if hatched late. Since the price almost always drops in late June, these cockerels from the late hatches rarely return much profit. With the heavier American breeds the growth of the cockerels for roasters, if sufficient range is available, is probably the best and most profitable plan.

After separating the cockerels which are to be sold for broilers the plan should be to confine them to separate brooder yards and feed them for a week or two special rations designed to put on a maximum growth of flesh of fine quality. Such a ration should be fed as a moist mash and should be supplemented with only small quantities of scratch grains. An excellent finishing ration for broilers is the following:

	Pounds
Wheat bran	100
Corn meal	100
Flour middlings	100
Ground hulled oats	100
Meat scrap	100

Mix this mash with sour buttermilk or skim milk and feed in troughs. Grit may be added to the amount of 5 per cent. of this mixture to aid its digestion. After feeding twice daily, morning and night, with a small grain feeding at noon for about seven to ten days, the cockerels will be in prime condition for market and should be shipped immediately, before they begin to go back and show a loss rather than the desired gain.

A hint here and there will often help to eliminate some labor and to insure greater efficiency in the care of brooder chicks. An elevated platform or table about four inches high on which to place mash boxes and drinking fountains will help to keep them clean and free from litter, and can be used after the chicks are one week old.

A roll of inch-mesh wire about two feet wide, if set in a large circle about the hover of the coal-burning stove each night when the chicks are young, will prevent crowding in the corners of the house and will show the lit-

tle rascals where to go for their heat. After using this for a few nights an inspection after dark will show the chicks to be lying in a perfect ring about the stove, at such a distance from it as to give them the desired temperature. This circle of chicks has been designated by the poultry fraternity " the doughnut," from the circular position which the chicks take if the temperature is correct.

A temporary yard adjacent to the brooder house, made of specially constructed wire-covered frames, will confine the chicks close to the house when first let out on the grass and will guard against their straying away and getting chilled. After it has been used for a few days it may be removed to another house, and the chicks given unobstructed run. They will, with very few exceptions, return to their own house each night.

Outdoor Training

When the chicks are five weeks old it is well to provide the brooding yards with large

outdoor hoppers in which dry mash may be kept. By having this mash available out of doors they will consume more of it. Likewise the water supply should be well distributed to insure a greater consumption.

A catching box about eighteen inches wide and two feet long, made of a frame covered with one-inch-mesh wire, will be found very handy about the brooder house in catching and transferring chicks and in separating the sexes. One end should be fitted with a slide door into which the chicks can be driven when the box is properly placed in a corner of the brooding pen.

Plan a definite system in all the operations of caring for the chicks, and then follow it. Try to eliminate unnecessary steps, yet be sure that all the necessary wants of the youngsters are attended to. Confinement of the chicks in exceedingly high temperatures will result in weakness and lingering deaths.

Chilling is disastrous, through immediate deaths from suffocation and resulting mor-

tality from weakness and digestive disorders.

Cannibalism, if allowed to develop, will cause heavy loss and disaster to the brood. It can be checked by getting the chicks out of doors and by darkening the brooder house.

Diarrhœa can be checked and prevented by the liberal feeding of sour milk and by the prevention of chilling.

Harden the chicks off gradually by getting them used to a lower temperature before they are transferred to unheated houses. Failure to do this will cause even three-month-old pullets to crowd and die from weakness and suffocation.

From the baby chicks which are hatched and brooded each spring will come the next season's pullets. From these pullets must come the eggs which in turn are to be the money crop.

The early life of the brooder chick is the weakest link in our poultry chain. Let's strengthen that link.

THE SECRET OF BETTER CHICKENS

ARE YOUR PULLETS UP TO THE WEIGHT FOR THEIR AGE?

MANY poultry raisers are looking to increase their flocks; many are the amateurs who are planning to make a real start with chickens. Much of the success of these efforts is going to depend upon the quality and vigor of the resulting pullets when it comes time to put them in the laying pens this fall.

Poultry raising is no more successful than the weakest link in the chain of poultry practice which is followed. In poultry operations, no matter how large or how small, this weakest link is most often the failure successfully to rear to maturity the required number of healthy, well-grown birds to replace the old hens, the majority of which must pass on at the end of the first or second year's laying to the boiling pot or the stewpan.

We hear a great deal to-day about breeding improved strains of producers; but no matter how carefully one's birds are mated and bred, if proper growth and unhindered development are not assured in the offspring they will not develop to the fullest extent those desirable traits which they have inherited from their parents. Hence improvement through breeding must be accompanied by proper growth. This applies equally to the fancier who is breeding for perfection of plumage and to the producer of high-quality table poultry. The problem of the breeder is to handle and care for the growing stock during the summer so as to insure a uniform, continuous growth and development from hatching time to maturity.

In the light of past knowledge it was supposed that if a feeder knew the protein content of the feeds he was using and if he knew their energy value and their digestibility, it would be possible and simple to plan an adequate and satisfactory diet. The present

THE RANGES AT THE VINELAND CONTEST

Each house holds one colony stove and 300 chicks. This system can be adapted to any kind of poultry raising. Just look at the range!

practice among feeders of figuring rations on the basis of nutritive ratio and energy value is based entirely upon these older ideas of feeding. Very recent investigations show that correct feeding is the vital problem affecting growth and development.

The Value in Green Feeds

Dr. E. V. McCollum, of Johns Hopkins University, formerly of the University of Wisconsin, together with his co-workers, has recently discovered certain fundamental truths underlying the whole question of nutrition and growth. These investigations have demonstrated that we must have a much wider knowledge regarding the content of feeding stuffs in order properly to plan our rations and methods of feeding. The most notable development resulting from this newer line of thought has been its bearing upon growth and the value of certain feeds for the young.

It was early discovered that animals will

not grow normally on a diet of whole grains alone, such as corn, wheat or oats. These feeds are known to be perfectly wholesome and good, yet when an animal is restricted to them it simply cannot grow. The complete studies, including all kinds of types of feeding stuffs, have demonstrated that there are certain unknown properties about some feeds which give them the power to make the young animal grow and develop normally. These obscure properties have been termed vitamines.

What is of special interest to all poultry feeders are the available sources of these products. They are found in milk, in the yolks of eggs and in the green leafy parts of plants. These three feed products have been termed by Doctor McCollum "protective feeds," because they are so constituted as to make good whatever deficiency exists in rations composed of seeds, by-products and roots, with or without meat. The effect upon animal growth of the presence or absence of

these feeds which contain this unknown but very necessary property can be best exemplified by quoting the general results of some recent experiments conducted by Doctor McCollum.

There are two distinct types of unknown substances which exist in these so-called protective feeds, both of which are essential to proper growth and development. The first substance is found to exist in butterfat and egg yolks, and the effect of its presence or absence has frequently been demonstrated by feeding young animals for a certain period on normal complete rations containing these products, during which time they will grow normally. If, however, all butterfat or egg yolk is withdrawn from the ration, growth stops immediately. The tissues round the eyes soon become swollen; within a few days the eyes will be entirely closed, and within a few weeks, if this deficient ration is continued, the animal will die. If at any time within a few days before death butterfat or

egg yolk is again supplied to the ration the animal will start development, the eye trouble will disappear, and if the injury to the eye has not progressed too far the animal will soon resume normal appearance and function.

The second dietary essential is found in the tender leafy growth of plants. We have learned that a lot of young animals fed on normal rations with plenty of succulence will develop normally; but if we withhold from the ration nothing except this second unknown, they will cease to grow. Nothing will happen to their eyes, as in the former instance, but in the course of a few weeks or even a shorter period it will be noticed that they drag their hind legs, and unless the condition is corrected death is pretty sure to follow in a short time. This condition can be avoided and corrected, if taken early enough, by the feeding of a liberal amount of leaves, especially thin leaves, such as alfalfa, clover, celery tops, and so forth. The application of

these findings to successful poultry raising is definite and easy.

Applying the results of these interesting discoveries to the practice of feeding growing poultry, we find the following products must be given special prominence in the diet: No effort should ever be made to raise chickens unless they can run over an extensive range on which an abundance of green feed is growing. In addition, the growing chickens should be fed liberal quantities of milk or milk by-products. Infertile eggs from the incubators can well be boiled and fed to the chicks during their early growing period. The inclusion of all these three products will insure vigorous, healthy, well-grown pullets which will develop their inherited traits and become productive, profitable adults.

To meet these three conditions in practice may be sometimes a problem, but unless it can be done it is rarely profitable to attempt to grow pullets. The following description of range practices is an explanation of the

methods used to rear over two thousand pullets at the Vineland Egg-Laying Contest during the spring of 1918. These practices were worked out to include the latest of Doctor McCollum's discoveries, and the success of this method can best be tested by a study of the tables showing the gains made by the birds, and also by studying the wonderful production which these pullets have made in the contest pens during the winter of 1918–1919.

The growing ranges are located on an area of considerable size. Fairly low ground was selected in order to insure an abundance of tender green grass during the hot, dry summer. The area used provided range room of one acre for each three hundred pullets grown to maturity. The range was kept in permanent sod, alfalfa being used exclusively. Birds at the rate of three hundred growing pullets per acre have ranged over this field for three years without injuring the luxuriant alfalfa.

Where it is impossible to provide such a large permanent range and the birds must be kept under more intensive conditions, it is frequently necessary to plow and re-seed the ranges each year in order to keep them in a sanitary condition and in order to provide the adequate growth of greens necessary. When such practice is necessary it is well to divide the range into two or three equal areas, growing the winter cover crop of rye or wheat on one. The colony houses are best located on this plot, so that the chicks can be let out early in the spring on the fresh green pasture.

Adjacent to this area peas and oats may be seeded early, providing spring greens in abundance. The balance of such small range areas can well be seeded to rape, which will provide a continuous supply of succulence through the summer.

At Vineland the chicks were brooded in colony houses equipped with coal-burning brooder stoves, the houses being located on

the summer range in their permanent position. As soon as the cockerels were sold, at about twelve weeks of age, the stoves were removed and the pullets reared in these same quarters, which practice reduced expense and insured perfect range conditions. Whatever the exact plans, always avoid small areas with bare yards.

Chickens, like all young animals, require an abundance of leafy plants for a considerable part of their diet. Nearly every raiser of poultry remembers the experiences he has had in the past with leg weakness and slow growth. Green ranges provide the elements in the ration which prevent these weaknesses and which the chicks cannot get from any other source.

