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AGRICULTURAL EXPERIMENT STATION

KANSAS STATE AGRICULTURAL COLLEGE
MANHATTAN, KANSAS

DEPARTMENT OF POULTRY HUSBANDRY

FIG. 1.—A profitable farm flock.

POULTRY MANAGEMENT ON THE FARM[1]

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SELECTING A BREED[2]

The breed to choose is a hard question for many to answer. There is no best breed or variety, but strains within a breed may vary widely in productivity. The recommendation frequently suggested to select the breed one likes best works very well if one has good taste and judgment. For example, one might admire the size and sturdy qualities of a Dark Cornish, but it would be one of the last to choose if the production of market eggs was desired. The choice should be limited to a variety which has been carefully selected and

1. Contribution No. 82 from the Department of Poultry Husbandry.

2. For ready reference to the principal subjects treated in this circular, the reader is referred to the "General Index," page 49.

bred to intensify the qualities in which one is interested and which excels other varieties or strains in those qualities.

The Farm Flock

For a farm flock one of the general purpose breeds is usually the most satisfactory. The Rhode Island Red and the Plymouth Rock are the most popular breeds in this group. One can choose from two varieties of Reds or several varieties of Rocks. Poultry dealers who buy on a graded basis usually pay a small premium for white and buff varieties. The often-heard criticism that losses by hawks and crows are much greater among white varieties due to their greater visibility has been overemphasized. It is well known that hawks frequently spy rabbits, mice, ground squirrels and other protectively colored animals which hide in the grass. Therefore, they could probably locate a colored chicken easily enough if they were hungry and circumstances permitted.

The above-mentioned breeds are good for the production of eggs, and they are of sufficient weight and quality to satisfy market requirements and the family as table poultry. Objections are found in their tendency toward broodiness, lack of foraging ability, slowness in maturing, and their inability to escape motor cars along the main highways of the state. It is the opinion of farmers that Leghorns due to their greater alertness and agility suffer much less from motor traffic than the less active breeds. This loss, however, can be reduced by the use of poultry netting between the farm buildings and the road.

The farm flock shown in figure 1, is that of Mr. W. J. Sayre, Manhattan, Kan. This is one example of the increased interest farm men are taking in poultry. The gable roof, open front, straw-loft house with ventilator in rear for summer use has given good results on this farm. The flock consists of White Plymouth Rocks and numbers about one hundred fifty. This flock is a good investment according to the figures supplied by Mr. Sayre for 1924, which are as follows:

RECEIPTS

Market eggs	$225.00
Hatching eggs, 3,000 @ 6¢	180.00
Hens, 80 at an average of $1.28 each	102.40
Broilers (under 2 pounds)	69.00
Breeding cockerels	21.00
	$597.40

EXPENDITURES

Feed cost	$187.50
Interest on investment of $500 @ 6 per cent	30.00
	$217.50

These figures show a net income of $379.90. Depreciation and cost of labor have not been deducted.

COMMUNITY COOPERATION

There are many advantages in standardizing one or two varieties in a community. In order to market cooperatively or to attract buyers from any distance it is necessary to have uniform products in large quantities. The adoption of one breed and variety in a community would give everyone a larger number to choose from when selecting breeding stock; would attract more buyers as the reputation for good stock increased; and would make possible the standard grading of both market eggs and poultry.

The Commercial Flock

The commercial poultry raiser, that is, the man who keeps 500 or more hens, finds in the Single Comb White Leghorn a very satisfactory fowl for the production of uniform white market eggs. The Leghorn is a good ranger, produces more eggs than the heavier breeds and at slightly less cost, and the hatching eggs run high in fertility and hatchability. Leghorns seldom go broody, therefore they produce more eggs during the summer in proportion to winter production, than the breeds inclined to broodiness. Since summer eggs are worth only about half as much as winter eggs for market purposes, the excess of net income from Leghorns is not in proportion, to the increase in the number of eggs laid.

The Leghorn is unpopular as a farm fowl because of its small size and inferior quality of meat. Most markets dock hens under four pounds in weight from 4 to 6 cents a pound, as small fowls are not in great demand. Some Leghorn breeders have escaped this dockage by increasing the size of their hens through selection, to a weight of four pounds or more at maturity. This is a much wiser policy than to resort to cross breeding or to the selection of some of the larger breeds of the Mediterranean class which are much less prolific.

For quality of flesh the Leghorn broiler up to two pounds is very satisfactory, but beyond that weight neither old nor young stock possesses the best of quality. Jersey or Holstein steers are not found among the prize winners at the fat stock shows, neither do we expect choice hens or prime roasters from fowls which have been selected for generations for high egg production. It is not practical to try to develop both maximum egg and meat qualities in the same breed.

The English Leghorn is larger than the American Leghorn and ranks high in egg production, but does not conform to the standard shape or color for Leghorns in this country. It is inclined to coarseness and therefore receives very little consideration when exhibited in a standard show with American Leghorns. The present need is for American Leghorns possessing good size, quality, and the ability for high egg production.

FIG. 2.—The back-yard flock of Mr. F. J. Hanna, Manhattan, Kan., which averaged 101 eggs each in 8 months as two-year-old hens. The income for eggs from 58 hens was $182.05 and the cost of feed was $55.10. Many of the eggs were sold to neighbors at retail prices and garbage from a nearby sorority house kept down feed costs.

The Back-yard Flock

A small flock of 10 to 20 hens can be kept successfully in the back yard of residents in the town or city. One of the general purpose breeds is frequently recommended, especially where the hens are to furnish meat as well as eggs for the table. When eggs are the principal object, White Leghorns will give satisfactory results. (Fig. 2.) They do better in confinement, consume less feed, and are nonbroody. These are regarded as advantages since back yard flocks commonly must be housed throughout the year; feed is usually purchased at retail prices, hence is an important item; and nonbroodiness is a convenience for the caretaker.

It is not advisable to raise chicks in small back yards, although many attempt it and some are successful. The losses from poor hatches, rats, cats, and internal parasites from contaminated ground are very great. A more satisfactory practice when replacing the flock is to buy March, April, or May hatched; pullets in September or October, keep them for one or two years and then eat or sell them and renew the flock. Such pullets can be purchased from those who make a business of supplying pullets five or six months of age; or from poultry receiving stations where mature pullets may often be found on the market. Only healthy birds should be selected. One can afford to pay $1 to $1.50 each for healthy mature pullets, as they will, if properly cared for, give good production during the fall and winter season of high prices as well as through the following spring and summer.

When poultry for meat is the object of a back yard flock, chickens can be purchased when 6 to 8 weeks of age, after they are brooder weaned, and fed in small pens until they reach the desired size for table use.

HOUSING FARM POULTRY

The housing of poultry is quite different from housing other farm animals. A building well adapted to men, cattle, or horses would be very unsatisfactory for poultry due to the great difference in the habits and general make-up of these animals. The temperature of the hen averages about 106 degrees Fahrenheit. She has no sweat glands and does not pass urine, and much of the liquid intake is eliminated through her respiratory organs. According to Dr. B. F. Kaupp, of the North Carolina Agricultural Experiment Station, the pulse of a heavy-producing hen averages 350 times a minute compared with the human pulse which averages 72 a minute. The respirations of the hen occur about 32 times a minute, while in man they average about 18. Careful studies by Calin, quoted by King, found the number of cubic feet of air breathed every 24 hours per thousand pounds of live weight to be as follows:[3]

	Cubic feet
Cow	2,804
Man	2,833
Horse	3,401
Hen	8,278

These figures indicate that the hen in breathing utilizes about three times as much air per pound of live weight as does the cow. Air exhaled from the lungs is heavily charged with moisture. This

3. King, F. H. Physics of Agriculture. Sixth Edition. 1914. Reference, page 354.

accounts for the high humidity found in poultry houses which are closed too tightly. Damp litter and the collection of frost on nails in the house are indications of an excess of moisture present.

It is well known that chickens, as other animals, suffer more in cold weather when surrounded by high humidity than when placed in a relatively dry atmosphere.

FIG. 3.—Front view of the Kansas 20- by 40-foot open front, gable roof, straw loft poultry house.

The principal difference between poultry houses and other live-stock buildings is in the large open front provided in the former. From one-third to one-fourth of the area of the front wall is left open to insure good ventilation without drafts and the proper elimination of moisture by the constant circulation of air through the large open front. The front is covered by wire netting and equipped with muslin or burlap curtains to be used in stormy or cold weather. The curtains are made of light material to enable the air to pass in and out freely thus equalizing the humidity inside and outside of the, building.

Drafts through a poultry house are very harmful in cold weather, but they are not created when the air enters and leaves the same opening. It is when the air passes through. cracks and knot holes

on one side of the building and out the open front on the other side that drafts are created and serious damage results.

Any building with tight walls on three sides and open in the front will be relatively free of drafts up to 20 or 30 feet in length, (Fig. 3.) Beyond that length it is necessary to place solid partitions from front to rear every 20 or 30 feet to prevent end to end and whirling movements of air currents. This type of ventilation, however, is not

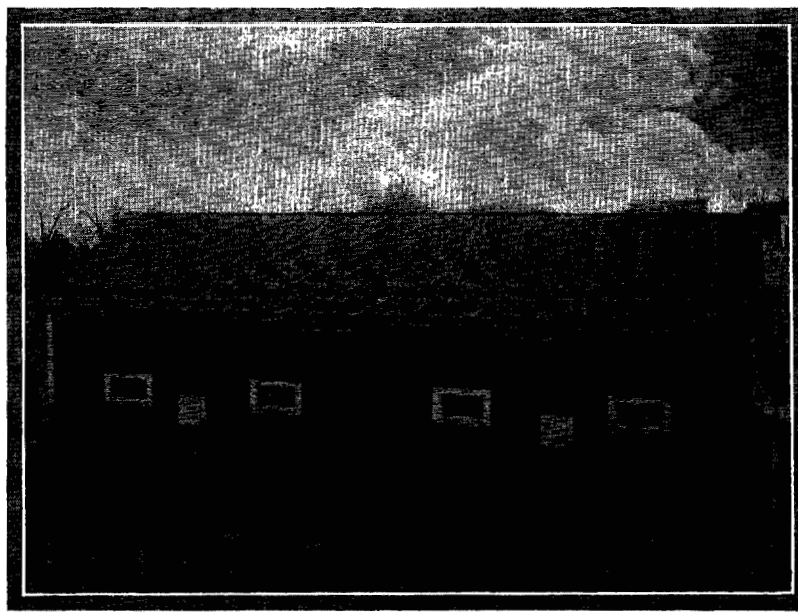

FIG. 4.—Rear view of the Kansas 20- by 40-foot open front, gable roof, straw loft poultry house. Note that a portion of the ventilator is open as for summer use, and a portion is closed as for winter use.

sufficient during the summer in Kansas. A rear ventilator 8 to 10 inches in width should extend completely across the back of the building just under the eave. (Fig. 4.) Summer drafts do not injure fowls as do those of winter. Rear ventilators should not be opened in the spring until warm weather is assured and they should be closed tight before frost in the fall.

Location of the House

A south or southeastern slope provides the best location for a poultry house. If such a site is not available a high location with good water and air drainage should be selected. When the location is flat, as it is in many sections of Kansas, the house should be

elevated on the foundation and the yard graded to provide rapid drainage of surface water. A sandy loam is the most desirable type of soil. It absorbs the water quickly, permits the sun's heat to penetrate some distance into the ground, is not tracked into the house, and is fertile enough for vigorous plant growth. Clay or gumbo soils should be avoided.

A wind break of trees, a hill or larger buildings are advantages in keeping the birds comfortable. The house should be placed facing the south in the open where it can be well ventilated and kept clean. The location should be some distance from the barns, granaries, and sheds, but convenient to the residence. Chickens can become a nuisance in the pig pens and horse troughs when housed too close. The loss of young chicks from rats can be reduced by locating the brooder house some distance from the other buildings. The problem of keeping the chickens out of the vegetable and flower garden can best be solved by fencing the garden.