Why Milk Is So Good

We learn that milk products are equally essential because they provide another dietary property without which proper growth cannot be maintained. Skim milk is prob-

ably the best. It contains a limited amount of fat and much casein. Buttermilk is probably equally as good. In the absence of these two milk products there are a number of by-products which are available. At Vineland, last season, semi-solid buttermilk was used until the chicks were nearly four months old. This product is buttermilk dried down to the consistency of cream, which can be diluted with water and fed as a beverage. Dry buttermilk was also fed throughout the growing period in the dry mash. Other dry milk products which can be used are milk albumin and milk powder; but with many the price is prohibitive.

The question which will be asked by most feeders is the relative advantage of liquid *vs.* dry-milk products and the advantages of sour *vs.* sweet milk. It can be said without hesitation that the liquid milk is probably superior to the dry powder, especially when feeding very young chicks. They seem to

relish it better, and it has a stimulating effect upon their appetites.

It is generally recognized that sour milk is superior to the sweet for two reasons: First, because the sour product, containing lactic acid, is slightly more palatable and acts as an internal disinfectant, cleansing the digestive tract and killing certain undesirable types of bacteria. Sour milk has been found by actual tests at many experiment stations to be more easily and completely digested than sweet milk. It is further impossible to feed the milk sweet all the time, for in warm weather it will sour quickly and it is unsafe to feed the product first sweet and then sour. The writer, after years of experience in rearing thousands of pullets, can say without hesitation that he would question his ability to brood and rear successfully without a liberal supply of sour milk.

Eggs provide the same missing element in the growing ration which milk does, yet, owing to their expense they cannot be ex-

tensively used. At Vineland the growing birds were fed all the infertile eggs taken from the incubators throughout the spring. Such eggs can be hard boiled and fed in moderate quantities, but be sure that they are cleaned up and not allowed to become sour and moldy. Eggs are highly palatable and are relished by growing birds. They also contain much digestible food material in addition to this unknown food property without which the young cannot grow.

There are few poultrymen who have figures to show just what the normal rate of growth of pullets should be. The following table, No. III, A, compiled from experimental work at New Brunswick, New Jersey, during the past few years gives in tabulated form the normal growth and development of young growing poultry which were cared for normally but which did not receive milk or milk products and were not given the advantages of luxuriant green forage. These figures were secured before our knowledge

regarding the importance of milk and green leafy plant growth was as well developed as it is to-day.

TABLE III

A

Growth which chicks and pullets could be expected to make on limited range with restricted green forage and no milk.

Age	Weight of 100 chicks: American breeds pounds	Leghorns pounds
Hatching time	8	8
First week	10	10
Second week	13	15
Third week	21	23
Fourth week	30	33
Fifth week	41	42
Sixth week	49	54
Seventh week	65	71
Eighth week	78	87
Ninth week	93	102
Tenth week	108	116
Eleventh week	129	132
Twelfth week	140	141
Pullets only		
Thirteenth week	150	132
Fourteenth week	164	151
Fifteenth week	193	172
Sixteenth week	218	188
Seventeenth week	255	196
Eighteenth week	300	210
Nineteenth week	325	225
Twentieth week	338	238
Twenty-first week	360	262
Twenty-second week	370	281
Twenty-third week	381	297
Twenty-fourth week	385	301

B

Growth which the chicks and pullets at Vineland Contest made on alfalfa range, plenty of milk and the best of care. Spring of 1918.

Age	Weight of 100 chicks: American breeds pounds	Leghorns pounds
Hatching time	8	8
First week	10	12
Second week	15	16
Third week	24	28
Fourth week	42	45
Fifth week	62	68
Sixth week	87	92
Seventh week	105	112
Eighth week	134	135
Ninth week	155	150
Tenth week	175	165
Eleventh week	190	173
Twelfth week	204	177
Pullets only		
Thirteenth week	210	182
Fourteenth week	230	190
Fifteenth week	250	205
Sixteenth week	285	223
Seventeenth week	312	240
Eighteenth week	340	260
Nineteenth week	365	279
Twentieth week	377	304
Twenty-first week	390	315
Twenty-second week	402	323
Twenty-third week	405	329
Twenty-fourth week	410	335

Table No. III, B, shows the gains made by the 2000 pullets at the Vineland Contest,

cared for in such a way as to be given every benefit of our present-day knowledge regarding the value of these protective feeds. In addition to the feeds previously mentioned, these Vineland pullets were given access to the following dry mash which was at all times available:

GROWING MASH

	Pounds
Wheat bran	300
Wheat middlings	100
Ground oats	100
Corn meal	100
Gluten feed	100
Meat scrap	100
Dried buttermilk	100

They were given a scratch ration composed of equal parts of wheat and cracked corn. They consumed during the growing period practically equal parts of mash and grain and made the remarkable growths shown in the accompanying charts and tables for pasture-milk fed and grain-fed lots.

We are never too old to learn. New

things are being developed constantly. The poultry grower who keeps posted and up-to-date in his every practice has the edge on his more conservative neighbor. Here is the lesson: Give the growing chicks an abundance of green range, preferably alfalfa or clover. Feed milk liberally as a beverage, supplemented with powdered buttermilk. Never let the infertile eggs from the incubators go to waste; boil them and feed to the chicks.

Are your pullets up to weight for their age? If not, why not? Probably you are not giving them a naturally balanced ration.

THE OPEN-FRONT POULTRY HOUSE

ITS RESULTS ARE A FULL EGG BASKET AND A HEALTHY FLOCK

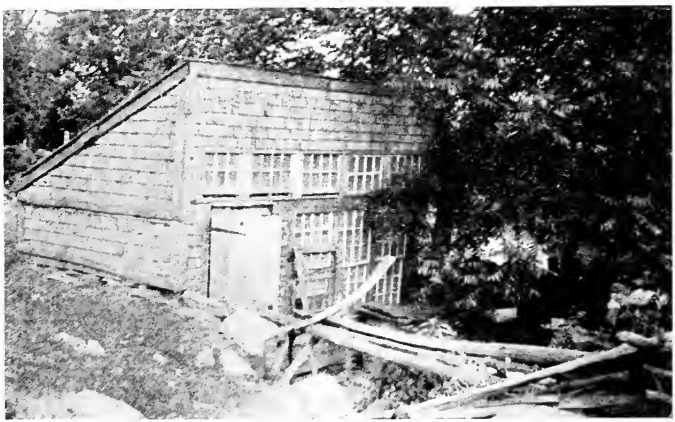
PRIMITIVE man, living at first in the open, made no effort to build for himself a home or permanent shelter, but preferred to dwell alone, a law unto himself and the mortal enemy of his neighbor. The lapse of years has seen this primitive being pass through successive stages of human development and progress, until he has reached his present degree of civilization and enlightenment. The progress of civilization can be measured in large part by the development and elegance of the shelters, or homes, in which man lives and the appliances for his convenience and personal comfort.

The domestication of fowls, including their

development and care, has kept pace with man's progress. We find the original jungle fowl running wild with no shelter but the branch of a tree or a secluded bush. Later history describes the gradual stages in their domestication and we get fleeting glimpses of crude attempts to provide simple shelters for small flocks of birds even before the beginning of the Christian era. During the last century rapid strides have been made in the care and management of all livestock, especially of poultry.

To-day the housing problem and sanitary practices have been improved to such an extent that large flocks are being kept with perfect safety in close confinement in specially constructed and well-planned houses. The intensive practices of modern times have made it necessary to pay careful attention to sanitation, ventilation, sunlight and temperature control, which never would have been necessary under the isolated conditions to which the wild fowls were accustomed.

A MULTIPLE UNIT LAYING HOUSE
It can be adapted to any number of birds by building to any length desired



THE ALL-TOO-COMMON FARM POULTRY HOUSE
Not enough ventilation, too much glass and damp

Guarding Against Moisture

A satisfactory egg production is the surest step to profits. Health is the first requisite for such production. A sick hen will not lay or pay. The best guaranty of health and production is a congenial, clean environment; an environment that keeps the hens dry, insures to them plenty of fresh air, allows of their spending much of their time when confined to the house, scratching and dusting in the warm pleasant rays of a winter's sun; an environment which will keep them sufficiently warm without excessive moisture and dampness. The average flock of hens is best confined to its quarters during the cold, wet winter weather; which means that special precautions must be taken to insure that biddy shall be kept in a healthy, happy contented frame of mind.

Only by knowing the requirements of the birds, the principles governing health and the practical problems of building proper poultry houses, can the poultry keeper of to-day

successfully meet modern intensive conditions and present-day competition. The farm flock, the city flock and the commercial flock must be housed with the same principles in mind. What are these principles?

Years of experience in sheltering laying flocks has demonstrated the fact that hens do not like to get their feet wet nor do they like to be kept in damp quarters. Under such conditions disease will soon break out and production will drop to nearly nothing. There are just three kinds of moisture against which we must guard when we are building poultry houses.

The most common and harmful is condensation moisture, which is caused by the moisture in the air in the house being so plentiful that with certain temperature conditions it will condense and hang in drops on the walls and rafters. It moistens the litter and makes the house damp and musty. This condition can be prevented by having the house well ventilated, by building it so that much of the

front wall will be entirely open, provided with only a muslin curtain, which can be lowered in very cold or stormy weather. Such a curtain, even when shut, allows plenty of fresh air to enter the house, but stops all drafts and keeps out driving snow or rain. The large amount of open front makes it possible for the impure, poisoned and moisture-laden air to pass out quickly and be replaced with fresh air laden with oxygen.

In building the poultry house a substantial foundation and floor must be provided, preferably of concrete, and so constructed that no ground or surface water can work up through the floor and dampen the litter; also that no surface water will flow round and into the house during spring freshets. This means that the wall on which the house is built must be at least six or eight inches above the surrounding ground level, also that the floor, if built of concrete, must be laid on a thick coat of cinders or gravel to insure drainage from below.

Again, the house should be so planned that driving rain or snow will not blow in and wet the litter. This condition can be avoided by providing the front of the house with a projecting hood, or drip, which is described in the following plans and specifications.

Damp quarters may often be caused by crowding too many birds into a given area. Four square feet of floor space in the poultry house should be allowed each bird. If you want to keep the birds laying and avoid roup, canker, colds and general disability keep the winter quarters dry.

Hens are noted for a relatively high body temperature. This means large requirements for fresh air and plenty of oxygen. Never be afraid of giving the birds too much air, provided the house is not drafty. Old-time poultry houses were made absolutely tight, and what few openings were left in the front wall were provided with glass sash and these were always kept closed, with the result

that sickness, low vitality and non-productivity prevailed.

Birds do not require a high degree of temperature in their quarters, but they must be provided with sufficient warmth in the cold winter days to prevent freezing of comb and wattles. A cold, dry atmosphere is far to be preferred to a warm, moist one; so open up the hen house.