Types of Houses

The Permanent Laying House.—Permanent laying houses usually range in width from 16 to 20 feet. They may be as long as desired providing solid cross partitions are placed every 20 or 30 feet to prevent drafts. The following dimensions give the capacities of a number of sizes commonly recommended:

SIZE OF HOUSE	FLOOR AREA Sq. ft.	CAPACITY	
		Heavy breeds	Leghorns
16′ x 16′	256	50	60
18′ x 24′	432	100	120
20′ x 40′	800	200	225
20′ x 80′	1,600	450	500

The rule generally followed is to allow for general purpose breeds 4 square feet of floor space for each bird when 100 are housed in one flock, and 3½ square feet for Leghorns. In smaller units more space is allowed and in larger units slightly less area is required.

The value of a deep house is in the increased ventilation by leaving the front open most of the time throughout the winter. The birds being far removed from the open front makes the closing of curtains necessary only in very cold or windy weather. While a square house is the cheaper to build, a rectangular house makes less congested roosting quarters, permits of sunshine covering a larger area of the floor, and gives a house a better appearance. A house 20 by 40 feet with a gable roof and straw loft has proved very satisfactory for Kansas. (Figs. 3 and 4.) Glass windows areused in the ends and the rear, but not in front.

The Portable Brooder House.—A portable brooder house is usually built on 4- by 6-inch sled-like runners so it can be moved about to give the young chicks the advantage of "clean ground" over which to range. These houses are usually 8 by 12 feet or 10 by 12 feet in size. If moved when the ground is frozen or covered with snow, one team of heavy horses is sufficient, otherwise two teams or a tractor would be required. (Fig. 5.)

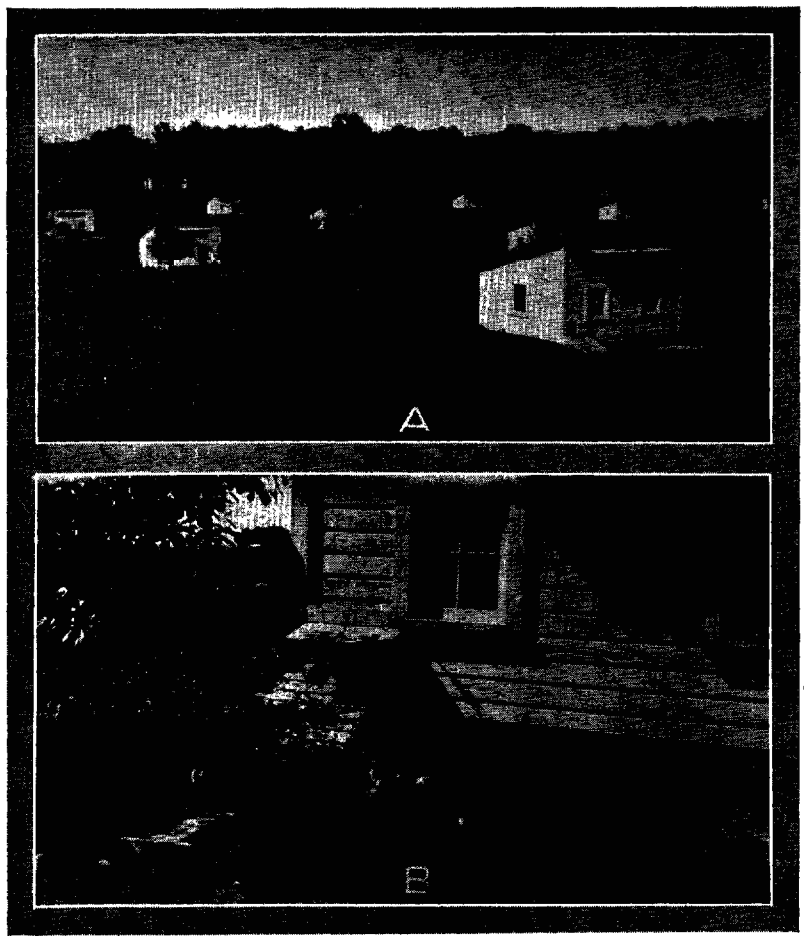

FIG. 5.—(A) Kansas 10- by 12-foot portable colony brooder houses. (B) Approach to brooder house.

Material for Buildings

A concrete wall reinforced with hog wire or heavy poultry netting and extending into the ground below the frost line makes the best foundation for a permanent house. The floor may be of dirt boards, concrete, or hollow tile. Dirt floors can be used without great danger if the top six inches is renewed each year. A hard clay, gypsum, or clean sand should be used. There is too much dust in common soil for good results.

Concrete floors are underlaid with several inches of coarse rocks covered with small stones and gravel or cinders to prevent dampness soaking through. A two-inch layer of concrete of a 1-3-5 mixture covered with a surface coat of one part cement to one and one-half parts screened sand, troweled smooth for ease and thoroughness in cleaning, makes a good floor. The most satisfactory floor is made of hollow tile laid on well packed earth and covered with one inch of cement. This type of floor is always dry and the dead air space beneath makes it much warmer in the winter than solid concrete. Board floors are used extensively in small portable houses, but they are not so satisfactory in large houses due to rotting when wet, warping, splintering, and the harboring of rats underneath.

Six-inch drop siding of fir or yellow pine is advisable for the front and end walls. On the north, shiplap or six-inch flooring covered with roofing paper makes a good wall. Tile blocks for the walls can be used when this cheaper than lumber. It is important that the tile be well made and hard burned and that every joint be made air tight.

The Straw Loft.—The straw loft which is now frequently used in poultry house construction has done more to add year around comfort to poultry in the house than any other innovation of recent years. The straw overhead is an insulation against extreme temperatures, keeping the interior cool in summer and warm in winter. It also absorbs surplus moisture which is carried away by circulation of air through the gable ends which are open continually. The majority of people who examine a straw loft house for the first time inquire if it isn't a good hiding place for mites and rats. In case of bad infestations of either there might be trouble, but during several years' use at the poultry farm of the Kansas Agricultural Experiment Station there has been no trouble of this nature. Sparrows may nest in the straw and it gets very dusty after several years' use, so renewing once in five years might be advisable.

INTERIOR FIXTURES

In a well-planned poultry house, provision is made for roosting, laying, feeding, and exercising in the same room. The entire floor space is utilized for scratching by placing the water and feed hoppers on stands two feet above the floor and attaching nests and supply hoppers on the end or partition walls. These fixtures are arranged to give maximum light over the floor. The old practice of placing the nests under the droppings boards has been discontinued by many poultrymen as a means of eliminating dark corners on the floor. The interior fixtures are portable for convenience in cleaning and disinfecting.

Roosts and Droppings Boards —Roosts can be made of 2- by 2-inch material with upper corners rounded. They are placed on a level reaching along the entire rear of the house and spaced 14 inches from center to center. Six to eight lineal inches are provided for each adult chicken depending upon the size. The roosts are hinged to the rear wall about 3 feet above the floor.

Droppings boards are built under the roosts to collect the night droppings. This practice greatly reduces the number of general house cleanings a year, and makes possible the utilization of the entire floor space for scratching and the production of more clean eggs. The droppings are scraped from the boards once or twice a week and scattered on the fields not utilized as poultry range. Level droppings boards are considered better than the slanting ones which, in reducing the amount of light that passes behind them, afford dark corners in which sick or timid birds hide.

Nests. —The nests are conveniently located on the partition walls where the hens and eggs will be affected least from fluctuating outside temperatures. They should be roomy, easily cleaned, darkened, covered and equipped with a door for closing at night to shut out broody hens. A nest 14 inches square and 12 inches high will accommodate the average hen. One open nest is provided for every eight hens in flocks of average size. If trap nests are used one nest to four hens is desirable. A battery of nests resting on wall brackets is illustrated in figure 6. The batteries can be made two or three nests high if necessary. Well-cured hay, chaff, or straw makes good nesting material. Whatever the material is, it should be used freely to prevent soiled or cracked eggs.

Antibroody Coop. —An antibroody coop is indispensable when members of the dual purpose group are kept. The coop is made of

two-inch slats placed one inch apart on the bottom and two inches apart on sides and ends. It may be placed over the roosts, but a better location is outdoors in the shade and elevated three or four feet above the ground. A feed trough and water vessel are attached to the outside. Birds should be confined in this coop upon the first indications of broodiness. The longer a hen remains broody the longer will be the time required to break her of her broodiness.

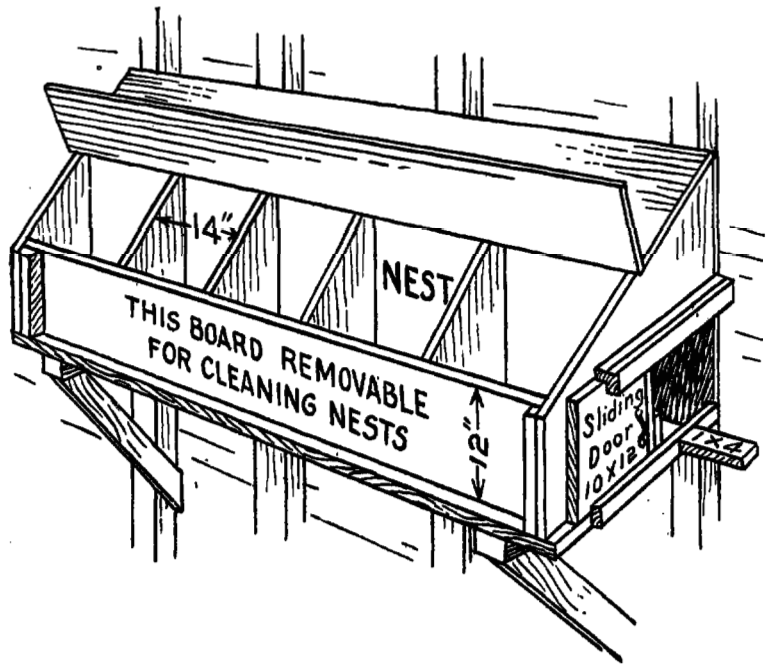

FIG. 6.—A battery of simple, convenient, and practical wall nests.

Dry Mash Hopper.—A nonwaste, nonclog mash hopper is one for which poultrymen have striven many years. The hopper illustrated in figures 7 and 8 approaches these requirements very closely. The accessibility of water near the mash encourages greater mash consumption which should mean more eggs. The large number of hens which can feed at one time and the provision for timid or shy hens to have an equal chance are other advantages of this hopper. Mash is added daily from a supply hopper attached to the wall.

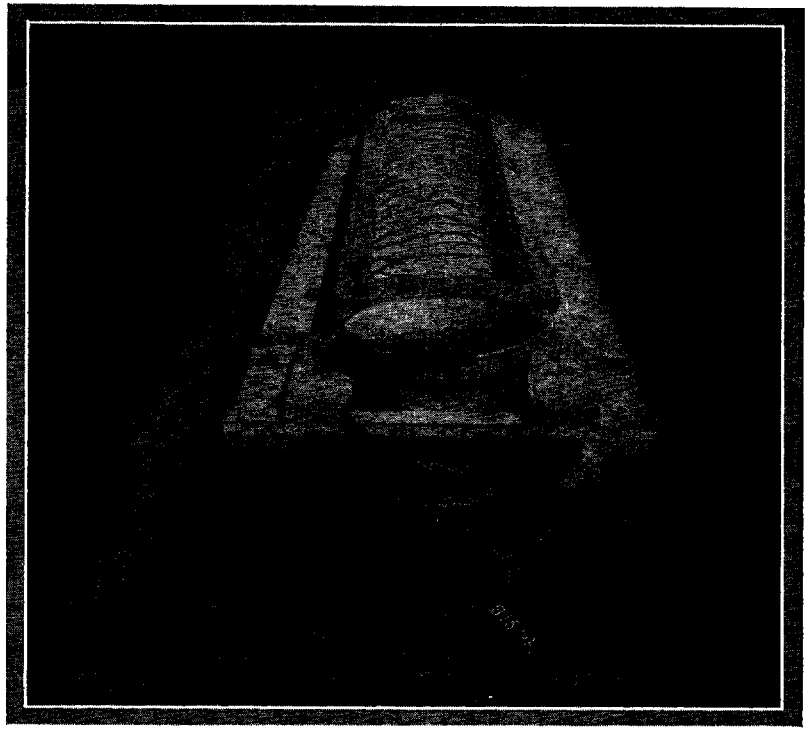

FIG. 7.—End view of a nonclog, nonwaste dry mash hopper.