Plenty of sunlight in the poultry house is surely a necessity. It is warming; it lends to the contentment of the flock, and, best of all, it is a natural germ destroyer, making the house a fit place for healthy hens to live in. This is another reason for the open front, and plenty of it. Have the openings in the front walls so placed and of sufficient size that the direct rays of the sun strike on every bit of the floor at some time during the day. Sunlight is the free gift of nature; as a purifier it has no peer; as a tonic it is unexcelled.

Just stop a minute and review the above

requirements of a desirable poultry house and see what it is more than anything else that will insure the proper environment for the birds. Why, sure enough, it is the open front. By its proper use sunlight and fresh air can enter and invigorate the birds without causing drafts and with no harmful effects. Open fronts are the panacea for most of the ills of the poultry house. The truth of this statement has been proven over and over again for, as our friend, Wid Card, says: " What is, is, and can't be any iser."

Keeping Down the Building Costs

Whatever the style of house or the size, convenience in attendance is a principal requirement. The location of doors, the arrangement for opening and closing curtains and the arrangement of the interior fixtures must be such that the work of caring for the birds can be done with the least possible expenditure of labor. Labor is one of the great-

est cost factors in keeping poultry and every plan or means to save labor is earning dollars for the owner.

The poultry house should not be built of expensive material with fancy trimming and superfluous fixtures. Simplicity of design and suitable materials will do much to keep down unnecessary cost and at the same time insure efficiency.

Actual plans and specifications speak louder than words. Here is the way hundreds have built and are building their poultry houses. It pays to bet on a sure thing rather than to take a chance on an experiment. For years there has been a growing demand for a standardized poultry house, capable of housing 100 or more birds, which house will admit under commercial conditions of indefinite expansion along the same lines of construction, to allow for future increase in the size of a plant.

With the purpose in view of working out the plan of such a house, the poultry depart-

ment of the New Jersey Agricultural Experiment Station has for a number of years carefully investigated various styles and details of construction, with the result that the type of house here described has been recommended and with occasional modifications has been adopted extensively throughout the country for farm flocks and commercial poultry production.

The *multiple-unit idea* is standardized on the basis of a one-unit house, twenty feet wide twenty feet deep, having 400 square feet of floor space. Allowing four square feet to a bird, which is the standard allowance, this single unit has a capacity of 100 layers. The shed-roof construction is used and the house is so designed in all its details that it will furnish an ideal environment. The open front is arranged so that plenty of sunlight can be admitted, and provides an adequate means of ventilation. The specifications of the house are so planned that moisture can be entirely eliminated and the

standard unit is plenty large enough for the unit capacity recommended.

Specifications for a 20-by-40 Multiple-Unit House.—For purposes of description, in order to show better the possibility of the multiple-unit plan, a double unit will be used. Where permanent houses are built it is always the best practice to use concrete for the foundation and floor. The foundation trench should be dug about three feet deep and one foot wide. It should then be filled half full of coarse cinders, coarse sifted gravel or crushed stone. This should be tamped thoroughly; the firmer it can be made the better the results.

The form for the wall should next be erected on this cinder subgrade. It should be so built that a finished wall eight inches wide and two feet deep can be poured of concrete, made by mixing one part of cement, three parts of sand and five parts of cinders. The top layer of concrete should be finished with extra cement to give a better wearing surface.

Bolts may be embedded in the wall, which serve the purpose of fastening the sills to the foundation.

The concrete floor should be laid inside the wall and flush with the top. It should be three inches thick, made of the same mixture as the wall, with a one-inch wearing surface made of one part of cement and three parts of sand. The finish coat of the floor should be perfectly level and smooth.

A List of the Materials

The frame of the house can best be built of four-by-six for sills, four-by-fours for posts and two-by-fours for all studding, plates and rafters. The walls can be built of either novelty siding or tongued and grooved boards. The roof and interior partitions and fixtures can best be built of one-inch barn boards. The following list of lumber and material will be required to build a twenty-by-forty house:

LUMBER AND MATERIALS FOR 20-BY-40 HOUSE

Sills, 6 pieces 4″ x 6″ x 20′, hemlock or yellow pine.

Plates, 8 pieces 2″ x 4″ x 20′, hemlock or yellow pine.

Posts, 2 pieces 4″ x 4″ x 14′, hemlock or yellow pine.

Posts, 2 pieces 4″ x 4″ x 18′, hemlock or yellow pine.

Studding, 9 pieces 2″ x 4″ x 18′, hemlock or yellow pine.

Studding, 4 pieces 2″ x 4″ x 14′, hemlock or yellow pine.

Rafters, 21 pieces 2″ x 4″ x 22′, hemlock or yellow pine.

Purlin, 2 pieces 2″ x 6″ x 20′, hemlock or yellow pine.

Frame for nests and dropping boards, 5 pieces, 2″ x 3″ x 16′, hemlock or yellow pine.

For end walls and front, 500 sq. ft. 8-inch novelty siding.

For roof, rear wall and interior fixtures, 2000 sq. ft. 8-inch, tongued and grooved yellow pine boards.

For curtain frames and trim, 200 linear feet 1 in. by 2 in. white pine.

For nests, 100 linear feet 1 in. by 4 in. white pine.

Roofing paper, 1060 sq. ft., or 11 rolls.

Four special sash.

Muslin, 8 sq. yards.

Nails—10 pounds 20-penny wire; 50 pounds 10-penny wire; 20 pounds 8-penny wire.

Hinges, locks, tacks, hooks and wire.
For foundation and floor:
Cement, 35 bags.
Cinders or gravel, 30 cubic yards.
Sand, 5 cubic yards.

The above material will cost, according to present prices, approximately $250. In normal times the entire house could have been built for 88 cents per bird for all material, but to-day the cost will be nearer $1.25 per bird for the same material.

Some special features of the house are a two-foot projection over the front to keep rains and storms from beating in the windows and curtain openings. The back wall is provided with rear ventilation, so arranged that the air can circulate between the rear studding and rafters and enter the house from the back, thus cooling it very materially during excessively hot weather.

The droppings board and perches are arranged along the back wall, and the nests are located under the front of the droppings

board. The interior of the house is divided every twenty feet by a partition running from the back wall to within six feet of the front wall.

The front of the house is built with two glass and two curtain openings in each section. One window in each double section is constructed in the form of a combination door and window clear to the sill, thus making it possible to remove litter and do the work in the pens easier and quicker.

Recent records of performance at the Vineland International Egg-Laying and Breeding Contest have called attention to the excellent housing conditions provided, with the result that the colony laying house in use at Vineland is being widely adopted for small flocks of layers. It has the open front idea developed to its fullest extent.

The Vineland Type of House

The Vineland house is eight feet wide and ten feet deep and has a capacity of from

fifteen to twenty hens. The shed-roof construction is used with a projecting hood over the front eighteen inches wide. The droppings platform is arranged at the back, on one end of which is constructed a broody coop of plaster lath. Most of the front is open, being covered by a large muslin curtain four feet wide and six feet long, hinged at the top and opening up tight against the rafters.

MATERIALS FOR VINELAND HOUSE

Sills, 2 pieces 4″ x 4″ x 8′, hemlock or yellow pine.

Sills, 2 pieces 4″ x 4″ x 10′, hemlock or yellow pine.

Plates, 2 pieces 2″ x 4″ x 8′, hemlock or yellow pine.

Studding, 4 pieces 2″ x 4″ x 20′, hemlock or yellow pine.

Rafters, 5 pieces 2″ x 4″ x 12′, hemlock or yellow pine.

Perches and support, 2 pieces 2″ x 2″ x 12′, hemlock or yellow pine.

Walls, front and sides, 150 sq. ft. 8-in. tongued and grooved yellow pine.

Roof, back wall and fixtures, 200 sq. ft. 8-in. barn boards, yellow pine.

Trim and curtains, 100 linear feet 1-by-3 white pine.

Roofing paper, 200 sq. ft.

Two regular sash.

Hardware and muslin.

The total cost to-day for this house for all material will be approximately $50. These two recommended types of houses will answer all requirements for any flock.

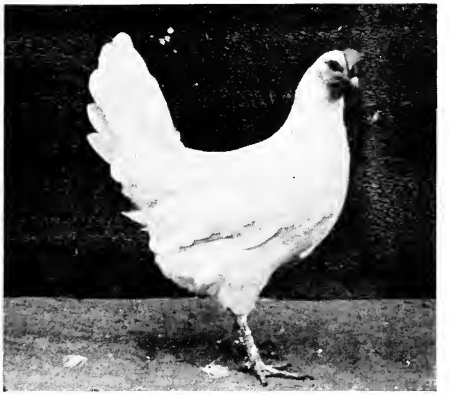
FUEL FOR THE EGG FACTORY

FOR THE HEN'S SAKE LOOK CAREFULLY TO HER FEED SUPPLY

WHY must hens be scientifically fed? When we wish to heat our home we build a fire in the furnace. During the process of combustion the fuel being burned gives off large quantities of heat, together with certain gases, mostly carbon dioxide, which pass up the chimney. A considerable amount of residue consisting of ash or mineral matter remains. Exactly the same process takes place within the hen; the same elements are present in her feed that are put into the furnace as fuel, and the same by-products are liberated.

The feed given fowls after being digested and assimilated by the blood is burned in the body and heat is generated which keeps the body warm; likewise carbon dioxide is given off in large quantities through the process of respiration, and certain insoluble, undigested

THE RAW MATERIAL OR FUEL



THE MACHINE

THE COVETED FINISHED PRODUCT

materials remain. The amount of heat produced is in direct proportion to the amount and the quality of feed given. All animals use their feed supply first to maintain their own bodies, and after these requirements are met the remainder goes to produce a product outside of the body, such as eggs. In the absence of production this reserve supply is stored up in the body as fat.

When a manufacturer makes an article of merchandise he has to put into it a certain kind and amount of raw material, and he expects to get in the finished product an article the size and quality of which is in direct proportion to the amount and quality of the raw material used in its production. He does not expect to get more out than he put in. Likewise the poultry feeder cannot expect to get something for nothing.

Feeding a Fourfold Problem

The American hen is one of the most efficient manufacturing plants in existence.

She is nothing more or less than a machine, a very delicate yet a very efficient machine, which is so designed and highly developed through breeding and care that she can transform raw material or fuel, in the form of grains and their by-products, into one of our most relished and widely used breakfast foods. What is of special significance is the fact that she can bring about the transformation in a way to leave a handsome margin of profit to her owner.

There is no more efficient transformer of raw material into a finished product for human consumption on the farm to-day than the hen. She is in a class by herself, the pride of her owner, and worthy of envy by the other inhabitants of the farmyard. She consumes upward of twenty times her own body weight in fuel, and from this produces eggs equal to ten times her own body weight. Truly a remarkable performance. The feed which we give our flocks must not only supply the fuel to keep the egg factory running

smoothly, but it must also provide in suitable form the raw materials from which eggs and poultry flesh can be manufactured.

The feeding problem is most vital to the successful management of the poultry flock. Feeding costs represent about one-half the cost of producing a dozen eggs. A great saving in the cost of production and a corresponding increase in profits can be secured through the application of business principles in handling this problem. It is a fourfold problem, including the selection of the proper ingredients for the rations, the purchase of them at fair prices, the mixing of proper rations, and the practice of proper methods of feeding. Every feeder of poultry should study these problems carefully, and it is hoped that the following suggestions will help to solve them successfully.

The immediate question is to find the availability of the common feeding stuffs. This should include a study of the local market, as well as the possibility of buying in consid-

erable quantity from the grain-growing sections of the country, more especially round Chicago, the center of our grain trade and the point where the greatest reduction in prices for quantity buying can be secured. The buying of feed coöperatively has helped small feeders to take advantage of these reduced prices.

The New Jersey State Poultry Association has made notable progress in organizing local associations for the coöperative buying of feed. Mr. Hundertmark, of Passaic, secretary of the association, has been a prime mover in this work, and he says: "There is no one thing which will enable our small producers in the Metropolitan District of New York more efficiently to handle their flocks than making possible coöperative buying, which results in a saving to them on every bag of feed of from ten to sixty cents."

The question of whether it is best to use manufactured feeds or to practice home mixing must be determined. Where some grains

are grown on the farm it usually will pay to home-mix and to buy such other ingredients as will insure a well-balanced ration. The user of only small quantities of feed can most always do better by buying ready-mixed goods. The tendency in the manufacture of some feeds is to use too much fiber, such as alfalfa, ground oat hulls, and so on.

A bird's digestive system is so built that it cannot use fiber to advantage. Often flocks with plenty of mash before them will be literally starved due to the high fiber content in the mash, from which they cannot get a sufficient amount of digestible food material. Look out for these "starvation" mashes. In the last analysis the problem of home mixing *vs.* ready-mixed goods must be determined on the merits of each case, the determination being made on the basis of price and quality of the goods.

Frequently it is desirable to investigate possible supplies of feeding stuffs, more especially the grains which may be available

by purchases from local farmers. This is especially true in grain-growing localities. Often feeds of excellent quality can be purchased at a great saving just after harvest, if the feeder is alive to such possibilities. The first problem, then, is a careful study of the available markets to determine the kinds and supply of the proper feeding material available.

The possibilities in saving through seasonable buying are worthy of careful study. Grain is always cheaper in the fall and early winter, just after the season of the harvest. This is due to the fact that many farmers do not have the facilities or do not wish to hold the grain crop over into or through the winter and are willing to clean out immediately for a fair profit. This is the season for the poultry feeder to buy. His wants must be anticipated; and if a good business man he will appreciate the advantages of such a practice and will accumulate a money reserve with which to invest in cheap feed in the

fall. This supply will carry him safely through the winter, resulting in the saving of many dollars.

Another suggestion, if practiced, will help to lower feed cost and will insure greater business efficiency. That is buying for cash. There is nothing to be gained by allowing the feed man to own one's business for from four to six months each year. A business man is one who anticipates the needs of his business and provides for these needs. Limited capital may make credit purchases of feed necessary, but this should happen very seldom.

Every time credit is extended for feed the merchant selling the feed must, as a necessary protection, charge for such service. The all too common practice of buying grain on long credit is one of the factors which makes such high prices prevail in the retail grain business. Most grain dealers would prefer to make quick turnovers and handle greater volume for cash than to do the huck-

ster business which our present methods so frequently entail.

It Pays to Buy the Best

When studying the question of price do not fail to grasp the fact that you are buying not according to weight alone but according to composition—that is, price should be based on the feeding value purchased. For example, one hundred pounds of meat scrap may be worth three dollars or it may be worth five and a half dollars, depending upon the quality and amount of actual available feeding value contained in it. The price which is paid should be based on the unit of feeding value as well as upon the weight.

It is a wasteful practice to buy anything to feed poultry that is not of first quality. Birds cannot produce eggs and maintain themselves in normal health if they are given feeds which are moldy, sour, unclean or in any way not the very best. It always pays

to buy and feed the very best. Care must be taken when buying feed, especially when buying in quantity or when buying from the farmer growing the grain, to see that it is thoroughly dry; that it does not contain an excessive amount of moisture. This is especially necessary when buying corn. When large amounts of moisture are present the material does not keep well; when buying such material the purchaser is paying too much for water. When buying oats or other grains with considerable fiber be sure that they are heavy grains, well filled out. When buying direct be sure the grain is properly cleaned. Certain grains and by-products are not suited to poultry, such as rye and cottonseed meal.

All poultry feeds should be purchased on the basis of their composition. It must be remembered, however, that the amount of ingredients marked on a bag of feed represents the total composition or what the chemist finds when he analyzes it. It does not tell

the feeder what the bird is capable of getting out of the mixture.

The following table of digestible nutrients found in the commonly used poultry feeds is given to explain the procedure to follow when figuring rations for home use:

DIGESTIBLE NUTRIENTS IN 100 POUNDS OF COMMON POULTRY FEEDS

GRAINS

	Protein	Carbohydrates	Fat	Ash	Fiber
Corn	8.7	64.5	4.3	1.5	2.0
Wheat	9.3	62.7	1.2	1.9	2.2
Oats	9.2	40.5	3.7	3.5	10.9
Barley	9.0	60.0	1.4	2.7	4.6
Buckwheat	6.4	54.1	2.2	2.1	1.03

MASH FEEDS

	Pro. tein	Carbohydrates	Fat	Ash	Fiber
Wheat bran	12.5	38.7	3.0	6.3	9.5
Wheat middlings	13.4	44.3	4.3	4.4	6.0
Ground oats	9.0	40.3	3.9	3.3	9.9
Corn meal	7.0	64.1	3.4	1.3	2.3
Gluten feed	21.6	46.6	3.2	2.1	7.1
Oil meal	16.5	35.9	10.4	2.7	9.0
Alfalfa meal	10.2	5.0	.7	.9	30.1
Meat scrap	50.0	....	10.0	24.5	2.5

When planning the exact mixtures which will be fed, it is first necessary to select a sample or trial ration, figuring this through to determine the amount of protein, carbohydrates and fat, as well as the amount of fiber and the cost.

In planning the daily diet of a flock of hens the best procedure is to determine the grain and mash mixtures. The grain mixture should be relatively wide—that is, quite largely composed of carbohydrates, with a limited amount of protein. The mash mixture should be narrow, containing much protein. The following grain and mash mixtures are the famous Vineland Contest rations, which have proven their worth as egg-producing rations:

VINELAND SCRATCH RATIONS

Ingredients	Amount lbs.	Protein lbs.	Carbohydrates lbs.	Fat lbs.	Fiber lbs.
Cracked corn	100	8.7	64.5	4.3	2.0
Wheat	100	9.3	62.7	1.2	2.2
Oats	100	9.2	40.5	3.7	10.9
Total	300	27.2	167.7	9.2	15.1
Total average	100	9.1	55.9	3.1	5.0

VINELAND MASH MIXTURE

Ingredients	Amount lbs.	Protein lbs.	Carbohydrates lbs..	Fat lbs.	Fiber lbs.
Wheat bran	100	12.5	38.7	3.0	9.5
Wheat middlings..	100	13.4	44.3	4.3	6.0
Ground oats	100	9.0	40.3	3.9	9.9
Corn meal	100	7.0	64.1	3.4	2.3
Meat scrap	100	50.0	....	10.0	2.5
Total	500	91.9	187.4	24.6	30.2
Total average ..	100	18.4	37.5	4.9	6.0

In order thoroughly to analyze these two mixtures it is first necessary to determine the nutritive ratio, or the relation between the protein on the one hand and the energy-forming food materials of carbohydrates and fat on the other. We know that fat has a heat or energy value two and a quarter times as great as carbohydrates; so in order to express a ratio we must first reduce the fat to terms of carbohydrates by multiplying the amount of fat by two and a quarter and then adding it to the amount of carbohydrates. This being done, we divide the combined energy value by the protein and express the

result as a ratio, the protein being reduced to unity or one. The above calculation can best be expressed in the following formula:

Nutritive ratio equals..	P:C.H. plus F x 2¼
Substituting the values of the Vineland grain ration and solving the equation, we have....	9.1:55.9 plus 3.1 x 2¼
	9.1:55.9 plus 6.98
	9.1:62.88
	1.0: 6.9

We find that this grain mixture has a nutritive ratio of 1 to 6.9, or to every part of protein there are 6.9 parts of carbohydrates and fat, which makes a very satisfactory grain ration for summer feeding. During the winter the corn in this mixture can well be doubled to increase its heating properties. Working through the mash mixture in the same way we find it has a nutritive ratio of 1 to 2.65, which is much narrower and excellent for an egg-producing ration. If, upon completing a sample mixture, it is found to be materially wrong, the defect can be corrected by altering the amount.

A grain mixture should never have a fiber content above 5 per cent., and a mash mixture should never have more than 8 per cent. of fiber for the best results.

Price is an important consideration, but should never be considered as having equal or greater value than quality or proper balance of ingredients.

A scratch ration fed morning and night, with dry mash before the birds all the time in self-feeding hoppers, is the best, safest and most productive method of feeding for egg production. Feed early in the morning and late at night in order to shorten the long rest period during the night. Feed most of the grain at night in order to compel the birds to eat all the mash possible during the day. Some feed sparingly of grain at noon to induce greater exercise and activity, which practice induces a greater appetite, for if we expect to take it out in eggs we must get it into the birds in the form of food.

Recent feeding tests at the New Jersey Agricultural Experiment Station and at the Vineland Contest have developed very interesting results regarding the proper proportion of mash and grain to feed. It had been formerly suggested and practiced that two parts of grain to one of mash was the best proportion. The best results have recently been obtained where the birds were compelled to eat equal parts of mash and grain during the winter and spring; during late spring, summer and early fall the grain should be materially reduced, thus compelling the flock to consume greatly increased amounts of mash. Mash contains more protein, which is the egg-making material; hence its greater use tends to force greater production. The following table has been worked out to show the proper amounts of grain to feed layers during each month in order that the proper proportion of mash and grain consumption can be assured:

AMOUNT OF GRAIN TO FEED LAYERS EACH MONTH IN THE YEAR

Month	Pounds per day per 100 birds	Pounds for each feeding A.M.	P.M.
November	12	4	8
December	12	4	8
January	12	4	8
February	12	4	8
March	10	4	6
April	10	4	6
May	10	4	6
June	8	3	5
July	8	3	5
August	6	2	4
September	5	2	3
October	5	2	3

One must not forget to give the birds all the pure water they can drink and have a supply of it in clean containers before them all the time.