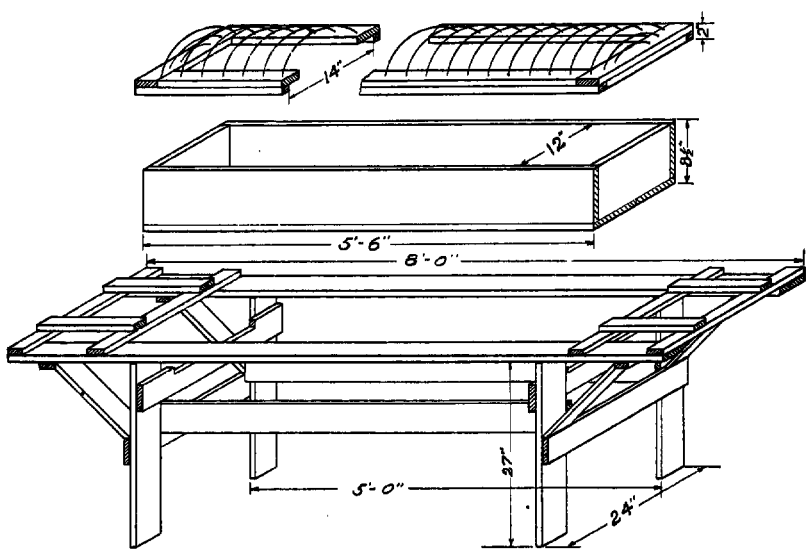

FIG. 8.—Working plans for the nonclog, nonwaste dry mash hopper shown in figure 7.

Curtains for Open Fronts. — Open fronts, which are covered with either one-half inch hardware cloth or one-inch mesh wire netting, are equipped with curtains which are closed in severely cold or windy weather. The curtain material is either medium-weight muslin or a single thickness of burlap. The object of using coarsely woven material is to permit the circulation of air through the cloth. Heavy cloth such as ten-ounce duck is not satisfactory.

The curtains are tacked to well-constructed frames made of two-inch material and hinged to the casing above the opening. They are swung up out of the way when not in use, and when used they are held in place by cleats or fasteners which will hold them solid regardless of the wind velocity.

SUNSHINE

The value of sunshine in destroying disease germs, drying, illuminating, and adding comfort and good cheer to the interior of a poultry house has long been realized, but only recently was it discovered that most of the beneficial properties in the sun's rays are filtered out if they pass through glass or finely woven cloth. The Agricultural Experiment Station of Wisconsin found that thin-shelled eggs were related to lack of sunshine, and the Kansas Agricultural Experiment Station found a relationship between the hatchability of eggs and the amount of direct sunshine during the spring months. Tests by the Department of Physics in K. S. A. C. showed that 10 per cent of the ultraviolet rays (which are the beneficial rays) would penetrate glass cloth, 25 per cent would pass through cel-o-glass, and 33 per cent would pass through medium-weight muslin.

Sunshine which passes through glass has very little, if any, germicidal power, while direct sunshine will destroy many of the disease germs commonly found in poultry houses. The open front should be so arranged that it will let not "a little" but a lot of sunshine in.

REPRODUCING THE FLOCK

The most expensive and the most important step in poultry production is reproducing the flock. It has been pointed out that chickens are high-geared animals, and like fast running machines they are short lived. One-half to three-fifths of the flock should be replaced annually, which means a rapid turnover of stock. The greatest expense involved comes in reproducing the flock. Just what this expense will amount to depends upon the per cent of chickens hatched and matured from a given number of eggs, and this is determined to a large extent by the vigor of the breeding stock.

Constitutional Vigor.—The vigor of fowls is measured by their general appearance; the number, fertility, and hatchability of eggs; and the livability of the chicks after they are hatched, Constitutional vigor in poultry is essential to success in all phases of the industry. It matters little how much knowledge the poultryman has, how good his equipment is, or how well bred hi sflock may be, if it lacks vigor it will not long survive.

The contrast in appearance between good and poor vigor is best illustrated in figure 9. The vigorous bird has a short well-curved

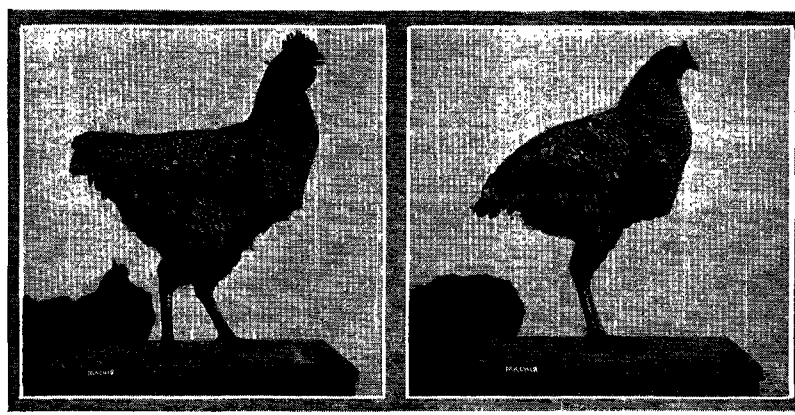

FIG. 9.—Cockerels showing good vigor (left) and low vigor (right). Note the difference in shape of head and body.

beak, prominent clear eyes, a relatively deep, broad head with a bright red color in comb and wattles. The back is broad and carries level to the tail. A full breast and well-developed abdomen gives the body a rectangular appearance, The legs are squarely placed and stand wide apart at the knees. This description applies to both male and female. Only the most vigorous appearing fowls should be used in the breeding pens. The appearance alone may be deceiving, however, and it cannot always be relied upon to measure vigor. The number of chicks that hatch and live to three weeks of age, from 100 eggs set, is a better measure of the inherent strength of a pair of individuals.

The bird of low vitality is "crow-headed," narrow in back which droops toward the tail, "cow-hocked," and has a generally unthrifty appearance. Such a bird should not be tolerated under any conditions.

The Production of Hatching Eggs

Selecting Breeding Stock.—The cockerel that crows first and the pullet that lays the first egg may be vigorous in every sense of the word, but they are usually undesirable as breeders. They are precocious or early-maturing birds that are fine-boned and undersized and usually always remain so. The continuous breeding from this type would eventually reduce both the size of the fowl and the size of the egg. Slow-maturing birds, which do not begin laying until 10 or more months of age, are also undesirable. The most desirable age to come into production is six to seven months for Leghorns and seven to eight months for general purpose breeds.

Hens Versus Pullets.—The eggs from well-developed hens are thought to be more desirable for hatching than the eggs from pullets. The chicks from hen eggs are larger and more vigorous than from pullet eggs. Hens usually lay very little during the two or three months preceding the breeding season, which is thought to be an advantage in securing good hatchability. Hens may be used for the production of hatching eggs until two to five years of age. When it is necessary to hach eggs from pullets they should be well-matured birds preferably with a pause in production just prior to the breeding season.

Mating to Increase Egg Production.—The art of culling has made it possible to select in the fall the highest-producing hens in the flock. These should be mated with males from hens of high egg records when possible, It is not practical for farmers to trapnest or pedigree'their poultry, but they can purchase pedigreed cockerels from bred-to-lay stock, and when mated with carefully culled hens, improvement will be realized,

Number of Hens to One Male.—One male for 12 to 15 females of the general purpose breeds, and 15 to 20 females for Leghorns is a good proportion to use. Cocks are usually mated with pullets and cockerels with hens, but adequate experimental data are not available to prove the necessity of this practice. The flock should be mated five to seven days before the eggs are saved for incubation. If it becomes desirable to change males and secure pure stock from the second mating, three weeks should elapse after the first male is removed before saving eggs from the second mating. There seems to be no advantage in keeping the males separated from the flocks during the winter prior to the breeding season, unless the eggs from such flocks are receiving a premium price for being infertile.

Selection and Care of Eggs for Hatching.—From a well-selected flock 75 to 80 per cent of the eggs gathered will qualify as desirable for hatching purposes. Eggs weighing 22 to 28 ounces per dozen with clean, strong shells are most desirable for incubation. Eggs with thin, cracked, or dirty shells and those that are misshapen, undersized or oversized should be discarded,

It is necessary to gather eggs daily or every few hours in cold or very warm weather. They should be held at a temperature between 45 and 65 degrees F. Better results will be secured by not holding the eggs longer than seven days before incubating. Fair results, however, may be expected from eggs properly kept 10 to 14 days. When kept longer than one week it is well to turn them daily.

Incubation

The farmer now has the option of buying baby chicks from any one of a large number of commercial hatcheries or of hatching his own by either the natural or artificial methods.

There are many advantages in buying baby chicks where one is assured good quality of stock, and there are associations in many of the leading poultry states, including Kansas, which were organized primarily to guarantee good-quality chicks true to name and from carefully selected stock.

Much of the drudgery of incubation and brooding is escaped when one can buy the season's supply of chicks from good stock, properly hatched early in the season, and brood them all together under one hover. Being of the same age they can be handled alike throughout the brooding and growing periods and they will mature and come into production about the same time in the fall.

NATURAL INCUBATION

Nests for natural incubation are made in pairs and located some distance from the poultry house. One hen can usually brood all the chicks that two hens will hatch. The, hen naturally prefers a quiet, secluded location where she will be unmolested by other hens. There is also less danger of broken eggs and of hens leaving the nests or becoming infested with lice and mites when they are isolated from the laying flock.

The Coop.—A coop 15 inches wide from front to rear, 30 inches long and 18 inches high in front and 12 inches high at the back, with a removable partition in the center and a shed roof hinged at the

top and hooked to the rear wall makes an ideal coop ror natural incubation. A wire-covered runway in front is provided for feed and exercise. Such a coop is illustrated in figure 10. This coop is light, portable, serviceable, and attractive. Cheap boxes or barrels may be used, but they are not as accessible, nor do they afford protection to the hens, the eggs, or the chicks as does this coop which is a combination for both natural incubation and brooding facilities.

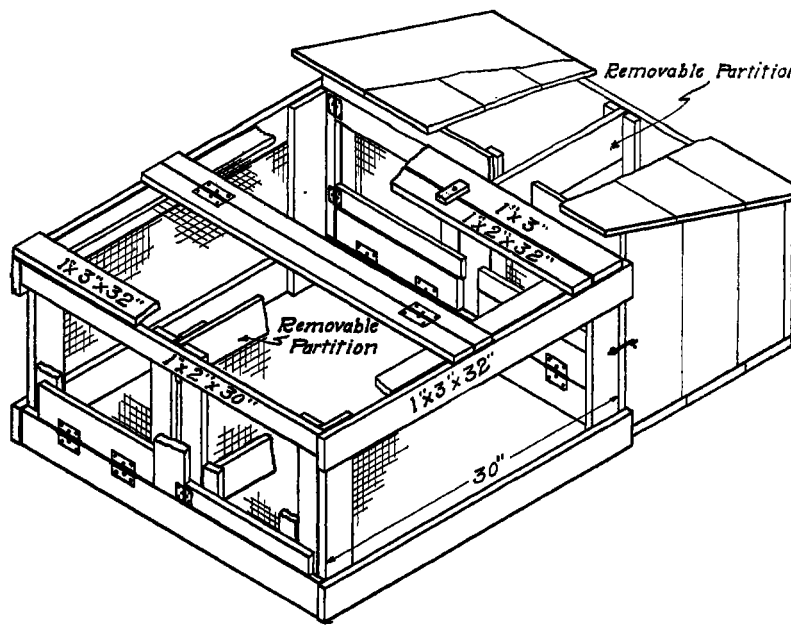

FIG. 10.—A portable coop for hen hatching and brooding.

Locate the coop on a slight elevation and bank dirt around the outside to keep out surface water. Make the nests on the ground by scooping out two to three inches of dirt, gradually sloping the sides so the eggs will neither roll out nor pile up. A small amount of grass, hay, or straw is placed on the earth nest and it is ready for use.

Choosing the Hens.—After dusk select broody hens of medium size with long feathers, clean shanks, and a fair disposition. Two-year-old hens are preferred to pullets. Transfer the hens after dark to the nests which have been prepared and give each one two or three eggs to sit on. If the hens accept the nests, they should be dusted thoroughly the following day with Sodium Fluoride to de-

stroy all lice. (Never dust the hens just before the chicks hatch, as the powder will irritate the eyes and air passages.) After this the hens may be intrusted with the eggs they are to incubate. It is customary to set an odd number of eggs under each hen, 11 to 13 or 15 being the usual number, but much depends upon the size of the eggs, the size of the hen, and the season of the year.