Don't forget the green feeds. All through the life of our birds, from the time they enter the brooder until through laying, green feeds—better described as succulent feeds—

play a large part in determining first their growth and later their production.

During the winter months the feeding to laying hens of epsom salts every two weeks in the drinking water at the rate of one pound to one hundred birds will keep the bowels laxative and will aid in keeping up a good appetite and a high production.

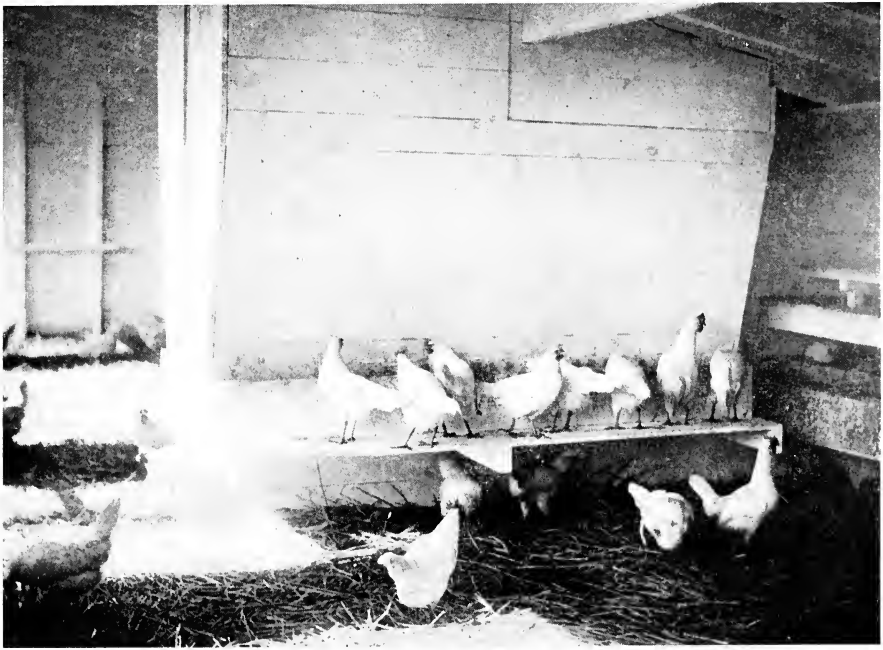
A summer range on green alfalfa or clover will help supply succulence, and during the winter mangel beets or sprouted oats should be fed liberally. Plenty of grit and shell enables proper digestion of feed and insures an abundant supply of lime for eggshells.

HEALTHY HENS

THE ONLY KIND THAT LAY AND PAY

We surely would not think of keeping our own home in an unkempt, dirty, unsanitary condition, nor would we think of eating anything but wholesome, clean food. The war famous " cootie " is unknown in the modern American home because we practice personal hygiene and keep our own selves clean. Why are we so particular about all of these things? Because they mean health, the power to tackle our work with pep, and earn for the full support of ourselves and families. Being blessed with health we can each get our share of enjoyment out of this earthly existence as we pass along life's short way.

For exactly the same reasons that flock of hens in which we are so deeply interested must be kept clean; must be given clean, wholesome feed, and a congenial, clean home



AN IDEAL ENVIRONMENT FOR THE LAYERS
Hen cannot help but keep healthy in such light, clean, airy quarters

in which to live. Such conditions mean healthy hens, which are the only kind bringing both profit and pleasure to their owner.

John Wesley, over a century and a half ago in one of his famous sermons, wishing to drive home to his hearers the importance of correct living, paraphrased one of Francis Bacon's earlier quotations by saying, "Cleanliness is indeed next to godliness." Continuing his reference to cleanliness, he said, "Certainly this is a duty, not a sin." So to-day in our poultry work it is the duty of every owner of fowls to keep them clean and healthy. It is the one factor of the greatest single importance in poultry management. More thought in the handling of our flocks must be given to the prevention of, rather than the curing of, disease. Let's not suffer the losses of poor production and try to find a remedy after the mischief is done. It has been said that: "An ounce of prevention is worth a pound of cure." Surely in the poultry game an ounce of prevention is worth

ten pounds of cure, for the sick hen not only does not lay, returning no profit for her care and keep, but she becomes at the same time a constant source of contamination to all other birds in the flock. The resulting discouragement, more often than not, proves disastrous to the success of one's business. The hatchet when used forcefully just behind the ears of a sick bird is the very best remedy in most cases, especially when serious infections of a contagious nature have become established.

The prevention of disease, which must be our aim, can be accomplished in large measure by the maintenance of a sanitary environment, which simply means cleanliness in all the operations of management. All disease germs delight to live, and multiply very rapidly, in nasty, filthy surroundings. The remedy is:

Keep things clean!

Disease can be controlled to a great extent by paying special attention to the mainte-

nance of vigor in the birds through breeding. The continuous practice of breeding and selection for vigor result in succeeding generations of birds which possess natural resistance to disease organisms. Vigorous birds just can't help living and thriving even under somewhat adverse conditions. Those are the kind of birds we want.

In order to maintain the flock free from disease, it is essential to keep your eye on the individuals in the flock all the time and thus be able to determine immediately any abnormal condition or evidence of disease should it appear. A loss of appetite, digestive disorders, diarrhœa, eye or throat trouble or any other suspicious conditions, should be immediately noted, the trouble determined, and prompt measures taken to check it. The removal of the cause in a normal flock will usually be sufficient. In instances of serious infections of a roupy nature which may be exaggerated by bad weather, flock treatment may be necessary to effect a cure. If a diag-

nosis determines the presence of a serious contagious condition, all affected birds should be immediately removed and their quarters thoroughly disinfected. In such cases it is the safest plan to kill and burn all infected birds. Play safe and never bury dead carcasses. Rodents, dogs or other animals are apt to dig them up and scatter them about, spreading the infection. Never throw the dead birds into the bushes even at some distance from the plant. Such practice is the height of folly and the one committing the crime will soon rue his laxness. Most serious epidemics are caused by carelessness and the utter disregard of preventive practice.

Clean birds are those which are free from body parasites. Lice and mites sap the vitality of the fowls, lower their normal resistance to disease and check their production due to the unnatural irritation. Loss of appetite and loss of weight follow severe attacks of these parasites. Here again prevention is easier and better than eradication. The body

louse is very common to all domestic fowls, there being very few individual birds or flocks which do not show a greater or less degree of infection. The body louse is a characteristic little yellow fellow which can be found about the fluff in the vicinity of the vent. They stay on the bird's body all the time and are for that reason hard to combat. Clean dust boxes where the birds can roll and dust themselves in dry, fine soil will help to hold them in check, but it never effects entire control. Sodium fluoride properly applied will completely control these pests. The United States Department of Agriculture, in Farmers' Bulletin No. 801, has described this method of control very fully. Sodium fluoride costs about thirty cents a pound, one pound being sufficient to treat 125 birds by the dry-powder method, which is to be preferred to dipping at all seasons, except in mid-summer. Sodium fluoride is a stomach poison, killing all types of lice which are found on the plumage of poultry. The pinch

method of applying the powder dry has been recently tested at the New Jersey Poultry Department and found to be very rapid and efficient. This method consists of holding the bird with the left hand, by the wings, while with the right hand a small pinch of fluoride is taken from a convenient dish and placed in the region of the vent, one beneath each thigh, one on the under side of each wing, one below the wattles at the base of the neck and one on each hip. This work can be done very rapidly when the routine is learned, two men being able to handle over 100 birds each hour. Sodium fluoride has the following advantages when used for the eradication of lice:

One treatment will eradicate all lice of all types, including those which hatch out after the application.

Sodium fluoride is absolutely non-injurious to the fowls, eggs or chicks.

It does not stain the feathers.

It is a very cheap and efficient method of lice eradication.

Better give it a trial; send for the government bulletin and be convinced as the writer was only a few weeks ago.

Unlike the lice, the red mites are blood-sucking insects. They are very tiny and straw-colored when empty. When they are filled with blood they are reddish in appearance, this characteristic giving them their common name. They do not live upon the body of the bird at all times, but do their injury at night when the birds are on the roost and are quiet. In the daytime they live in the cracks and crevices in the roosts, nests and dropping boards. They appear as thick red dust, which, if watched for a moment, will be seen to move very rapidly. Because of this habit of leaving the birds during the daytime it is particularly easy to control them. All infested places should be painted with some material which will kill these parasites. Gas tar, a by-product in the manufac-

ture of illuminating gas, or any one of the commercial wax perch paints are very satisfactory for this purpose. Carbolineum, a wood preserving paint, is very good for this purpose. The material used should be painted on the perches and all other places which are likely to become infested in sufficient quantity to penetrate the cracks and the grain of the wood. The painting should be done early in the morning and the birds kept off the perches during the day or their feet will become dirty and soil the eggs and the nesting material. The colony houses where the growing stock roost during the night should be treated in a similar manner. This preventive painting is a short but sure job, and if the mites are present it will be work that will return large profits for the time invested. The red mites when present in large numbers suck great quantities of blood, thereby decreasing the strength, vigor and vitality of the flock. Get a little gas tar, apply it thoroughly and test this method

for yourself; for you know the proof of the pudding is in the eating.

There is one other form of mite which often does considerable damage and that is the scaly leg mite. The minute parasites burrow under the scales on the legs of the fowls, giving off a whitish calcareous deposit which often distends the scales and causes the legs to be misshapen. This insect is very common in farm flocks and can be controlled by dipping the legs of birds affected in crude oil. One or, at the most, two treatments will always effect a cure, if taken before permanent damage has been done to the bird's legs.

Too much cannot be said in favor of feeding our poultry nothing but clean, sweet, wholesome grains and by-products. The old-time practice of feeding the barnyard flock anything and everything that was not fit to feed to any of the other livestock has passed. We know to-day that the hen has one of the most delicate digestive systems of any of our livestock. We know that she will

respond nobly to care and proper feed and she will also go to pieces very quickly if fed faulty feeds. Mouldy grain, damp and musty feed, sour feed, rations high in fiber, are all unfit for poultry feeding. Give the hen a chance—in return she will make you a sure winner.

The birds in the laying flock, of necessity, must be confined during the greater part of the winter. This means the necessity of keeping their quarters absolutely clean and sanitary if they are to be kept healthy. The houses must be so designed and built that a congenial, sunny, dry environment will be maintained, and they must be so managed that they will be kept in a clean condition. There are four very necessary operations which go to maintain clean poultry houses.