From the third to the eighteenth day the hens should be removed from the nests daily for feed and exercise. Shelled corn and water make a good ration throughout the incubation period of 21 days. The examination of eggs for cracked and dirty shells should be made while the hens are off the nests.

A good hen is the best possible incubator, and while machines are rapidly taking her place she is still, and probably always will be, the standard by which results artificially obtained are measured.

ARTIFICIAL INCUBATION

Many advantages are claimed for the artificial over the natural method of incubation. Some of these may be enumerated as follows: Ability to hatch large numbers at any season of the year; assurance that the eggs will not be destroyed by natural enemies, storms, or other unfavorable conditions; and assurance that the chicks will be started in life free from external parasites and many other troubles which may be contracted by associating with hens.

Selecting an Incubator.— There are two distinct types of incubators which are commonly referred to as "hot air" and "hot water" types. These terms refer to the method of heating the egg chamber. The first is constructed on the principle of the hot-air furnace. Air is drawn from the room past a metal cylinder heated by the lamp into the egg chamber, where it circulates until cooled to a certain temperature, when it escapes through openings in the bottom. This method provides a forced system of ventilation, which is adequate under most conditions. Due to the rapid exchange of air it is necessary to regulate the evaporation of the egg contents by reducing the size of the exits or adding moisture in sand trays or in open vessels.

The hot-water incubators operate on somewhat the same principle as the hot-water furnace. Water heated by the kerosene lamp circulates through pipes in the egg chamber and the proper temperature is obtained by radiation. This type of heat is more uniform, but there is no forced ventilation and the exchange of air is very slow. This condition makes it possible to operate the incubator without

adding moisture. Good results are secured from both types of incubators when they are provided with good eggs and properly operated.

The important thing to remember in choosing an incubator is that it pays to get a good one. Good machines will last a lifetime, and the value of the eggs to be incubated will amount to vastly more than the original cost of the incubator.

Locating the Incubator.— The incubator should be given a permanent location preferably in a well-ventilated basement or cellar. Second choice would be an unheated room in the house. Ventilation in the room without drafts is important, as it is impossible for the air in the egg chamber to be better than the air in the room where the machine is operated. A good plan is to introduce the fresh air into the room, near the floor rather than near the ceiling. It is also advisable to provide ventilators for the removal of the stagnant air from both the floor and ceiling where a number of small incubators are operated in one room.

The sun's rays should not be permitted to strike the incubator, as they will increase the temperature beyond the control of the regulator. Curtains of muslin or other light material hung over the windows will modify the sunlight and also admit sufficient light.

Operating the Incubator.— After selecting the location the incubator must be leveled from side to side and front to back to insure a more even temperature. A carpenter's level is good for the purpose. A new cotton wick should be placed in the lamp and the corners trimmed to give a round flame. The best grade of kerosene should be used in the lamp bowl. Fill it to within one-half inch of the top. This will allow the proper expansion after heating without running over. Light the lamp, put it in place and turn the flame up just enough to be seen above the cap. Allow it to heat 5 or 6 hours, after which time turn the flame up until one-fourth inch appears above the cap in which position it should remain while regulating the incubator to the proper temperature.

Follow carefully the instructions which go with the incubator. If they have been lost or destroyed write to the manufacturer for another copy. One person should be responsible for the running of the machine. It is a good policy to have some system in doing the routine work. Look at the incubator three times a day, morning, noon, and night, and observe three parts of the machine at each visit, Examine first the temperature through the glass door, second the disc of the thermostat over the lamp chimney, and third the lamp flame. If everything is all right proceed to the next step. If

something is wrong decide which part is at fault and correct it before opening the door ta the incubator. After making the observations, fill and clean the lamp. This should be done once a day, preferably in the morning.

Two or three days will be required to regulate the incubator to the proper temperature, after which the eggs may be placed on the egg tray in a natural position, transferred to the incubator, and not disturbed until the morning of the third day when the tray should be removed in order to turn the eggs. From the third to the eighteenth day the eggs should be turned three times daily. They should be turned each day before filling the lamps as kerosene transferred from the hands to the eggs would destroy their hatchability. They are usually candled on the seventh and fourteenth days of incubation and all eggs which are infertile or contain dead chicks removed.

On the evening of the eighteenth day the moisture pans, if used, should be filled with water and the thermometer tied to the bottom of the hatching tray so it will not be knocked over when the chicks begin to hatch. The door of the incubator should not be opened again until the eggs are practically through hatching which should be the afternoon of the twenty-first day providing the operation has been correct.

A dark cloth may be hung over the glass door to keep the chicks quiet while hatching.

The Proper Temperature.— Careful experiments at the Agricultural Experiment Station of Purdue University, Lafayette, Ind., have shown that best results come from temperatures of 101, 102 and 103 degrees the first, second and third weeks, respectively, where the bulb of the thermometer stands level with the top of the eggs. If the thermometer is suspended one-half to one inch above the eggs, 103 degrees throughout the incubation period should be used. These temperatures are recommended when the machine is operated in a room temperature above 50 degrees. In rooms below that temperature one degree should be added to each of the above. The thermometers should be tested at the beginning of every season and corrections made for inaccuracies. Any physician or druggist can explain how the test is made.

Under normal conditions one can expect from every 100 eggs set, 10 to 15 infertile, 25 to 35 dead chicks in shell, and from 50 to 65 strong healthy chicks. Many can do much better than this, and a few not so good. Much will depend upon the breed, the management and the skill of the operator.

Brooding

To brood and rear chicks successfully requires more knowledge and skill than to hatch them properly. Good brooding is looked upon as fundamental to success in the poultry business. If the chicks are stunted in their growth or impaired in any way, the result is slow-maturing late broilers, undersized pullets, retarded production, and poor hatchability in the eggs produced.

NATURAL BROODING

The coop shown in figure 10, which is for natural incubation, is also well adapted for brooding. The partitions between the nests and the runways are removed and all chicks are placed with the better of the two hens. The hinged slat in front of the nests is dropped so the chicks can have the use of the screened-in runway the first few days without danger of the hen stepping on them. Later the hen may be given the freedom of the runway and the chicks allowed to run out through the small opening in front for free range about the coop. As long as the mother hen is confined the chicks will not stray far or out of hearing of her warning call in case of danger.

This method is satisfactory where comparatively few chicks are hatched each year. The hen assumes the responsibility of her family and there need be little worry on the part of the owner about proper ventilation, temperature, or exercise for the chicks.

ARTIFICIAL BROODING

There are four common types of artificial brooders; namely, fireless, portable hovers, coal stove, and continuous hot water pipe brooders. The general principles of all types are the same. They supply heat from above, provide a compartment in which the temperature approaches that of the body, as well as one or more compartments with lower temperatures.

Fireless Brooders. — These brooders are made by surrounding large jugs with burlap or felt. These are enclosed in a box with a cover and filled with hot water three or four times a day. Another method is to equip boxes with ceilings four or five inches above the floor and made of felt or wool and well insulated above. When 25 chicks are crowded into a space 10 to 12 inches square the heat given off from their bodies is conserved sufficiently to keep them comfortable. There are a few types of fireless brooders on the market which give good results. These types are to be recommended

only with small numbers of chicks and when it is impractical to use other methods.

Portable Hovers.—Those who raise less than 300 chicks annually will find the portable hover inexpensive, practical, and satisfactory. It is a small metal brooder with heating system and regulator attached. The source of heat may be kerosene, or electricity. Being light in weight it can be easily moved and adapted to buildings or rooms of any size. Fifty to seventy-five chicks-can be brooded comfortably under one hover. (Fig. 11.)

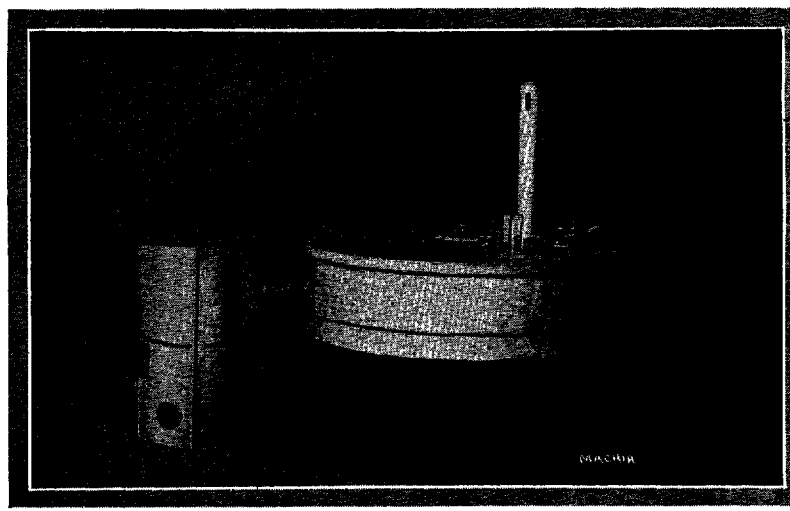

FIG. 11.—A portable hover for artificial brooding.

Coal Stove Brooders.—These brooders consist of cast iron stoves, with sheet iron hoods or canopies for deflecting the heat towards the floor and regulators for automatically controlling the temperature, (Fig. 12.) This type is very popular where units of 300 or more can be brooded together. The stoves vary in size and their rated capacities range from 500 to 1,500, but experience has shown that 350 to 400 is the maximum number to place in one unit regardless of the size of stove. When more than that number are brooded together the losses from crowding, dampness, and stunted growth. overbalance the economy of large units. Hard chestnut coal is the most satisfactory fuel, but the cost makes it almost prohibitive. Soft coal can be used, but it requires more attention. Equal parts by weight of a soft nut coal and stove coke make a good substitute

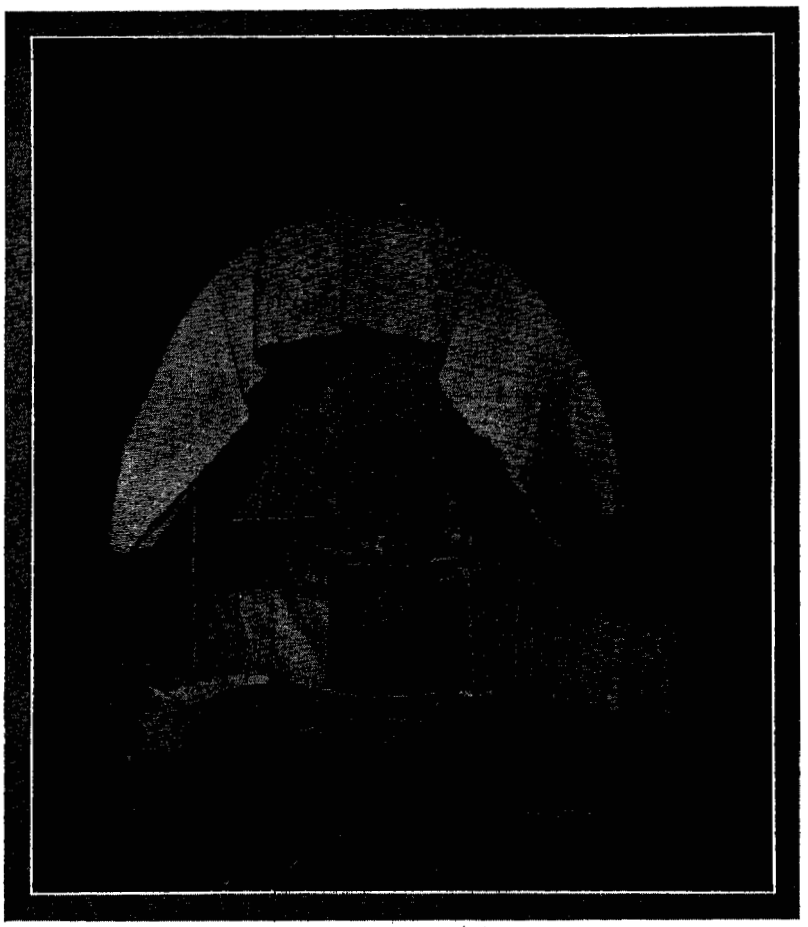

FIG. 12.—One type of coal stove brooder suitable for 300 to 400 chicks.

for hard coal. Oil-burning brooders are also used for large units. They give satisfactory results for late spring end summer brooding, but do not give sufficient heat for early spring use. Both types are used with best results in portable colony houses 8 by 12 feet or 10 by 12 feet in size. (Fig. 5.)

Continuous Hot Water Pipe Brooder.—This type of brooder consists of a central heating plant from which extend long rows of hot water pipes. The pipes are enclosed or covered to conserve the heat and convey it to the space occupied by the chicks. This method is no longer recommended except for winter broiler production or for starting chicks early in the spring. The system is

expensive to install, is idle a large part of the year and the buildings being permanent cannot be moved to clean ground when the soil in the runways becomes contaminated with internal parasites.

Operating the Brooder.—The building and the brooder should be thoroughly cleaned and disinfected before the chicks hatch. The floor is prepared by covering that portion under the hover with coarse clean sand, while finely cut straw, hay chaff, or alfalfa leaves from the barn loft can be spread over the remainder of the floor. Two days is sufficient time to get the brooder regulated to the proper temperature which is 95 to 100 degrees on the floor where the chicks live. After the chicks are placed around the brooder, a small-mesh poultry netting is put around them 12 or 18 inches from the outer edge of the hover to prevent the chicks from leaving the heat. This guard may be removed after the first week.

The daily routine in caring for the brooder consists of regulating the temperature, caring for the heater, and cleaning the floor under the hover. Chicks showing any signs of sickness are killed and burned as their chances of recovery are slight while the danger of spreading the disease is great. An outside yard should be provided for use after the first week, and chicks should be permitted to run out in the sunlight as much as possible. The chicks should be taught to go out and in by driving them all out doors and after 10 to 15 minutes, depending upon the weather, driving them all in again. This should be done even though the ground may be frozen. After repeating this four or five times the chicks will go out and in of their own accord.

POULTRY FEEDING

The grains required for poultry feeding can be grown on the farm. It is not necessary to buy a large variety of expensive feed for good results. The grains recommended are yellow corn,[4] kafir, wheat, milo, barley or oats. These may be fed alone or in combination of two or more mixed together. There is no section in Kansas in which some of these grains cannot be grown. This group contains those feeds which supply most of the body heat and energy.

These grains are not complete when fed alone or in combination, but must be supplemented with a second group of feeds, preferably of an animal origin, as for example, insects, milk, fresh meat, green cut bone, commercial meat scrap or high-grade tankage. This

4. Yellow corn contains Vitamin A and white corn apparently does not. If yellow corn is not available and white corn must be fed, Vitamin A should be supplied in the form of green feed or well-cured alfalfa leaves.

group is rich in protein which is necessary to supply muscle and feathers in growing chicks, and the egg white in mature hens. The present-day farm flock is too large to find an adequate supply of insects, so it is necessary to feed milk in some form, to kill rabbits and supply as fresh meat, or to purchase some of the commercial forms of protein feeds. The supplying of protein from an animal source also furnishes some of the important minerals.

A third group contains the succulent and green feeds. These contain some important food material, but are of particular value in stimulating the appetite and for their physical effect on the digestive tract. Green feeds not only supply one of the vitamins essential in a balanced ration, but they furnish the pigment which gives the egg yolk a rich yellow color. The common sources of this group during the fall and winter are wheat or rye pasture, sprouted oats, mangel beets, or cabbage. Vitamin A is present in the green feeds but deficient in cabbage and beets. Where the latter are used exclusive of green feeds, yellow corn or some other source of Vitamin A should be fed in the ration. The absence of this vitamin in the ration is the cause of nutritional roup and also reduces the production and hatchability of eggs.

The fourth and last group of feeds consists of minerals which are supplied by feeding bone meal, oyster shell or lime stone, grit, charcoal, salt, and water. Bone meal is required for bone development and oyster shell for the production of egg shells. Neither of these will take the place of hard grit which is needed for grinding the feed. Charcoal has no food value, but it is sometimes used for the favorable effect it has in the digestive tract. Fine table salt perhaps has some value as a mineral. One-half of 1 per cent of the ration is sufficient, and more than 1 per cent is likely to cause harmful results. Clean fresh water is always desirable, except when feeding baby chicks. They thrive best on milk which contains some nourishment and sufficient water to quench the thirst. Water comprises more than 55 per cent of the fowl's body and over 65 per cent of the egg. In other words, a dozen eggs weighing one and one-half pounds contain one pint or a pound of water. Water also serves to cool the body, aids in digestion and absorption, and acta as a lubricant for the joints and muscles.

The supplying of some of the materials in each of the above groups is necessary in a well-balanced ration whether it be for growing chicks or laying hens.

Methods of Feeding

Feeding Chicks.—Nature supplies the chick with a large mass of egg yolk at hatching time which is suffcient nourishment for two or three days. If chicks are fed before the bulk of this yolk is absorbed, the yolk decays and soon causes the chick's death.

A good practice is to transfer chicks from the incubator to commercial chick boxes as soon as the hatch is over and leave them in these boxes at room temperature for 36 to 46 hours, then transfer them to the brooder. It is important that 25 chicks be placed in each compartment of the box and that two sticks an inch or more in thickness go between the boxes if they are stacked in tiers. The first feed after the chicks are placed around the brooder, consists of sharp chick grit and milk. It is well to dip each chick's beak in the milk when transferring them from the box to the brooder. When the latest hatched chicks are 48 hours old they are given a scratch feed of grain.

The method of feeding used and recommended by the Agricultural Experiment Station consists of a grain ration the first week and grain and mash thereafter. Grain more nearly approaches the natural diet and there is less danger of chicks overeating before the yolk is entirely absorbed which is about the sixth day.

The K. S. A. C. standard chick ration is as follows:

SCRATCH GRAIN	Pounds
Cracked corn	60
Cracked kafir or pin-head oats	20
Cracked wheat	20
Total	100

DRY MASH	Pounds
Bran	30
Shorts	30
Corn meal	25
Meat scrap	10
Mineral mixture (*a*)	5
Total	100

(*a*) The mineral mixture consists of: Bone meal, three pounds; crushed oyster shells or calcium carbonate (ground limestone or marl), one pound; and salt, one pound.

The scratch grain is fed sparingly five times a day, for example, at 6 a. m., 9 a. m., 12 m., 3 p. m., and 6 p. m., during the first week. It should be fed on a board or cardboard at first until the chicks become accustomed to eating. Later it may be thrown in the litter.

During the second week grain is fed three times a day, or every six hours, and the above dry mash is fed in an open hopper from 9 a. m. to 3 p. m. Finely chopped green or succulent feed, such as sprouted oats, wheat, rye, lettuce, or onions, can be supplied once daily. Milk in some form should be kept before the chicks all the time during the first month and longer if it is plentiful. In order

to teach the chicks to drink the milk readily it is well not to supply water the first week. At such times the milk should not be clabbered or too thick to satisfy the thirst.

When the chicks are six weeks old continue with cracked corn in the grain mixture, but gradually substitute whole kafir and wheat for the cracked forms recommended above. From eight weeks of age to maturity the chickens can have access to self-feeders with grain on one side and mash on the other side, providing they have free range, When the chicks are grown under confinement, the grain should be hand fed twice a day. The above mash will be satisfactory until the pullets are ready to lay, at which time they should receive a laying mash.

Feeding Laying Hens. —It is necessary to feed hens liberally throughout the year for good egg production. A dry mash should be kept before them in open hoppers at all times and grain should be scattered in a deep litter twice daily at the rate of about five pounds in the morning and seven pounds in the evening per 100 hens. However, one should feed according to the hens' appetites rather than by measure. Where grain is fed in the head or on the ear, allowance should be made for the husk or cob.

The K. S. A. C. standard ration for laying hens is as follows:

SCRATCH GRAIN	Pounds	DRY MASH	Pounds
Cracked corn	200	Corn, Oats, Wheat ground together	100
Wheat	200		100
			100
Total	400	Tankage (high grade)	75
		Total	375

In western Kansas kafir or milo may be used as a substitute for corn in the grain mixture and barley for oats in the mash. When wheat is high in price it can be omitted from the mash, in which case equal parts of corn and oats can be ground together, and 20 pounds of high-grade tankage added to 80 pounds of this mixture. Oats or barley will grind much easier if mixed with another grain as corn, kafir, or wheat. One hundred pounds of bran and 100 pounds of shorts would make a good substitute for oats and wheat, respectively, in the above mash when the latter are too hard to obtain or high in price. The relative price of grains will always influence the proportion used. For example when corn is cheap and wheat is expensive, the above scratch is made of three-fourths,corn and one-fourth wheat. The exact combinations of grains used is not nearly so important as the proportion of protein and grains.

Twenty per cent of digester tankage or meat scrap added to almost any mash mixture will give good results, together with scratch grain which hens will not eat in the same ratio it is mixed, that is, they will not pick up three parts corn and one of wheat. They will eat first the grain they like best.

The amount of mash consumed can be regulated by the quantity of grain fed. If the chickens eat too much mash, either feed more grain or keep the mash hopper closed part of the day. When feeding pullets in the fall and winter two parts of scratch grain should be fed to one part of mash consumed. This is changed to equal parts of grain and mash in the spring and two parts of mash to one of grain during the summer. A larger quantity of grain is essential in the fall to promote growth and supply heat and energy, while in the summer the fowls are fully matured and less feed is required for body heat and more for egg production.

Feeding Market Poultry.—The pen method of fattening is the most practical on the farm. The poultry is confined in small clean pens three to six weeks and hopper fed shelled or cracked corn, and a mash of equal parts of ground corn and oats to 85 pounds of which is added 15 pounds of tankage. These materials are fed in separate hoppers and are available at all times. Additional quality and flavor can be gained by finishing the birds the last 10 days on a buttermilk mash. The grain and meat scrap is discontinued and a mash made of 60 pounds of corn meal and 40 pounds of oatmeal mixed with buttermilk to the consistency of thick cream is fed in a V-shaped wooden trough two or three times a day. This is advisable only for home use, local trade, or when the birds are killed and dressed at the conclusion of the fattening period. Milk-fed birds will not stand shipping alive without heavy shrinkage.

CULLING

The term culling as used here refers to the sorting and judging of hens for egg production. By careful examination one can first, distinguish hens which are laying from those which are not; second, calculate with some degree of accuracy how long a hen has been laying and whether or not she has taken any lengthy vacation periods; and third, determine her rate of production fairly accurately. No pretense is made to predict future production on hens or pullets or even to suggest the possible production of the daughters of a male bird. An estimate of the individual's future value is based entirely upon that individual's past record. If, for example, a hen

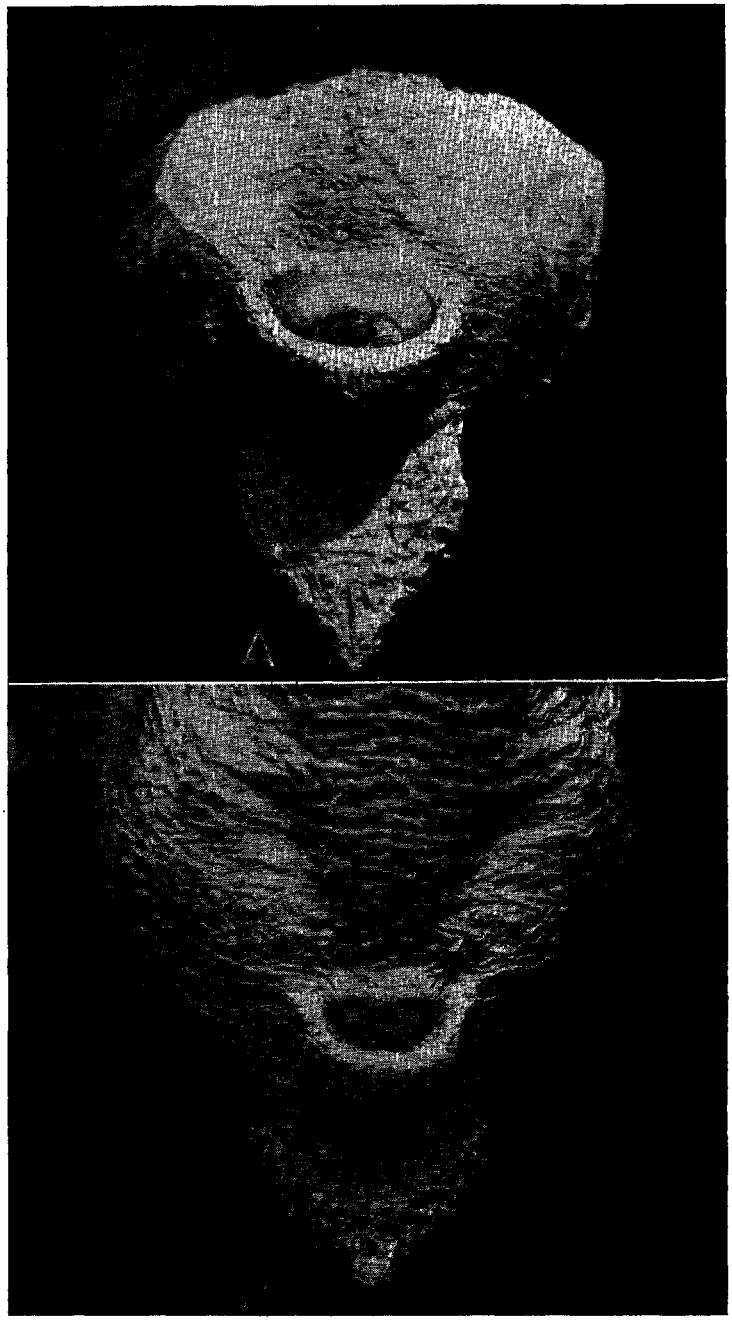

FIG. 13.—The vent and abdomen of a laying hen (A) and of a nonlaying hen (B).

shows good past production and still retains her vigor there is no good reason, barring accidents and improper care, why she will not continue to be a good producer in the future.