First, do not fail to have a general house cleaning at least twice each year, spring and fall, just as mother used to do. If the weather is bad and disease appears, additional cleaning will be necessary. During

this cleaning everything movable in the pen should be taken out, swept clean and exposed to the sun and air for a number of hours. Remove all the litter and sweep the interior of the house clean. The muslin curtains will have to be beaten to remove all dust, and the windows scoured so as to admit all possible sunlight. After the dry cleaning the interior should be thoroughly sprayed with a good disinfecting solution. A combination disinfectant and whitewash paint is very desirable. A commercial whitewash paint and disinfectant known as Carbola is very efficient. After the walls and floor have had time to dry, which usually takes about two or three hours, the fixtures should be replaced, the floor covered with clean, fresh litter, the nests filled with new nesting material. The house is now ready for the birds. Unfortunately, it is too often the practice to bring the new pullets off the range and put them in the house where the old birds have been during the summer, without any ade-

quate and complete cleansing process. A once-over, with a hit here and a miss there, does not do the trick; make it a good job, completely done.

There are two operations which must be regularly and frequently performed if the house is to be kept in this clean, livable condition. One has to do with the proper removal and disposal of the droppings. Twice a week is often enough. After each removal, the dropping boards should be covered with some good absorbent and deodorizing material, such as acid phosphate or dry soil. During long spells of damp weather in the winter when the droppings take up moisture and give off objectionable odors, it may be necessary to remove them more often. Do not be induced to use a dropping pit in the poultry house. This may save some labor, but the danger of spreading disease and the fact that it takes up floor space which should be for the use of the birds, is reason enough why the elevated dropping boards are preferable.

Another important operation is the care of the litter. The litter is placed in the house to carpet the floor and serve as a hiding-place for the grain and to compel the birds to take sufficient exercise. It can only perform this function when it is deep, coarse, dry and clean. When the litter, for any reason, becomes finely ground and packed, it should be loosened up with a fork, and finely ground material removed and additional coarse litter applied. When—due to rain beating in, or to a driving southerly storm, or from any other cause—the litter becomes damp it should be removed and fresh dry material supplied. At least twice a week it is a good plan to fork the litter towards the front of the house, leaving it level and loose. It is an excellent plan to start in the fall with three or four inches of straw on the floor, adding to this from time to time, so that a depth of four to eight inches is maintained throughout the winter.

Don't forget to keep the fixtures, such

as drinking fountains, hoppers, feeding troughs, and so forth clean. More poultry diseases are spread through the medium of the drinking vessels than any other cause. The drinking water furnishes an ideal medium for disease-carrying germs to multiply and thrive in. The drinking vessels should be rinsed out daily and scalded at least once a month. The feeding troughs must be kept clean, and if moist mashes are fed, should be kept scalded regularly. Be sure that the mash hopper does not waste, for such increases the cost of feeding and makes a dirty feeding floor as well. Systematic cleaning, proper care of the droppings, a floor kept covered with clean coarse litter, and clean feeding appliances all go to make up a congenial, healthy environment for our egg machines.

Lay out large yards when planning your plant. Such yards are much more sanitary and they are easy to keep covered with permanent sod. The birds have a large area

over which to roam, and it is not seriously contaminated except in the immediate vicinity of the house. Such area can be plowed and seeded to correct this condition. Where it is necessary to confine the birds to a limited area, some definite system of crop rotation should be practiced which will necessitate the frequent cultivation of the yards, and the turning over of the surface soil. Double yards are frequently laid out so that it is possible to practice a definite crop rotation. An excellent scheme which has proven its worth in practice is to seed in one yard peas and oats early in the spring, keeping the birds confined in the other yard. When these get about six inches tall, the flock can be let out to forage on them, and buckwheat can be seeded in the bare yard. After the peas and oats are fed off the flock can graze on the buckwheat, while soy beans are planted where the peas and oats were. While the soy beans are being fed off, the remaining yard can be seeded to winter wheat or rye

which will make a fine growth during the fall and winter and provide early green food the following spring. The frequent cultivation necessitated by the care of these crops maintains the yards in a clean sanitary condition. The yards should be thoroughly drained, so that there are no pools of stagnant water standing on the surface. By plowing the yards and growing a crop, the filth is turned under and used to grow feed. Can you beat it?

Given vigorous fowls which are kept clean, fed wholesome feed and given a clean home in which to live, disease and sickness haven't much of a show. A normal flock of laying birds may be expected to suffer a mortality from uncontrollable causes, such as prolapsis, accident, apoplexy, ovarian disorders and the like, of from 5 to 10 per cent. A greater loss than this is due to an epidemic or from mortality brought on by keeping the birds in improper houses, carelessly handled and improperly fed.

HOW TO TELL THE GOOD HEN

SIMPLE RULES OF SIGHT AND TOUCH WILL DO IT

How can I get that extra dozen eggs per hen, those few eggs which mean the difference between barely meeting production costs and a handsome profit?

How often has every poultry raiser asked himself this same old question? The thought expressed is fundamental to success in all production fields. In the growth and culture of plants and animals it is the total production per unit which limits financial rereturns. The heavy yield of corn per acre, the extraordinary yield of fruit per tree, the large production of milk and butterfat per cow and the maximum egg production per hen all spell gross returns and a maximum profit. Truly, poultry profits are in pro-

portion to the production which one can get from his birds.

Some of the more skeptical may want proof of this statement. Here is a record of three pens from the Vineland Contest selected for high, medium and low production. They are all Single Comb White Leghorns with ten pullets in each pen.

	High pen	Medium pen	Low pen
Total eggs laid 365 days.....	2212	1666	1117
Eggs laid per bird.....	221	166	111
Feed consumed per bird, lbs....	83.02	79.68	75.79
Feed cost per bird.....	$2.36	$2.27	$2.17
Return from eggs per bird.....	8.49	6.38	4.26
Return over feed per bird.....	6.16	4.11	2.07

These records show that a hen which lays heavily or poorly eats very nearly the same amount of feed and requires the same amount of labor and overhead investment. The hen which produces heavily greatly increases her earning power due to the increased value of her product, and this very greatly increases the profit to her owner. It

is impossible for all to have hens laying over 200 eggs per year. There are, however, some such superior birds in every flock and by systematically weeding out the low producers and breeding from the best we can set the 200-egg mark as our goal. It may never be reached as a large flock average, but the effort of having striven for this high production will surely carry our flock averages far above what they ordinarily would have been had not this effort been made. Never be satisfied to let good enough alone, but rather follow Emerson's advice and "Hitch your wagon to a star." There is surely some difference between a return above feed of $2.07 and $6.16. Which flock would you prefer to keep?

Another proof that production counts is found in a survey of 150 poultry farms in New Jersey, where it is shown that the egg yield per bird was the factor most responsible for a satisfactory labor income.

RELATION OF EGG PRODUCTION PER HEN TO LABOR INCOME

Eggs per hen	No. of farms	Egg receipts per hen	Hens per farm	Average labor income
60 and less....	9	$1.30	505	Loss...$ 176.00
61 to 80.....	13	1.90	673	Loss... 67.00
81 to 100.....	32	2.30	650	Profit . 312.00
101 to 120....	53	2.90	785	Profit . 775.00
121 to 140....	27	3.40	717	Profit . 1173.00
141 and over..	16	4.20	808	Profit . 1823.00

Here we see that nine farms averaging 505 hens per farm where the birds averaged to lay only 60 eggs or less lost to their owner an average of $176 per farm, while a production of 101 to 120 eggs on 53 farms with an average of 785 birds per farm paid a labor income of $775, or one dollar per bird kept. Finally sixteen farms with an average of 808 birds per farm which averaged to lay 141 eggs or more per hen, paid a labor income of $1823 per farm or $2.25 per bird. It surely does pay to strive by every known means to keep the flock production up. Note especially in the above table the regular increase in the egg receipts per hen as the pro-

duction increases, which is the factor which makes the increased profit possible.

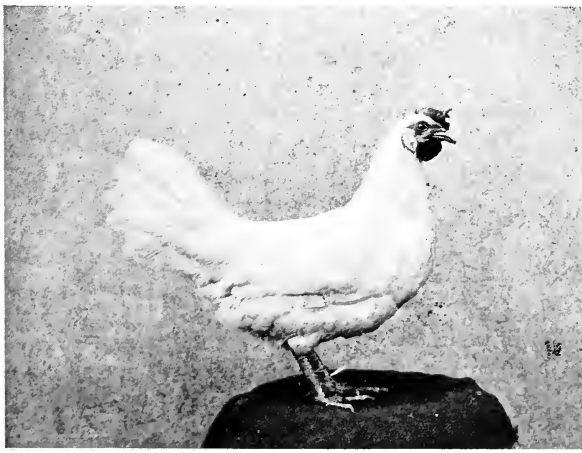
High and sustained production can be brought about in two very definite ways, each of which is essential to the complete accomplishment of the object in view. First, good breeding, rearing and care in housing and feeding are essential in order to produce good birds and in order to get from the flock all the eggs they are capable of laying. Of equal, if not of greater importance, is the practice of culling out the non-layers as they stop producing during summer. There is probably no one factor in the modern development of poultry management which will mean so much in the way of sustained high flock production as proper culling. "Eliminate the non-producers as they appear," must be our battle-cry every summer.

But few have appreciated that it is possible by systematic culling to maintain an average flock production during the summer of 50 per cent. and still fewer are those who have

practiced this method which accomplishes two very definite purposes. First, by eliminating the birds as they stop laying for the season, the flock production is kept up, or the same number of eggs are secured from less hens, which results in a great saving in the feed bill. With feed where it is in price no one can fail to practice culling if only to bring about this one very material saving. The second big object accomplished by this regular culling during the summer is the fact that along about the middle of September we find that we have left from one-third to one-half of the original flock in which the culling was started in early summer. These birds which are left, however, are the late layers; they are the late moulters; they are the birds which we naturally want to hold over for breeding the next spring. It is generally agreed that the best producers in any flock begin laying earliest, they lay the latest in the summer and moult the latest and quickest. These are just the birds we have left after

A HIGH PRODUCER WITH A RECORD OF 271 EGGS

Note the underline of body, deep at the rear with excellent capacity. It's the only type of hen that can lay well



A POOR PRODUCER WITH A RECORD OF 67 EGGS

Also note the under body line with contracted abdomen resulting in small capacity. The kind of bird which can never lay a lot of eggs for she isn't built that way

the summer culling is over. Summer culling, then, eliminates the inferior birds and automatically selects the best for future breeding.

But how about that 50 per cent. production from the flock during the summer? Here is a little rule which may help. So often one is uncertain whether the flock needs culling or not, and, if so, how much should it be reduced. In any flock if the average production falls below 50 per cent. it is sufficient proof that there are a certain number of birds which are not laying at all. Hence, to tell the number of idle hens in any flock which should be culled, take the per cent. of production and multiply it by 2 and subtract the result from 100 times. The result will give the approximate number of idle, slacker hens which should be removed to every hundred birds in the flock. Expressed in another way, for every per cent. which the production drops below 50 there are two idle hens in every 100 which should be culled. For example, if a flock of 100 hens is laying

40 per cent. production in July, one would expect by following this rule to find 20 birds which should be culled, reducing the flock to 80, but maintaining the same production; the 40 eggs formerly received being a 50 per cent. production from the remaining 80 hens. Experience in hundreds of culling tests has shown us that this rule, while only approximately correct and varying somewhat, depending upon the quality of the birds in a flock, is, nevertheless, a very reliable guide to be used in determining whether it is time to cull and about how many birds one may expect to have to take out.

Culling will generally have to be started about the middle or last of June if the 50 per cent. production point is to be maintained. Probably the best time to cull is in the evening, going through the flock with a pocket flash lamp and taking the birds off the perches and placing them in shipping crates. The non-producers can be very quickly detected with a little practice by following the

suggestions in the accompanying diagram. It is not a good plan to catch and handle often for purposes of culling all the birds in a flock, as the unusual conditions may cause fright and a serious drop in production. Catching and handling takes time and thus reduces efficiency. It will generally be found desirable to set aside a definite evening to do the culling work, say, for example, the first and third Monday of each month, beginning with the third Monday in June. This will mean that the flock will be looked over every two weeks which, if the work is done with care, will result in a production through July, August and September of around 50 per cent. Surely this is worth trying, for eggs bring good money in the summer and the cost of production, especially feed requirements, is lower than in the winter, for the birds are running on range and the weather is warm. The chance of error in culling is very slight and any one wishing to check up his work can confine the culls in a separate

pen for a few days to determine the accuracy of his judgment.

Very accurate methods of determining the non-producers from the layers have been worked out at a number of experiment stations; the factors listed on the following chart have been tested out and found accurate and reliable in connection with the studies being conducted at the Vineland International Egg-Laying and Breeding Contest. A study of this diagram will enable one to tell the good hens from the poor ones at a glance.

IT PAYS TO CULL

TO ELIMINATE THE INFERIOR BIRDS—TO SELECT THE BEST FOR BREEDING

Good	How to tell the	from the	*Poor*
White, Large, Moist		Vent	Yellow, Small, Dry
White		Ear Ring	Yellow
White		*Ear Lobe	Yellow
White		Beak	Yellow
White		Shanks	Yellow

Wide, Thin	Public or Lay Bones	Narrow, Thick
Wide	Span	Narrow
Large, Plump, Bright	Comb	Small, Shrunken, Dull
Bright, Bulging	Eye	Dull, Flat
Lean	Head	Fat

* In white ear-lobe breeds only.

When handling individual birds to determine their fitness to remain in the producing flock or to determine the previous performance, it is desirable to consider all of the points listed, but when going over an entire flock in the evening by pocket flash lamp it is only necessary to consider the condition of the comb, the amount of yellow pigment in ear-lobe, beak and face and when taking her off the perch to place in shipping crate test her span and feel the lay bones to determine their condition and to verify the condition as determined by the previous tests.

In order that the terms used in the diagram

may be more easily and completely understood and in order that the reasons for certain of these changes may be better appreciated the following discussion will be devoted to culling methods. Appreciating the need for the standardization of culling methods and for the development of a uniform practice a culling school was held at Cornell University during July, 1918, at which time and place certain general recognized principles of culling were formulated and later approved by the American Association of Instructors and Investigators in Poultry Husbandry. These principles which follow represent in condensed form the findings and present practices of the leading poultry investigators in the United States and Canada and are as simple, yet as complete, a discussion of the principles involved as it is possible to present in such a short and condensed form:

" In order to lay well a bird must have a sound body. She must first of all be vigorous and healthy if she is to stand up under

the continued strain of long production. Vigor and health are shown by a bright, clear eye; a well-set body; an active disposition and an indication of good blood circulation. The bird must be free from physical defects, such as crooked beak, excessively long toe-nails, eyes that overhang so that the bird cannot see well; excessively scaly legs or anything else which will keep her from getting her required feed supply. Color or pigmentation changes offer one of the easiest and safest guides in culling. A laying fowl uses up the surplus fat in the body; especially it removes the fat from the skin. In yellow-skinned breeds this loss of fat can readily be seen by the loss of yellow color. The different parts of the body tend to become white, according to the amount of fat which is being taken from these parts, depending upon the amount of fat which has been stored up in these parts and the circulation of blood through them. It should be recognized that all yellow color changes are

dependent upon the feed, the coarseness of the skin and the size of the bird. A large bird fed on an abundance of green feed or other material that will color the fat deep yellow, will not bleach out its color in these various parts as quickly as will a smaller bird or a bird which nature has endowed with a pale yellow coloring.

These pigment changes occur in the following order: vent, eye-ring, ear-lobe, beak and shanks. The vent changes very quickly with egg production, so that a white or pink vent on a yellow-skinned bird generally means that the bird is laying; while a yellow vent means that the bird is not laying. The eye-ring bleaches more slowly than the vent and the ear-lobe a trifle more slowly than the eye-ring. In red ear-lobed varieties this character must be omitted in the determination. The color leaves the beak beginning at the base and gradually disappears until it leaves the front part of the upper beak last. The lower beak bleaches faster than the

upper beak. On the average-sized, yellow-skinned bird a bleached beak means a fairly heavy production for at least the past four to six weeks.

The shanks are the slowest to bleach out and hence indicate a much longer period of production than the other parts. The yellow color leaves the front of the shanks first and finally leaves after longer and greater production from the scales on the rear of the shanks. A bleached-out shank on the average-sized and yellow-skinned bird indicates that she has been laying fairly heavily for from 15 to 20 weeks. What is of special and great value to the poultry keeper and what makes culling possible is the fact that the pigment returns to these sections in exactly the same sequence that it left, only returning much more quickly. Hence, yellow found in the vent and ear-lobe while beak and shanks are white indicates that a bird has just started to rest after a long period of sustained production. Color can

and should be used extensively in the culling work. It can be most accurately discerned in daylight, or if at night by a blue rather than a yellow light. Color or any other single factor should not be used alone, but should be compared with other known factors to avoid error. There are certain body changes which offer possibilities in culling. A laying hen has a large moist vent, showing a dilated condition as compared with a small puckered, dry vent of non-producers. The abdomen of heavy laying birds is expanded so that the pelvic arches are widespread and the keel is forced downward away from the pelvic arch, so as to give large capacity. The distance between the keel bone and the pelvic arch is termed span and often measured by the fingers which can be laid between. Heavy production is further shown by the quality of the skin. Fat goes out from the skin with production, so that the heavy producers have a soft velvety skin that is not underlaid by heavy layers of hard fat. The

abdomen, especially, is soft and pliable in heavy producers. Heavy production is further shown by the thickness and stiffness of the pelvic bones. On heavy producers these bones are generally thin and pliable rather than stiff and thick. The stiffness and thickness of the pelvic bones is caused in large part by heavy fat covering them, which condition is found only in poor producers. In heavy layers the lateral sternal processes, which are small bones attached to the last rib, show good quality by being soft, pliable and extend outward, due to the fullness of the abdomen. One of the finer indications of high production is the fineness of the head, which is due to the absence of fat under the skin of the face. The wattles are loose and flat and fit close to the beak. The eyes in a heavy layer are full, round, clear and prominent, especially as seen from the front. The heavy layer is generally more trim and angular than the poor layer. The feathers lie closer to her body and are worn and thread-

bare after sustained production, due to the absence of oil at the base of the feathers.

The comb, wattles and ear-lobes expand or contract rapidly, depending upon the activity of the ovary. If the comb, wattles and ear-lobes are large, full, smooth, hard and waxy, the bird is in full laying condition. If the comb is limp the bird is only laying slightly, but it is not laying at all when the comb is dry, dull and small, especially at moulting time.

Moulting, or the changing of the plumage, can be used with great accuracy in culling work. When a bird stops laying in the summer she usually starts moulting. The later a hen lays in the summer, or the longer the period in which she lays, the greater will be her production. Professor Kent of Cornell University has found that the length of time that a bird has been moulting can be determined by the condition of the wing moult. It takes about six weeks to renew completely the primary feather next to the middle axil

feather of the wing and an additional two weeks for each subsequent or outer primary to be renewed. Thus, if three primary feathers are entirely renewed, it is evidence that the hen has been moulting about ten weeks. A good hen is much more active than the poor one, yet she is always more easily handled. The good layer shows more friendliness and alertness than the poor one. The non-producer is generally very easily frightened and squawks when being handled.

The methods of handling the poultry flock is progressing by leaps and bounds, and he who makes a success of his business in this day must study his birds and faithfully apply all available knowledge of external characters to the work of culling out the slackers. The ability to recognize the egg-producing quality of hens by simply looking at their external characters is a very recent development, yet it is of far-reaching importance in the further development of our poultry industry.

What are the steps in applying this practice to our own flock? It is simple. First, get acquainted with the general appearance of a good and poor hen. With this information at hand study your own birds and cull them during the summer in a very definite and systematic way. The results will be a better flock each year, due to the selective breeding accomplished. Less birds will be kept, yet with no reduction in egg production, which will mean smaller feed bills, and best of all, more cash will be left in the pocket of the poultryman for his year's labor.

If your flock is not laying close to 50 per cent. or better it is time to get acquainted with your hens.