This type of culling should be done between July 15 and October 15. The object of summer culling is to separate and dispose of the nonproducing hens, while the object of fall culling is to select the best individuals to save as future breeders. The former is quite simple and can be successfully practiced after a little study. The latter requires more study.

A hen that is laying has a large moist vent, a soft pliable abdomen, and a red comb which is usually warm to the touch. The vent of a hen that is not laying is small, puckered, dry, and yellowish in color. (Fig. 13.) Hens of the yellow skin varieties with pale or white shanks and beak and which have not molted until after the culling season opens are the best layers. As a general rule the later in the fall that a healthy hen molts or sheds her feathers, the more she has laid. A hen which produces four to five eggs a week

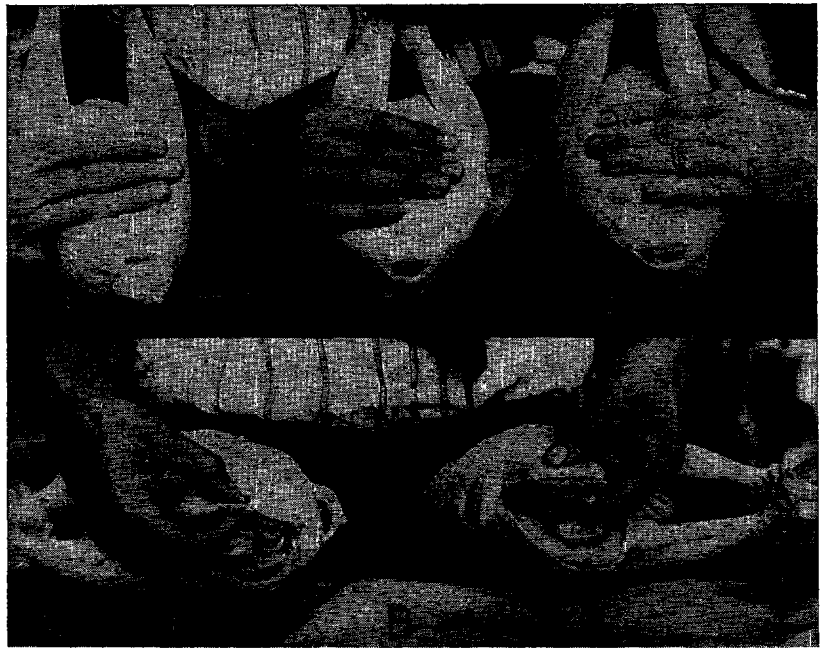

FIG. 14.—Illustrations showing relation of condition of abdomen to egg production. (A) Abdominal capacity of cull (1), high-rate producer (2), and low-rate producer (3). (B) Relative thickness of fat of high-rate producer (1) and low-rate producer (2). These birds correspond to Nos. 2 and 3, respectively, in (A).

is said to have a faster rate than one that produces two to three eggs a week. A high rate is associated with good body capacity, pliability of abdomen, and a fine quality skin.

It should be remembered that the season of egg production for an early spring-hatched pullet is from October until the following fall, after which time she stops laying, sheds her worn out, threadbare feathers, and develops a new, fluffy, glossy plumage for protection during the coming winter. This is another indication that the natural laws work fast in poultry. The horse and cow for example shed their hair in the spring and the new coat grows all summer and fall, while the hen molts in the fall and a new set of feathers are completely developed in six to twelve weeks. The hen seldom lays while the new feathers are growing. This is a point commonly misunderstood by farmers and poultry keepers. After the new plumage has developed and the hen has fully recuperated by restoring vigor and taking on weight, if properly fed, she will begin to lay again in January or February, and from that time on her laying year is from late winter or early spring until fall. This is a normal and natural process which man cannot change except to lessen the number of eggs produced.[5]

PRODUCTION OF POULTRY PRODUCTS

In the production of poultry products consideration is given only to the more important phases such as market eggs, hatching eggs, winter broilers, and capons.

Market Eggs

The most important phase of market egg production is to produce eggs during the season of high prices which is from October to February. It has been pointed out above that one cannot expect eggs from yearling hens as this is their recuperating season. Neither can eggs be expected from May- or June-hatched pullets as Leghorns require six to seven months to mature and start production, while the heavier breeds seldom mature under seven to eight months. Pullets hatched before the middle of March will lay in August and September, they are likely to stop and go through a fall molt similar to the course followed by the older hens. Therefore in the Middle West a fundamental practice which must be followed to get high egg production consistently during the season of good prices is to have the laying houses filled with pullets hatched from the middle of March to the first of May. It is al-

5. For full information on culling the reader is referred to Circular 98 of the Agricultural Experiment Station, "Culling Farm Poultry."

ways important to have pullets from a high egg-laying strain. There is no best breed of egg producers, as one can find many flocks of Rhode Island Reds which lay more than flocks of Plymouth Rocks or Leghorns and *vice versa,* but there are strains in any of the common breeds which will always average high in production if properly fed and managed. (Fig. 15.)

The natural season for egg production is in the spring, At that time range hens have, in addition to grain, tender green shoots of grass, a liberal supply of worms and insects, and plenty of exercise hunting insects. Therefore to stimulate egg production in the abnormal season, which is the fall, and winter, it is necessary to reproduce spring conditions as far as possible. This is acomplished by adding tankage or meat scrap in the mash, as a substitute for the worms and insects; supplying fresh, green feed daily to furnish materials found in the tender grass blades; and throwing the scratch grain in a litter six to eight inches deep to give the necessary exercise. All of these steps plus open front, draft-proof houses are necessary for fall and winter egg production.

Market eggs should be gathered daily and kept in a cool, clean room. The keeping quality of eggs is greatly reduced when they are washed, therefore the number of dirty eggs should be kept as low as possible. If the nests are covered and filled with clean litter more clean eggs will be gathered. Confining the hens when the ground is muddy is also a good practice to prevent dirt from being tracked into the nests.

The males should be sold or separated from the flock after the breeding season in order that infertile market eggs may be produced. Infertile eggs will not spoil if kept clean, hence the losses are small compared with fertile eggs which spoil quickly when kept at a temperature above 68 degrees F.

The market wants clean, fresh eggs with sound shells that will average 2 ounces each, 24 ounces to the dozen or 45 pounds net to the case.

Confinement Versus Free Range.—Greater egg production can be obtained by keeping the pullets confined in the house from October 1 to March 1. Since all the essentials for egg production have been supplied, even to the direct sunshine through the open front, there is nothing gained by turning the pullets outdoors. When given free or limited range they are subject to greater and more frequent variation in temperature, more of their feed is required to

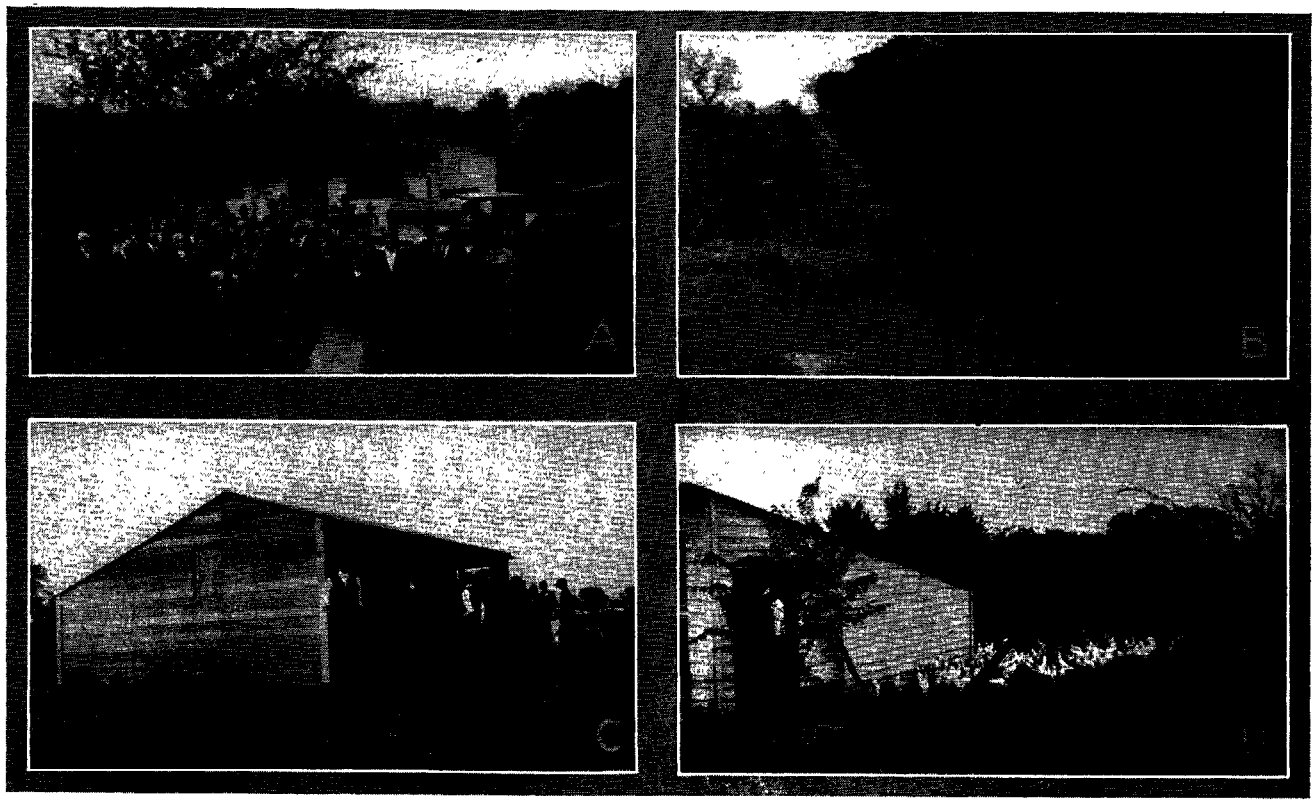

FIG. 15.—Scenes from a poultry tour in Johnson county. (A) Visiting an accredited hatchery. (B) Going to the next farm. (C) Examining a new laying house 18 x 24 feet with uneven span roof. (D) Inspecting Mr. G. C. Lund's Leghorn farm.

maintain their body temperature, and they utilize a larger portion of their ration to furnish energy for unnecessary exercise. The saving gained in waste feed picked up is more than offset by the reduced number of eggs laid. The recommendations under housing with particular reference to area per bird, cleanliness, and ventilation should be carefully followed for best results.

When the pullets are confined in the house during the winter, however, their eggs should not be used for hatching purposes. Hatching eggs should come from hens that are allowed free range all winter. They will pick up the grain scattered in the barnyard and feedlots.

Artificial Illumination.— Still greater production can be had by the intelligent use of artificial lighting. The theory in this practice is that hens give their greatest production normally in the late spring when the days and nights are about equal in length. By having a longer day in the winter and early spring there is more time in which to gather and assimilate feed. Likewise in the fall production is increased when the hens are given a 12- to 13-hour working day by the use of artificial lights. Slightly better results have been secured where lights were used both in the evening and morning, but the use of only morning lights is the simplest and least expensive practice as it does not require a dimming system which is usually necessary at night to send the birds to roost. Morning lights should be turned on, from 5 a.m. to daylight from about November 1 to March 1. The day should be lengthened gradually in the fall, starting the lights at 6:30 a. m. and increasing the length of the day 15 minutes daily until the lights are started at 5 a. m. A liberal supply of grain is scattered in the litter in the evening after the chickens go to roost and in cold weather some system should be used to prevent the water from freezing. The hens want both grain and water soon after the lights go on in the morning. There are various types of simple switches attached to alarm clocks which will pull the lights on at the proper time.

Many fail with lights when they lengthen the day too greatly, or when they become irregular or fail to feed all the hens will eat. Slight variations in these or other methods of management will bring on an untimely molt and the result will be loss rather than profit from the use of lights.

Forty-watt Mazda electric lights with 16-inch reflectors placed six feet from the floor and ten feet apart gave the best results at

the Cornell Agricultural Experiment Station, Ithaca, N. Y. While there is some increase in the total yearly production of hens under illumination, the greatest results from the change is in the distribution of production. A greater per cent of the eggs are laid in the fall and winter and fewer eggs are laid in the summer when they are cheap.

Hatching Eggs

The desirability of using eggs from hens for hatching purposes was pointed out on page 16. The unlimited range recommended for breeding hens during the winter holds egg production in check and affords an opportunity for renewed vigor, which is essential for eggs of good hatching power.

There is a growing demand for hatching eggs from standard-bred stock to supply commercial hatcheries. This affords a desirable outlet for the surplus spring production at a premium above the market price.

Accredited Flocks.—In order that they may become accredited, hundreds of flocks of standard-bred poultry in Kansas are examined annually by authorized inspectors. Every bird in the flock is examined and if healthy, vigorous, free from disqualifications, and reasonably true to the standard type and color for the breed and variety, is banded with a sealed legband bearing the year and the name of the association promoting the work in cooperation with the Agricultural Experiment Station. Birds which do not meet the requirements are identified by having their tails clipped. They must be disposed of or confined in pens without males throughout the breeding season. To date this is perhaps the best method devised for the systematic removal of the undesirable birds from the flock and leaving the most desirable as breeders. Farmers and poultrymen in large numbers should avail themselves of this service. Hatching eggs from these flocks are in growing demand.[6]

Winter Broilers

Producing winter broilers is a practice which allures many. It sweeps the country in waves. Profits appear great compared with prices in the normal season. It must be remembered, however, that, it is expensive to produce articles of food out of season, and chicks reared in winter are out of season. Winter broilers are a luxury, and the demand is therefore limited and confined to large cities.

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6. Further information may be secured by writing the Department of Poultry Husbandry, Agricultural Experiment Station, K. S. A. C., Manhattan, Kan.

The principal items which enter into the high cost of production are: The use of eggs which have a high market value; low fertility and hatchability; expensive buildings, equipment, and operating costs. The extent to which these obstacles can be overcome will determine the profitableness of raising winter broilers. The use of direct sunshine and codliver oil, which makes it possible to grow broilers in confinement, has increased the chances for success by reducing leg weakness and high mortality.

FIG. 16.—A flock of White Plymouth Rock capons.

Capons

Capons are castrated cockerels. Capons are docile in disposition, they can be kept together without fighting, their flesh remains soft in texture, they fatten readily, and their value is greatly increased over that of stags.

The cleanly castrated male can be recognized by his failure to develop a red comb; rarely, if ever, crowing; increase in size when mature; long, silky neck, back and tail feathers. (Fig. 16.)

Rhode Island Reds, Plymouth Rocks, and Brahmas are among the most popular breeds to caponize. They should be operated on when 8 to 10 weeks of age at which time they weigh 1¼ to 1½ pounds. A common mistake is to wait until the birds are much larger than this. March-hatched capons can be finished for the

Thanksgiving and Christmas market, while later hatched birds should be kept until the capon season which opens in February and continues until April.

Capons are increasing in popularity as a substitute for turkeys during the holiday season. They can be grown profitably for this purpose, and it is an excellent way to convert cockerels which would grow to be staggy cocks into palatable and very desirable table poultry for home use during the winter and early spring.[7]

MARKETING POULTRY PRODUCTS

Poultry and egg buyers can be found in all towns of any size. Some send trucks into the country and buy direct from the farm. Others receive at their stations in town, while others do both. The problem confronting the farmer is how and where to sell to receive the greatest net return. It always pays to investigate the different markets and buyers, find out what they want in the way of size, color, quality, etc., then sell to the best possible advantage.

Marketing Eggs.—Eggs carry better and look more attractive when packed in 30-dozen egg cases. They should be marketed twice a week and sold on a quality basis, and not a "case run" or "loss off" basis. It does not pay to candle eggs at home unless one has a high-class or specialized market in which case it is necessary to candle and remove eggs with blood spots, meat spots, or other foreign bodies. Parcel-post marketing involves too much detail work and bookkeeping to be entirely satisfactory. Those situated on main-traveled highways can dispose of many eggs to advantage by roadside marketing. This is a method that is sure to grow in popularity as the city population increases and the all-weather roads are extended. An attractive sign placed on the road a quarter of a mile each direction from the house announcing fresh eggs for sale at a stipulated price will give prospective buyers time to slow down and make a purchase.

Marketing Poultry.—The same general plan outlined under marketing eggs applies to marketing poultry. There are, however, more sharply defined seasons and price fluctuations with different grades of poultry than with eggs. For example, the market wants broilers that weigh two pounds each or slightly less. Above that weight they are frequently docked a few cents a pound. Springs, or frying chickens, as those above two pounds are termed, are in

7. Details regarding the operation of caponizing are discussed and illustrated in Circular 27 of the Agricultural Experiment Station, "Capons for Kansas."

great demand on the farm for home use, but they are seldom disjointed and served in restaurants and hotels. They prefer to serve young chickens in quarters or halves hence the demand for smaller birds. Roasters and capons are in demand during the winter holidays and early spring, while heavy hens are in demand at all seasons. Hens under four pounds in weight drag on the market.

White- or buff-colored plumage on all classes of market poultry is preferred, as the birds have a better appearance when dressed in

FIG. 17.—Number of poultry per capita consumed on farms in Kansas (15 chickens each). This number is greater than that consumed per capita in any other state, according to figures from the Bureau of Agricultural Economics, United States Department of Agriculture.

the pin-feather stage. Roasters and capons are usually dressed when the feathers are fully developed, so, with these, light color is less important.

Market poultry is most frequently sold alive from the farms in this section. (Fig. 17.) When it is shipped any distance it should be started to arrive in time for the best market day of the week. Friday arrivals are preferred for Saturday trade in most places. Heavy shrinkage can be avoided by shipping early in the morning so the birds will arrive at destination with empty crops and be weighed the same day. Where birds remain in shipping coops over night at a railroad station, express office, or an unloading plant, the shrinkage will range from 10 to 15 per cent in a 100-mile shipment.

When shrinkage, mortality, and delay in payments are taken into account little is gained by shipping very far even at a few cents more per pound. By selling at the door or to a local dealer the producer participates actively in the deal, his responsibility ends when the birds are accepted, there is little or no shrinkage and cash is paid on the spot, thus eliminating bookkeeping or trusting one's memory.

POULTRY PARASITES

Poultry parasites are divided into external and internal groups. The external group is again divided into two classes; namely, those which spend their life cycle on the body of the fowl and those which live in the coops or buildings and migrate to the birds for feeding.

External Parasites

Poultry Lice.—Lice belong to that class which lives on the fowl's body throughout the year. There are several species, but the habits and treatment of all are about the same. It should be remembered that lice are not blood suckers. They live on the scale and scurf of the body and feathers. The principal harm caused is an itching sensation which makes the birds uneasy and perhaps causes a slight damage to the plumage.

Treatment must be applied to the individual birds and not to their house. Sodium fluoride dusted into the plumage or dissolved in water at the rate of one ounce per gallon and used as a dip gives best results. The dipping method should be used in warm weather only and treatment early in the day will give the feathers time to dry before night. The thorough treatment of every bird twice a year will keep the flock practically free of lice.

Mites.—The red mite is a summer parasite which lives and reproduces in the poultry house, on the roosting poles, in the nests, etc. It migrates to the fowl's body at night, gorges with blood, and returns to its hiding place. It is much more serious than the louse, and a bad infestation will stop egg production, lower the vitality, and eventually cause deaths in the flock.

Treatment is simple and easy. Any crude oil product such as stock dip, standard disinfectant, or used crank case oil thoroughly painted on the roosts and supports early in the spring will prevent an infestation of mites. These parts should be painted once a year. Bed bugs or other parasites with similar habits are controlled in the same way.

Internal Parasites

The chief offenders in this group are long round worms, tape worms, and coccidia. All three types are serious among young chickens one to three months of age, but mature fowls may become badly infested.

Round Worms.—These are long, white wire-like worms which accumulate in large numbers in the intestine. Tobacco dust containing 1 to 2 per cent nicotine and fed in the mash at the rate of 2 per cent for a period of three weeks has proved to be the most practical treatment on the farm. This treatment is not 100 per cent efficient, but will remove the majority of the large round worms.

Tape Worms.—These are more serious than round worms. They vary in length from microscopic size to 10 inches. The body is segmented and the head, which is at the small end of the worm, is attached to the inner lining of the intestine. It requires severe treatment to dislodge tape worms on account of the hooked mouth parts.

Flock treatment recommended by the Agricultural Experiment Station consists of feeding 1 pint of wheat, 1 pint of oats, and 1 teaspoonful of concentrated lye cooked two hours in enough water to cover. Allow to cool before feeding, then give the birds all they will eat, supplying plenty of water to drink. Three hours after feeding give a dose of Epsom salts in wet mash at the rate of one pound per 100 adult birds. If the birds are given the salts treatment just before going to roost the droppings containing the worms and worm eggs can be cleaned up and burned the next morning thus checking an immediate reinfestation.

Coccidium.—This organism, which is microscopic in size, can live in the ground for a year or more, and eventually it enters the body in the feed or water. It is very difficult to combat. The most satisfactory treatment consists in preventing infestation by brooding the chicks on clean ground every year. By moving the brooder coops or colony houses to new locations each year, the danger from these parasites will be greatly reduced.[8]

DISEASE AND SANITATION

Diseases in poultry should be prevented as far as possible by the constant culling of low-vitality birds, providing roomy draft-proof houses, clean feed, water, and quarters, adequate rations, and plenty of direct sunlight. Diseased birds should be isolated or killed as

8. For more complete information on poultry parasites and their control the reader is referred to Circular 106 of the Agricultural Experiment Station, "Prevention and Treatment of Poultry Diseases."

soon as discovered, and all birds which die from unnatural causes burned. Filth and refuse should not be allowed to accumulate, and poultry manure should be hauled far into the field out of reach of both young and old birds. Dead animal carcasses or decayed meat is sure to cause trouble in warm weather if within reach. Only when they have no alternative do chickens roost in filthy quarters and eat rotten and decayed feed.

Feeding small chicks on the same ground year after year is responsible for heavy losses and the lowering of vitality which makes those that survive susceptible to diseases common among adults.