THE TRUTH ABOUT THE LIGHTING PROBLEM

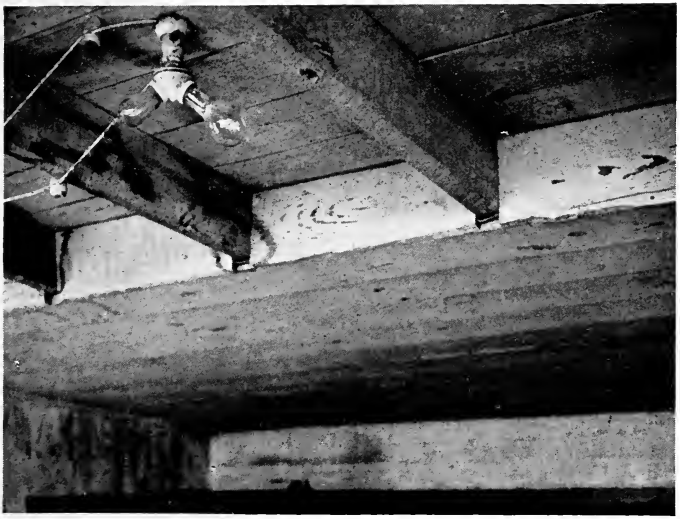
IT SIMPLY LENGTHENS THE DAY AND ENABLES THE HEN TO EAT MORE

New things are happening in the poultry world every day. He who expects to be successful and win out in modern competition must keep up to date. There is nothing in the poultry field which is being discussed more or which has more far-reaching possibilities than the use of artificial illumination in poultry houses to increase the hours of light and thereby shorten the long winter nights. The direct purpose of this practice is to enable birds to eat more feed and consequently lay more eggs, which results in a great increase in profits. Like all things new, it must be applied with care and not overdone. Experiments conducted to date show very conclusively that lengthening the day, in the fall and winter, by the use of artificial

lights advances the natural spring period of production many months. Birds under lights in the winter not only lay more, but they seem to be more vigorous, healthy and more disease resistant. As one farmer put it recently: "After running lights on my hens this fall I feel that every poultryman who allows his birds to stay on the perches during the long winter night without sufficient feed should be arrested by the Society for the Prevention of Cruelty to Animals and charged with starving his flock." This may be a rather drastic suggestion, but it does, nevertheless, call attention to the fact that the average flock in the winter does not have hours of daylight enough in which to consume even the feed required for the maintenance of their bodies, to say nothing of the additional needs for production.

Best Time to Run Lights

The best time to run lights is going to depend in a large measure upon the section of



ELECTRIC LIGHT IN A SUBURBAN POULTRY HOUSE

This one little light, last winter, earned for the owner of this flock of 25 hens the handsome sum of $41. Does it pay?

the country in which one is located. In the latitude of New England, New York, Pennsylvania and Maryland starting lights about September 1st and running them until April 1st seems to be the most effective period. Where conditions are such that the lights cannot be started until late January or even February an immediate favorable reaction is noticed and the results are very satisfactory. It must not be forgotten that the object is to shorten the long nights of fall and winter and hence the lights should be started when the days begin to show a perceptible shortening. A few days at this season of the year will make a very marked difference. There seems to be no harm in using lights on breeding stock or on undeveloped birds. In the case of the breeders, lights seem to increase fertility and hatchability of the eggs and in the case of immature stock lights seem to aid them in coming into normal maturity much more quickly than they otherwise would do. There is no advantage in running lights dur-

ing the summer months, for the days seem to be of such length that the birds have sufficient time to consume feed to the limit of their capacity.

Best Hours to Run Lights

As far as the birds are concerned and the production secured can be used as a measure it does not seem to matter much which part of the day the lights are used. While the time of day in which the lights are used does not seem to be vital, yet the length of time they are used is a very material question. A good rule is to run them long enough so that the birds get a uniform length of day, or from 14 to 15 hours, this period to include the normal hours of daylight plus the hours when lights are used. For instance, if in the fall it gets dark at six o'clock at night and dawn appears at six in the morning it means that the birds are getting twelve hours of daylight and twelve hours of darkness. The best results can be secured if the twelve hours of

daylight are increased to fourteen or fifteen hours. This can be done in one of three ways. This extra two or three hours of light may be given in the morning; or it may be provided at night by starting the artificial lights at dusk and running them until eight or nine o'clock; or, it may be divided and the artificial light provided half in the morning and half at night by starting the lights in the morning at 4.30 or 5 and running them until dawn and then starting them at dusk and running them until 7 or 7.30 at night. No effort should ever be made to run the day in which the birds are compelled to work longer than fifteen hours. It may work advantageously for a short time, but it is a grave question if in the end it will not result in a weakening and debilitating of the birds. In deciding upon which of the above methods are to be used the habits of the poultryman must, of course, be considered. If lights are to bring about the benefits desired, careful attention must be given the birds during the

time the lights are on, that is, they must be provided with feed and drinking water and they must not be neglected. If the poultryman wishes to use lanterns he will probably prefer night lights, because he will not want to get up at three o'clock in the morning to adjust the lanterns, but rather feeding in the evening and running the lights until bedtime, then turning them out and letting the birds get up with the sun in the morning. For the farmer who must be up early to do his chores possibly morning and night lights both may work out the most advantageously. For the commercial poultryman having electric lights possibly the best results would be secured by running lights only in the morning, having the lights automatically turned on with a time switch, feeding grain in the litter the night before after the birds have gone to roost and insuring an abundant supply of drinking water in the early morning hours by using some type of hot-water heater in connection with the fountain. So we find,

then, that the length of the artificial day which is created is standard, namely, 14 to 15 hours of light, but that the period of the day during which the artificial lights may be operated can be varied to meet local conditions within the limits just described.

Kind and Amount of Light

It has been found that any kind of light, from kerosene to electricity, has given excellent results providing, of course, that enough light is supplied so that the birds have no difficulty in seeing to eat. Electric lights are by far the most convenient, the least likely to start a fire and in many cases are the cheapest in the end. Where the poultryman is located near a city or a public supply of electric current he can probably secure his best supply of electricity by tapping this source. Where no such public current is available and he has a thousand or more birds to light he can without question afford to install a farm-lighting unit which will cost, in-

stalled, together with all wiring, from $500 to $800. When electricity is employed a 40-watt electric lamp is the least that should be used for each 100 birds, while 80- or 90-watt lamps will possibly be more profitable to use. When the electricity is not available, there are various types of lanterns on the market which burn gasoline. Most of them are safe from fire-danger, having been underwritten by fire insurance companies. The prices of such lanterns usually run from $5 to $15. One lantern centrally located is sufficient to provide illumination for 100 hens. Ordinary kerosene barn lanterns, if provided with reflectors or special magnifying lenses in front of the flame, have been used profitably. Usually from two to four barn lanterns would be necessary to sufficiently light a pen for 100 hens. No matter what the cost of installing a lighting system may be, if properly used, the initial cost will at least be covered by increased revenue from eggs produced by January 1st, following the

September in which the lighting system was put into use. This may appear to be a rather exaggerated statement, but actual practice tests on commercial poultry farms have shown this to be the case.

Feeding Birds Under Lights

Feeding fowls which are under lights is very much the same as feeding under ordinary conditions of management, but there are, nevertheless, a few important details which must be appreciated. The most significant factor connected with artificial illumination is the relation of production to feed consumed. During the short days and especially the long nights which are on the increase until the latter part of December the most of our poultry flock get very little more feed than that required to produce body heat and energy. Consequently, they are not getting the required extra feed supply from which to produce eggs. Probably the reason for many ills in the poultry flock in the win-

ter, especially in well-bred birds, is the fact that they do not get enough feed material to even maintain themselves in a vigorous, resistant condition. Lights not only affect hens by making them lay more often than they otherwise would, but they also bring into production hens which would otherwise be non-productive, due entirely to their enabling the birds to get a sufficient amount of digestible feed nutriments. Lights will not be effective unless the dry-mash method of feeding is used. Mash should be available to the birds at all times in self-feeding hoppers. Dry mash may be supplemented by feeding the same mixture wet, feeding it during the middle of the day. Only enough wet mash should be given, however, so that the birds clean it up in a half hour or so. A good dry mash which is being widely used and giving excellent results can be made of equal parts of wheat bran, wheat middlings, ground oats, cornmeal and meat scrap. The scratch feed should be given at least three times daily and

in bad weather in the winter as often as four times. A good scratch feed to give during the winter months should be two parts of cracked corn, one part of wheat, and one part of oats. The amount of mash which birds eat determine in large part the number of eggs which they will lay, for it is the mash feed which contains in a highly digestible and concentrated form the protein or nitrogenous elements which are so essential in the manufacture of the eggs. The problem, then, is to compel the birds to eat large quantities of mash. This means that only limited quantities of scratch feed should be fed at morning and noon, so that the birds will be hungry for mash feed during the day. The scratch feed given in the morning is primarily for exercise and birds will work harder and scratch more for one or two pounds than they will for ten. When the flock is fed too much they will eat their fill without exercise and loll around the pen in a listless condition eating very little mash. A good big feeding

of scratch grain should be fed at night, allowing the birds to go to perch with a full crop which will last them through the long non-feeding period at night. The following daily schedule will be found applicable for laying hens under lights during the winter months:

DAILY SCHEDULE FOR FEEDING SCRATCH FEED
POUNDS PER 100 BIRDS

	Early A.M.	10 A.M.	Noon	Late P.M.	Total
September	3	..	2	5	10
October	3	..	2	5	10
November	3	..	2	5	10
December	2	2	2	6	12
January	2	2	2	6	12
February	3	..	2	5	10

It may not always be possible to feed the fourth feeding in the morning in December and January, but where possible it is certainly desirable. By following this schedule the birds exercise sufficiently. They are kept hungry and consume large quantities of mash and they are compelled to eat as much mash as grain. When feeding late-hatched pul-

lets in September and October it may be desirable to increase the total grain feed to each 100 birds per day up to 12 or 14 pounds in order to get them into good condition of flesh before they start their heavy production in middle winter. The most urgent problem in feeding birds under lights is to be sure that they are given a light feeding of scratch grain at whatever time the lights are turned on in order that they will be induced to come off the perches and get to work immediately. The second important problem is to see that at all times at which the lights are lit that the birds have an adequate supply of fresh, clean water; and lastly, that the hoppers are abundantly supplied with mash. The following tabulations show the results of lights on practically 4000 birds during the winter months. These birds were kept in fourteen different flocks on fourteen different poultry farms. They represent records from city flocks, farm flocks and commercial poultry flocks. A marked increase in per cent. pro-

duction can be readily noted. These figures show an increase of nearly 100 per cent. production, which, when analyzed in terms of dollars and cents, we find means nearly a 400 per cent. increase in net returns over the feed cost.

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Total
Number of flocks.....	14	14	14	14	14	14	14
Number of birds.....	3940	3940	3940	3371	3878	3745	3,802
Number of eggs.....	35463	45190	53188	39771	52896	54003	280,511
Per cent. production	30	37	45	38.06	44	51.5	41
Average per cent. production for State where no lights were used.....	26	13	15	20.4	25	33.3	22
Increased egg production due to lights.....	5051	30312	35458	15686	22601	18050	127 158

The old saying, "He Who Lingers Is Lost," is bound to be true in so far as the application of artificial illumination to modern poultry raising is concerned. It is a practice which goes hand-in-hand with culling. One eliminates the poor birds and the other enables the best birds to do full justice to themselves. Artificial illumination greatly increases production and greatly increases profit. It is not a forcing or destroying prac-

tice, but it rather gives the hens an opportunity to develop their inherent traits and maintains the flock during the winter in a much more vigorous, resistant, producing condition. If these suggested methods are followed surely no harm will result but great benefits can be assured.