Disease outbreaks can often be avoided by using precautions when introducing new stock, returning birds from poultry shows, and bringing poultry shipping coops from express offices or buying stations. Chickens brought upon the farm should be kept in quarantine

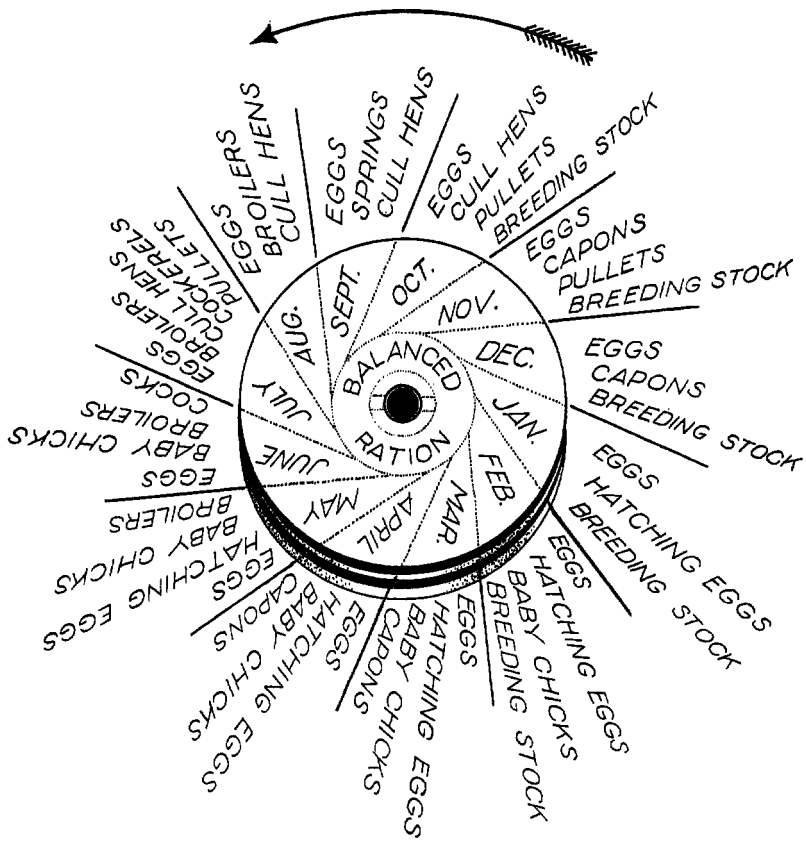

FIG. 18.—As the year rolls around the grist mill supplied a balanced ration, grinds out an even distribution of income from the standard-bred flock properly managed. (Diagram by Mr. A. P. Loomis, Diamond Springs, Kan.)

for 10 days before turning them with the general flock. All shipping coops should be thoroughly cleaned and sprayed before using.

In case a serious disease gets started, a thorough cleaning and disinfecting of all poultry buildings, equipment and yards is necessary, and in certain diseases, as, for example, tuberculosis, the entire flock may have to be disposed of and the place kept free of poultry for a year or more.

It is not the purpose of this circular to discuss flock or individual treatment of the various diseases. For a thorough discussion of this subject the reader is referred to Circular 106 of the Agricultural Experiment Station, "Prevention and Treatment of Poultry Diseases."

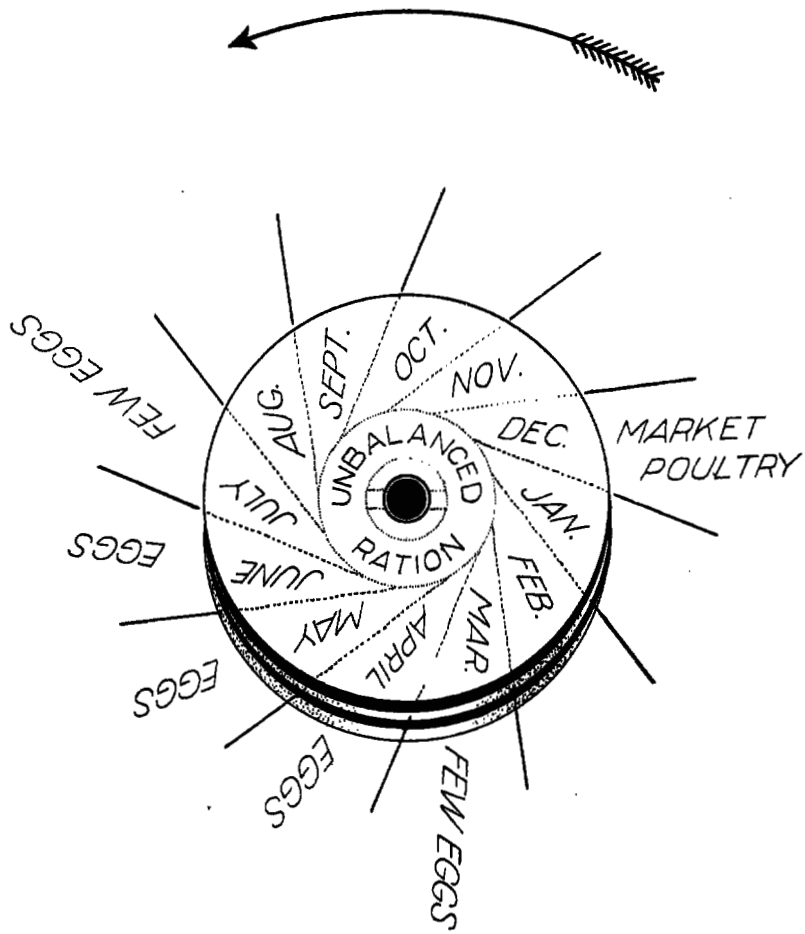

FIG. 19.—However, as the year rolls around an unbalanced ration in this grist mill returns only a small income a portion of the year from a mongrel flock poorly managed. (Diagram by Mr. A. P. Loomis, Diamond Springs.)

FARM POULTRY CALENDAR[9]

The following are suggestions of some of the more important work to be done each month in caring for the farm flock. (Figs. 18 and 19.) There will naturally be some overlapping, and these suggestions may not fit in with the farm program. In case they do not, it is recommended that the major items be listed which do nick best with the other farm work.

JANUARY

1. The flock should average six eggs each.
2. Keep birds confined in stormy weather.
3. Add six inches of fresh litter to the floor.
4. Supply fresh water twice a day.
5. Guard against frozen combs on breeding males.
6. Males to be used for the season should be on hand.
7. Mate pens by the 25th of the month.
8. Overhaul the incubator and order missing parts.
9. Look up a market for surplus hatching eggs or baby chicks.
10. Start the year right by reading the "Farm Poultry Calendar."

FEBRUARY

1. Your flock should average 11 eggs each.
2. Begin saving hatching eggs February 5.
3. Gather the eggs several times daily if temperature is below 40 degrees.
4. Set the incubator February 12 or 22 to bring first hatch off early in March.
5. Order material for shipping hatching eggs and baby chicks.
6. Supply green feed daily.
7. Clean frozen droppings from under roosts the first day they thaw.
8. Attend the Poultry Short Course at K. S. A. C.
9. Examine the brooder and be sure it works.
10. Take a day off and visit your neighbor's flock.

MARCH

1. Your flock should average 16 eggs each.
2. Locate the brooder on clean fresh ground.
3. Make necessary repairs on brooder coops and houses.
4. Order chick feed and buttermilk early in the month.
5. Diarrhea may be caused by overheating, overfeeding, chilling, crowding, moldy feed, irregular feeding or bacterial infection.
6. Spend several evenings reading literature on brooding chicks.
7. Keep the laying flock confined and give breeders free range.
8. This is a windy month; watch the drafts—keep hens comfortable.
9. Confer with your county agricultural agent for information desired.
10. Tune in the radio for poultry programs.

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9. In order that this calendar may be the greatest service it must be read and reread. Some one has said, "Read the Farm Poultry Calendar every month."

APRIL

1. This is one of the months of highest production. Hens should average 17 eggs each.
2. Insert an ad in the local papers if hatching eggs accumulate.
3. Keep the incubator running to full capacity.
4. Five eggs must be set for each mature pullet saved.
5. Four hundred chicks is the maximum to put around one brooder.
6. Don't destroy dead chicks without trying to locate the trouble.
7. Let a lot of sunshine in all the poultry houses.
8. Add more clean litter to the floor and refill nests.
9. Keep the hens shut in when the ground is muddy.
10. Write the Agricultural Experiment Station for literature and information on specific poultry problems.

MAY

1. This is the other month of highest production. Hen should average 17 eggs each.
2. Discontinue hatching chicks.
3. Give both laying and breeding flocks free range.
4. Find an egg dealer who will buy on the quality basis.
5. Locate a good market for those early broilers.
6. Sell the broilers just before they weight two pounds each.
7. The "early bird gets the worm," so open the houses at daylight.
8. Paint all the roosts and supports with some crude oil product.
9. Interest your boy or girl in some phase of poultry work.
10. Count the chicks living and number sold, then compare with number hatched to determine the mortality.

JUNE

1. Production starts on the down grade. Hens should average 13 eggs each.
2. Sell or pen up all the adult male birds.
3. Remember that infertile eggs cannot spoil.
4. Caponize some of the early hatched cockerels.
5. Select a warm day and dip the entire flock for lice.
6. Open the rear ventilators in the hen house.
7. Keep both eyes open for red mites.
8. Provide shade for chicks on the range.
9. Use springers freely on the home table.
10. Help your county agricultural agent organize a poultry tour. (Fig. 15.)

JULY

1. Another unlucky number for July production—average, 13 eggs per hen.
2. Separate the cockerels and pullets.
3. Begin to cull and sell the loafers.
4. Guard against losses from rats, skunks, crows, dogs and cats.
5. Heat kills many hens—cool water helps prevent this loss.
6. Examine the moping chicks for intestinal worms.
7. Wetting the mash to a crumbly state will increase palatability.
8. Sow Sudan grass for summer and fall pasture.
9. Spade up the hard-baked ground for dust wallows.
10. Interest your neighbors in working up a good poultry show at the approaching local or county fair.

AUGUST

1. The flock should average 11 eggs each this month.
2. Take an inventory of laying houses. Is there room for all the pullets?
3. Give all houses a thorough annual cleaning.
4. Cull the flock again.
5. Keep decayed meats and maggots cleaned up.
6. Repaint buildings which need it.
7. Send to the Agricultural Experiment Station for plans for poultry houses.
8. Those pestiferous broody hens—take care of them.
9. The first to crow and the first to lay are not necessarily the best.
10. Make an effort to diagnose your own problems.

SEPTEMBER

1. The flock should average nine eggs each.
2. The early pulleta should be brought into the laying houses.
3. Continue to feed the old hens a laying mash.
4. Feed the pullets scratch grain liberally.
5. Keep a laying mash before the pullets all the time.
6. Sort cockerels and band those good enough to keep or sell as breeders.
7. Close the rear ventilators in the laying house.
8. Seed the bare yards or adjacent fields to wheat or rye.
9. Dip all the poultry on the place for lice.
10. Take the family to the fair and find out from the poultry judge where your birds need improvement.

OCTOBER

1. Production declines; average seven eggs each.
2. The hens still laying are your highest producers.
3. Select the best laying hens to be kept as breeders.
4. Market all young stock not good enough to winter.
5. Sell the surplus breeding cockerels.
6. Don't overcrowd the houses—remember 3½ to 4 square feet per bird.
7. Each hen needs 7 to 8 inches of space on the roosting pole.
8. Begin to force the pullets for egg production.
9. The egg may be small at first, but it represents a day's work for the pullet.
10. Don't send a chicken to market you would not eat yourself.

NOVEMBER

1. This is the low month of the year for egg production, average three eggs each.
2. November 1 marks the start for most egg-laying contests.
3. Artificial illumination, if used, should start November 1.
4. Round up the largest capons to fatten for Thanksgiving.
5. Last chance to get your application in for flock accreditation.
6. The male is half the flock.
7. Choose vigorous, stout males of good color and type for mating.
8. Eggs are high in price because they are scarce.
9. Regularity in care and management is one secret of success.
10. Reserve the best capon for your own Thanksgiving dinner.

DECEMBER

1. The year closes with five eggs for the month and 128 for the year from each hen.
2. This monthly production is the average of 633 Kansas farm flocks for 1923-'24.
3. Drop the front curtains during extremely cold or windy weather.
4. Keep the pullets scratching in deep litter.
5. Feed a balanced ration.
6. Don't let pullets develop the habit of laying on the floor.
7. Keep sparrows and rats out of the house.
8. Calculate the profit or loss on the past year's work.
9. Outline the program for next year.
10. Make a number of good resolutions to improve the weak points in the past year's program.

GENERAL INDEX

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